From the Editors

It is a great pleasure to deliver to you the 8th issue of "Journal of Informatics and Regional Studies." This Journal intends to provide researchers and practitioners with the forum of discussion and sharing findings and ideas about Informatics and Regional Studies. We welcome you to join us to share your idea on this Journal.

This volume is a Special Edition for MISNC2015 which was held September 1st-3rd in Dogo, Matsuyama City. This volume contains the Slides from Keynotes presented at MISNC2015. MISNC2016 enjoyed keynotes of well-known experts from the world.

Also, this volume contains two papers from academia of Japan. In addition, this volume contains two slides presented in conferences in India and Korea, respectively.

We believe that this volume becomes a collection of wide varieties of research and presentations, which attracts your interests in the research arena of Informatics and Regional Studies, and hope you enjoy the volume of this year.

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An Analysis on Smartphone Adoption for University Students

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Abstract

The diffusion of smartphones is a market trend in most of the countries but not the case in Japan. Its diffusion speed in Japan is relatively slow among most of the OECD countries though her high diffusion rate of 3G/4G (LTE). There are some previous studies about this issue. Most of them point that there exists huge 'switching cost' in Japan. So, they say, switching cost for migration for smartphone is relatively high because so-called Galapagos phone provides relatively multi functioned in Japan.

In our survey this switching cost is very limited in university students in Kyoto Sangyo University. I had a choice-based conjoint analysis upon university students in Kyoto. According to this survey younger generation (university students) tend to use new system although they used to use feature phones. For them switching costs from feature phones to smartphone are relatively low and their willingness to pay for some types of applications are very high. They use SNS, GPS navigation, phone, e-mail, and/or file sharing applications, etc. This situation diminishes switching cost for migration with its strong network externalities.

In conclusion for younger generation, like students in my survey the switching cost is relatively limited under budget limitation. Their willingness to pay (WTP) for functions in smartphone (SM functions) is relatively high while WTP for functions of so-called Galapagos phone is negative. Especially SNS like LINE is the killer application for smartphone migration.

Keywords: Smartphone, Social Networking Service, Conjoint analysis, Switching Cost, and System Migration

1. Introduction

The diffusion Pattern of smartphone in Japan has unique characteristics. Though in most of OECS countries there is the relationship between subscription rates of 3G or higher generation mobile phone and diffusion rates of smartphone, this is not the case in Japan. According to FMMC[1] Japan has the second largest diffusion rate of 3G or higher generation mobile phone (98.6%, next to 99.3% of South Korea) in 4th of quarter of 2010. In Information and Communication White Paper 2014, MIC, about 30% of mobile phone users in Japan continue to use feature phones. Clearly the diffusion rate of smartphone in Japan is lower than referenced countries (US, UK, France, South Korea, and Singapore) in this While Paper though others, except South Korea and Singapore, are still in the step of migration to 3G.

One of the main factors is excess inertia of useful functions of Japanese unique feature phones, so-called Galapagos phone. CIAJ (2011) pointed out it as some common functions are lacked in major smartphones based on there 1,200 sampling survey on usage style of mobile phones. These kinds of reports strengthen the switching cost driven hypothesis for excess inertia. Park et al. (2011) and Ueda et al. (2012) discussed the relationship between systematic factors or competitive situation and diffusion of smartphone in Japan and South Korea.

[1] http://www.fmmc.or.jp/ictg/visual/201110.html (in Japanese)

While CIAJ (2012) also pointed out that most important factor in switching handset is the price of it (78.4% respondents, top ranked). In this period communication policy for incentives for retailers are changed and consumers are forced to buy handsets in higher price than before. So claims for price standards are one of the top issues for them.

In this survey we don't distinguish between handsets themselves, feature phone and smartphone but focus on functions of mobile phones. We try to collect consumer demand for each functions including smartphone-specific functions (SM functions), feature phone-specific functions (FP Functions), and of cause basic functions (BS Functions) and we'd like to reveal the migration myth in Japan. We use conjoint analysis for it.

2. Choice-based conjoint analysis

In this study, we use the choice-based conjoint analysis based on WTP (willingness-to-pay) to each mobile phone functions in order to estimate WTP for each of them. Proposal of Luce & Turkey (1964), Green & Srinivasan (1978) and later, conjoint analysis, according to the Green & Kringer (1993), it was developed in the marketing research field in 1970s like solid soap of design, new concept display, air line services, or service in hotel.

If the product or service is composed of several factors, or various biases occur when asked straight in stated preference method, then the importance of each factor cannot be distinguished. However, since the conjoint analysis can be decomposed into WTP for each element, preference rank also has characteristics that can be investigated simultaneously.

The choice-based conjoint model performs individual estimated conditional logit model representing the probability of choosing one option from several options. Respondents i is set to the selected card j from among presented included in the card set C. The utility function U_{ij} at this time is represented by random utility models, such as the following.

$$U_{ij} = V_{ij} + \varepsilon_j, \quad (j = 1, 2, \ldots, J)$$

Here, V_{ij} is observable elements as determined by the attributes that make up the card among utility, ε_j are unobservable elements. In this case, the probability $P_i(j|C)$ to select a card j by respondents i from the card set C is expressed as follow.

$$P_i(j|C) = Pr(U_{ji} > U_{ki}) = Pr(V_{ji} - V_{ki} > - + \varepsilon_{ji} + \varepsilon_{ki})$$

Assuming the Gumbel distribution (0, 1) and independence from unrelated card, conditional logit model can be obtained as follow.

$$P_i(j \mid C) = \frac{\exp(V_{ji})}{\sum_{k \in C} \exp(V_{ki})}$$

Here, utility is for the attribute variable X and payments T that defines the utility of the card j, if an additive function in a linear, Vji is observable elements of the utility function can be expressed as

follows

$$V_{ji} = \sum_{k \in C} \beta T_{jk} X_{jk} + \beta_T T$$

By maximizing the value of the log likelihood function can be estimated parameter β of the utility function. There the marginal WTP (MWTP) for that attribute X_1 is increased by one unit can be expressed as follows.

$$MWTP_1 = -\frac{\beta_1}{\beta_T}$$

In this paper as an attribute variable X, battery performance (H), common functions of smartphone (SM), common functions of feature mobile phone (FP), basic functions (BS), and monthly fee (C) is assumed five of the measurement model is as follows.

$$V_{ji}=\beta_h H+\beta_{sm} SM+\beta_{fp} FP+\beta_{bs} BS+\beta_c C$$

3. Analysis data and results

The web survey was conducted to students of lecture 'information economy theory' in Kyoto Sangyo University. They are second to fourth year students in Faculty of Economics or other social sciences fields. Summary is shown in the following table.

Table 1. Overview of the Survey Samples

	Survey period	Respondents	Conjoint Samples	Total Number of Conjoint Samples
FY 2015	The 10th of June 2015 to the 14th	187	178	1,508
FY 2014	The 24th of December 2014 to 28th	138	137	1,170
FY 2013	The 8th of January 2014 to 12th	181	181	1,483

The number of responses of usability studies is equal with the number of respondents but the number of conjoint sample is smaller than it because some responses can be considered resistance answer (like no answer, no reply).
First, in order to extract the factors, we asked the necessary functions in the mobile phone use in the seven stage rating scale from must need (7) to no need (1). That is, when the number is large, indicating that the respondent has more emphasis on its function. The results summarized are the following table. The maximum value is seven (7), the minimum value was one (1) in each year.

In the study, functions are divided by basic functions (BS), smart phone function (SM), and feature phone functions (FP). Of course there is a high demand with respect to BS, a relatively high demand is also observed with respect to SM. On the other hand, demand is relatively low with respect to FP. However, these results, since listening to each independently, does not guarantee either selected under the price constraints.

Table 2. Functions Necessary for Mobile Phone

Year / Functions	Total		FY 2013		FY 2014		FY 2015	
	AV	SD	AV	SD	AV	SD	AV	SD
(BS1) Blowing	6.48	1.2654	6.82	1.0662	6.46	1.2863	6.38	1.4105
(BS2) e-mail operated by mobile carriers	5.33	1.7661	5.87	1.4668	5.14	1.9432	5.13	1.8408
(SM1) SMTP mail	5.61	1.6189	6.10	1.2853	5.38	1.6991	5.51	1.7983
(SM2) Any of e-mail	5.61	1.5843	6.02	1.4343	5.42	1.7102	5.55	1.6026
(SM3) GPS	5.71	1.4413	6.01	1.2619	5.56	1.5323	5.72	1.5234
(SM4) LINE	6.00	1.5134	6.11	1.3677	6.13	1.6008	5.99	1.5735
(SM5) Facebook	3.69	1.9771	4.51	1.7745	3.52	1.9862	3.17	1.9702
(SM6) Twitter	4.51	1.9298	4.83	1.6913	4.30	2.0274	4.51	2.0537
(SM7) Any of SMS	5.51	1.6179	5.72	1.4085	5.57	1.7108	5.44	1.7308
(SM8) Online games	4.33	1.8706	4.57	1.5943	4.18	1.9606	4.36	2.0361
(FP1) Mobile payments	3.00	1.7292	3.38	1.5895	2.90	1.7705	2.81	1.7949
(FP2) Mobile TV	3.03	1.8005	3.52	1.6379	2.79	1.7547	2.86	1.9224
(FP3) Infrared communication	4.16	1.8401	4.82	1.5493	3.99	1.8881	3.81	1.9546
(FP4) All of FP* functions	3.54	1.7420	4.14	1.4103	3.29	1.8066	3.29	1.8878

AV: average, SD: Standard deviation

* FP (feature phone functions): Mobile payments, mobile TV, and Infrared communication

So, the top three mainly choices of function, summarizes the things similar, if further consideration of the impact of the co-line occur in the conjoint analysis, function and performance numbers and the number of choices, respectively, are grouped in three or less , we have created a conjoint type of card, such as shown in Table 3. Kowalewski et al. (2013), but has to adjust the coefficient estimates the m of the sum as zero, this paper did not make this kind of adjustment.

In this study the basic monthly fee includes general restraint period of the contract is a 24 months and all of the split amount of the terminal price. Battery performance represents the continuous use time.

It should be noted that, in Tanaka & Hamaya (2011), , they conducted the conjoint analysis of five levels of application, operation guarantee and trouble, risk spoofing and junk e-mail, change of communication carriers, and base price. Although no description of the statistics on the paper, it has pointed out that there is a relatively large willingness to pay to the application of a smartphone.

Table 3. Four Functions in Card and Price Standards

Monthly fee (C)	3	7	10
Battery performance (H)	5	20	30
SM Functions (SM)	1 (GSP)	2 (+SNS)	3 (+game)
FP Functions (FP)	0	1	
BS Functions (BS)	1 (browsing)	2 (+e-mail)	

Considering the efficiency of experiments for these various levels. Without presenting randomly we created a presentation sets that does not impair the efficiency. Table 4 shows the combination of nine sets of levels. In order to increase the research efficiency, rather than a two-choice, presented in five pair (including non of them) in a method of selecting one piece, seeking nine sets of selection per person.

Table 4. Variety of Cards

Card	C_1	H_1	SM_1	FP_1	BS_1	C_2	H_2	SM_2	FP_2	BS_2	C_3	H_3	SM_3	FP_3	BS_3	C_4	H_4	SM_4	FP_4	BS_4
1	3	30	3	0	1	7	5	1	1	0	3	5	1	0	0	3	10	2	1	1
2	7	10	3	0	0	7	30	2	1	1	10	5	2	0	1	10	10	1	1	0
3	10	30	3	0	0	3	5	2	1	1	3	10	3	0	1	3	30	1	1	0
4	7	5	3	0	0	7	10	1	1	1	7	30	2	0	1	10	5	3	1	0
5	3	5	1	0	1	3	10	2	1	0	10	10	2	0	0	10	30	1	1	1
6	3	30	3	0	0	7	5	1	1	1	7	10	3	0	1	7	30	2	1	0
7	10	5	2	0	0	10	10	1	1	1	10	30	3	0	1	3	5	2	1	0
8	3	10	3	0	0	3	30	1	1	1	7	5	3	0	1	7	10	1	1	0
9	7	30	2	0	0	10	5	3	1	1	10	10	2	0	1	10	30	1	1	0

Table 5 is one of the samples of set of cards. Respondents select one from these four cards or none of them. A variation of choice is following; BS has two functions, FP has all functions or nothing, SM has three functions.

Table 5. Samples of set of cards

3	thousand yen	7	thousand yen	3	thousand yen	3	thousand yen
30	hours	5	hours	5	hours	10	hours
3	SM functions	1	SM functions	1	SM functions	2	SM functions
0	FP functions	1	FP functions	0	FP functions	1	FP functions
1	BS functions	0	BS functions	0	BS functions	1	BS functions

Notice: This is simplified version of cards.

When incorporate many features, it can be difficult to derive useful results statistic worsens by multicollinearity though we want to add many factors on the survey. Therefore simplifying the choice by grouping multi functions, top priorities are check sign of each functions or the preference order.

With regard to function, we don't want to measure the marginal willingness to pay for the individual function itself, for to explore the magnitude relation of the sign and the absolute value is an object, dummy, like 0 or 1 for FP, 0, 1, or 2 for SM, turned into on, and each utility performs equal volume assessment.

Table 6. Estimated result

Total of Three Years (FY2013 - 2015)

	Coefficient	T Values	P Values	Significance
Monthly fee (C)	-0.1781	-23.627	0.000	***
Battery performance (H)	0.0280	18.658	0.000	***
SM Functions (SM)	0.4679	16.343	0.000	***
FP Functions (FP)	-0.3830	-9.059	0.000	***
BS Functions (BS)	0.1977	5.745	0.000	***

Sample Numbers (N)	4,161
Logarithmic likelihood	-4894.775

FY 2013

	Coefficient	T Values	P Values	Significance
Monthly fee (C)	-0.3152	-23.977	0.0000	***
Battery performance (H)	0.0406	16.308	0.0000	***
SM Functions (SM)	0.7880	15.921	0.0000	***
FP Functions (FP)	-0.1200	-1.677	0.0936	*
BS Functions (BS)	0.5983	10.027	0.0000	***
Sample Numbers (N)	1,483			
Logarithmic likelihood	-1,000.864			

FY 2014

	Coefficient	T Values	P Values	Significance
Monthly fee (C)	-0.1594	-11.6144	0.0000	***
Battery performance (H)	0.0279	9.9441	0.0000	***
SM Functions (SM)	0.5780	10.9119	0.0000	***
FP Functions (FP)	-0.5484	-6.8521	0.0000	***
BS Functions (BS)	-0.1602	-2.4169	0.0158	**
Sample Numbers (N)	1,170			
Logarithmic likelihood	-1,112.469			

FY 2015

	Coefficient	T Values	P Values	Significance
Monthly fee (C)	-0.22787	-18.5922	0.0000	***
Battery performance (H)	0.03420	13.3933	0.0000	***
SM Functions (SM)	0.50920	10.9028	0.0000	***
FP Functions (FP)	-0.52894	-7.4629	0.0000	***
BS Functions (BS)	-0.32475	-5.7313	0.0000	***
Sample Numbers (N)	1,508			
Logarithmic likelihood	-1,053.925			

***: 1%, **: 5%, *: 10%

When you do the estimate from here, get the results as shown in the following table. Except FP in 2013 becomes significant at 99% or 95% confidence interval. Of course monthly fee is negative but FP is also negative in all cases. This indicates that the results in the case where to perform the realistic choice is different in the case and budget constraints heard necessary functions separately.

Marginal willingness to pay (MWTP), this can be calculated from the ratio of each factor and rates, of each factor is the next table. Notice that here the MWTP, which is the amount you're willing to pay for the increase of one unit of for certain goods and services items.

It is a noteworthy point, mentioned in research of Softbank mobile [2], 'battery shortage of smartphone' is one of the common cram for smartphone but, as was seen in this study, it is much less than the SM functions in MWTP. So in the mobile phone model selection, according to this

[2] Softbank BB (2013) had an internet questionnaires of their 800 subscribers in the 6th to 8th of 2013 and 66.9% of respondents cram battery shortage.

survey respondents are focused on more SM function or variety of functions on smartphones.

Then, I like to consider the functions with a negative sign. First, an expected result, FP has a negative sign in all cases. This means that the FP functions have very limited values for our respondents. In addition in FY 2014 and FY 2015 BS also has negative. This is difficult to understand. Reference point is browsing in BS and added value of them is e-mail. Among university students in Japan message communication via e-mail is limited and LINE is the majority of communication tools for them. So performance of BS can be smaller valued.

Table 7. Marginal Willingness to Pay (MWTP) for Each Functions（Unit: Yen）

	Total	FY 2013	FY 2014	FY 2015
Monthly fee (C)	0.15714 ***	0.12863 ***	0.17484 ***	0.15009 ***
Battery performance (H)	2.62666 ***	2.49987 ***	3.62739 ***	2.23465 ***
SM Functions (SM)	-2.14971 ***	-0.38078 *	-3.44127 ***	-2.32127 ***
FP Functions (FP)	1.10985 ***	1.89802 ***	-1.00539 **	-1.42520 ***

***: 1%, **: 5%, *: 10%

4. Result of discussion and implications

From the results of this survey, for the Tokyo metropolitan area other than the young generation, such as the college students of Kyoto Sangyo University, the transition to smartphones, by MWTP to the SM, there is a possibility that the transition costs are limited.

That is 1) mobile payment services, such as mobile Suica has not spread outside the Tokyo metropolitan area, 2) Sekine (2011) pointed out of that the youth has short TV viewing time than previous generations, 3) exchange means, such as contact data in addition to infrared communication came out like QR code or Bluetooth. In short what it has been said that the killer service in FP is, or will not because it is recognized that there is no less important for the younger generation of non-metropolitan area. This is consistent inference with our result; FP has a negative sign in all cases.

As seen in IICP (2014), the Japanese young generation has a high WTP to service in the smartphone that are attracted to LINE and are affected by strong network externality effect.

According to CIAJ (2012) early users in 2009 emphasised designs and functions when they choose their smartphone handset, but the factors to be most important was changed to price standards in 2012. Gathering reports of CIAJ, Tanaka & Hamaya (2012), and our survey, communication policy change for pricing of handsets can affect the consumer behaviour. Under major oligopoly situation there is a risk that the spread rate is distorted by strategic factors of supply side, such as pricing policy and terminal of assortment. It is difficult for the late majority of spread curve of Rogers (1983) to be accepted laborious use provided by the MVNO. The spread of the service there is also a factor other than prices, this discussion is our future challenges

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Open Innovation Strategy of Japanese SMEs: From Viewpoint of ICT Use

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1. INTRODUCTION

Product innovation of Japanese small and medium-sized enterprises (SMEs) has been mainly carried out according to the so-called independence principle. This innovation method has run up against *a* brick wall, and they have been moving toward the open innovation system, which utilize positively managerial and innovation resources outside of SMEs by collaborating with other firms or organizations. Open innovation enhances new innovation by absorbing technology, knowledge and information outside of SMEs and combining them with internal innovation factors. According to Chesbrough (2003, 2006) which advocate the concept of "open innovation," this is expected to create new excellent business models by collaborating with entities outside of an organization. The business model of how to integrate internal resources and external resource for innovation is more evaluated than technology that invents a new product. Under this environment, it is requested that the relationship with partners becomes more open. However, Japanese SMEs work on open innovation with partners who have long-term commitment such as capital ties (Idota et al., 2010), which is different from the Chesbrough type. In this paper, the characteristics of the Japanese SMEs which have been successfully engaging in open innovation are clarified by examining the open innovation strategy of Japanese SMEs. This paper proposes features of an open innovation model of SMEs in terms of the best use of the Japanese strong points, relationship with partners and ICT (Information Communication and Technology) use to promote this model.

2. OPEN INNOVATION

Up to now, the importance that procures a necessary resource from the outside of business has been emphasized (Teece, 1987). According to this, how to procure insufficient resources in firms from the outside is focused. The new open innovation concept of Chesbrough, on the contrary, does not discriminate the subordinate-superior relationship among in internal and external resources. It focuses on the business model which aims to integrate these resources. In this sense, the ability to integrate them is more valuable than the resources for technological development.

Ability requested here is not specific to technology itself for innovation but ability to construct a business mode by making a rule, standardizing, and rearranging existing business activities. On the other hand, for open innovation, ability to procure necessary technologies from the market is required. It is important for such technology to be standardized to integrate easily with other technologies. Moreover, open procurement is required for open innovation.

3. PRODUCT ARCHITECTURE

The product architecture means an idea for manufacturing products. It has chiefly two types. The integral type implies that the assembling rule is not decided beforehand, but it can be adjusted in the production process in consideration of the entire optimality in the all stages of development and manufacturing. On the other hand, in the module type, the rule of parts is decided beforehand, while developing and manufacturing the product, parts combined are adjustable according to the rule. Because of the complexity of interface between parts, it is not possible to decide individual parts independently beforehand. Specific functions can be achieved by integrating two or more parts and then the interdependence of each part tends to be high.

Fujimoto terms this integral type as "*suriawase*" (type of Japanese adjustment) (Fujimoto, 2003). The ability to adjust parts or firms becomes important in the integral type. Various adjustments are required over the walls existing inside as well as outside of the firm, and success depends on this. Quality control is the result of the integration. Adjustment among parts is necessary for improving performance, quality, and the marketability of products. Moreover, adjustments are needed between parts as well as between complex functions like a product design, a productive technique, test and so on. Various adjustments are needed similarly between suppliers and an assembler when developing and manufacturing the product. The quality of products manufactured by the integral type is influenced by not only individual parts but also the success of adjustment. Accordingly in case of the integral type, related works increase since changes occur in the process of production. On the other hand, this type has merits such that adjustment is possible when unpredicted accidents might occur. Japanese firm has demonstrated the merits of the integral type.

On the other hand, interface among parts is rather simple and parts can be combined easily in the module type. The degree of independence of each part is high, since parts are designed and developed separately. If a big problem happens, it does not necessarily cause serious situation. For improving the independence of parts, it is necessary to standardize the rule of the design (design rule) and it is better that this

standardization is determined by the industry level, and particularly the interface of parts. One part is also need to be simplified to achieve one function alone. In the module type, the cost reduction and resulting price is achieved by simplification and standardization. Since assembling parts is easy and interfaces of parts are standardized, the cost reduction is easier in the modulation. In the market with intense price competition, the modulation of parts is inevitable to reduce cost and price. However, competition becomes intense more and more, since it becomes easy for newly-established firms to enter the market of products with the modular type.

Because of standardization in a module type, research and development of parts can be done concurrently, and then firms can promote easily technological development. Parts are specialized to firms because of independence of other parts. Therefore, open innovation accelerated by the modulation (Chesbrough, 2003).

Since big firms have been chasing this so-called independence principle in the past, SMEs have been playing a supplementary role as subcontractors. However, SMEs and other ventures can make the best use of their own strong points, and the possibility of succeeding in incubation has risen in the module type. Moreover, the modulation of parts has a strategic meaning for SMEs toward open innovation since they can expand their business partners.

According to the background thus mentioned, Idota, et al. (2010) clarified partner's type in Japanese open innovation and the ICT use from the analysis based on the questionnaire survey for innovative SMEs Japan. In our previous research, it turned out that the approach based on the mutual trust cultivated for the long-term relationship was important basis for Japanese open innovation. It is considered that the Japanese success of innovation of the new products is due to not only procurement parts and technologies innovative partners own from the market but also to the long-term relationship cultivated among large and SMEs. The features of firms succeeded in open innovation could not be analyzed in more detail by the previous research. In what follows, in order to construct a model of Japanese open innovation based its strength, the features of SMEs succeeded in open innovation, and the relationship with partners, and success factors of the ICT use to promote this model are analyzed by focusing on the product architecture that characterize firms' product development.

4. METHOD OF THESE ANALYSES

This study is based on a mail survey conducted to 2,260 Japanese unlisted companies in industries such as manufacturing, construction, and information and telecommunication in January 2010. This survey targeted unlisted firms which were

found in "*J*apan Company Handbook *(The Kaisha Shikiho)* the Unlisted Company in Second Half of 2009" (T*oyokeiza*, 2009) published by *Toyokeizaishinpo*, particularly those listed here were thought as actively engaging innovation activities. The number of valid responses is 152 (6.7%). The analysis covers three years from 2005 to 2008.

Let us summarize results of mail survey shown in Table 1. Responding firms has rather long history: firms with over 51 years operation are 67 (44.1%). Approximately two-third of firms (100; 65.8%) has capital less than 300 million yen. The number of employee with less than 300 is 109 (71.8%). The majority of respondents are thus small-sized firms. Regarding to the industry, 98 (63.2%) belongs to manufacturing, 25 (16.1%) to information and telecommunication companies, 19 (12.3%) to construction companies, and 13 (8.4%) to others.

Table 1. Summary statistics

		Freq.	%
Years of operation	51years over	67	44.1
	31-50years	36	23.7
	21-30years	27	17.8
	11-20years	14	9.2
	less than 10years	8	5.3
Capital (million yen)	less than 50	43	28.3
	51- 100	32	21.1
	101-300	25	16.4
	301-500	25	16.4
	501 over	27	17.8
The number of employees	less than 50	38	25.0
	51-100	20	13.2
	101-200	23	15.1
	201-300	28	18.4
	301-500	25	16.4
	501over	18	11.8
Industries (multiple answers)	manufacturing	98	63.2
	Construction	19	12.3
	information and telecommunication	25	16.1
	Others	13	8.4

Source: Authors

The situation of open innovation viewed by responses is summarized in Table 2. 56 (37.8%) have succeeded in open innovation in three years from 2005 to 2008. The number of firms with many integral technologies is 26 (17.6%), while that with the small number of integral technologies is 16 (10.8%). The total firms are 40 (28.4%). On the other hand, the number of firms with many module technologies is 14 (9.5%), whereas that with the small number of module technologies is 46 (31.1%). The total

firms is 60 (40.6%).

The percentage of firms with the integral technological type succeeded in open innovation is 31.0% out of the entire firms of this category, while that of firms with the module technological type succeeded in open innovation is 45.0% out of the entire firms of the module technological type. As a result, the module type firm is found to have more innovation that those of the integral type firms.

Table 2. Open innovation and type of technology

	Open Innovation		
	Yes	No	Total
Much more integral technologies	4	12	16
More integral technologies	9	17	26
Integral and module technologies are the same	16	30	46
Less module technologies	22	24	46
Much less module technologies	5	9	14
Total	56	92	148

Source: Authors

In the following analysis, only the data of the module technology type firm is used. The features of the firm succeeded in open innovation and the success factors of the ICT use are clarified. "The presence of open innovation" is used for the explained variable, while the explanatory variables contain "years of operation (Logarithm)," "capital (Logarithm)," "the number of employees" and "the type of industry dummy," in addition to "partner's type," "communications means," "frequency," "initiative of the joint development," "type of shared information," "relationship with partner," "managerial characteristics," "organizational ability," "types of ICT use and its effect," and "success factors of ICT use".

5. RESULT OF ESTIMATIONS

(1) Partner and location

By adding the variables to the explanatory variables such as "Supplier in the region," "Supplier outside the region," "Customer in the region," "Customer outside the region," "Same trade company in the region," "Same trade company outside the region," "Mother company or subsidiary company," "University in the region," and "University outside the region," type of open innovation partners and partner's location are analyzed. The estimation result is shown in Table 3. It is found that "Customers in the region ($p<0.003$)" and "Mother company or subsidiary company ($p<0.021$)" become positively significant. This indicates that SMEs owned the relationship with local

customers and Mother Company tends to achieve more open innovation.

Table 3. Type of partner and partner's location

				Observations	=	60
				Prob > Chi2	=	0.0065
				Pseudo R2	=	0.3717
				Log likelihood	=	-27.031614
Open Innovation	Coefficient	Std. Err.	z-value	p-value		Marginal Effect
ln (operation of year)	31.01879	17.4147	1.78	0.075		7.409197
ln (capital)	-0.1112164	0.1790534	-0.62	0.535		-0.0265653
No. of employee	0.0001561	0.0002483	0.63	0.53		0.0000373
Suppliers in the region	-0.226915	0.3038065	-0.75	0.455		-0.0542013
Suppliers outside the region	0.2664426	0.2466654	1.08	0.28		0.0636429
Customers in the region	0.7070028	0.238092	2.97	0.003	***	0.1688758
Customers outside the region	0.2170853	0.177665	1.22	0.222		0.0518533
Same trade company in the region	0.524972	0.4052421	1.3	0.195		0.1253956
Same trade company outside the region	-0.0194227	0.2501075	-0.08	0.938		-0.0046393
Mother company or subsidiary company	1.591917	0.6922443	2.3	0.021	**	0.3802478
University in the region	-0.3477749	0.2641113	-1.32	0.188		-0.0830701
University outside the region	0.0296012	0.3290466	0.09	0.928		0.0070706
Manufacturing dummy	1.318166	0.9543666	1.38	0.167		0.3148593
Construction_dummy	1.644135	1.109423	1.48	0.138		0.3927206
Information_dummy	0.8194796	0.9853922	0.83	0.406		0.1957422
Constant	-235.2532	132.5686	-1.77	0.076	*	

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%

Source: Authors

(2) Means of communication, frequency, and Information of customer needs and idea

Here to achieve open innovation, how and with what means SMEs collect information on customer needs and idea is examined. Again by adding variables to explanatory variables such as “Face-to-face,” “Phone,” “E-mail,” “Frequency of development with partners,” “Frequency of negotiation with partners by face to face,” “When jointly developing, our company offers the idea and customer needs to partner,” “When jointly developing, our company performs a leading role,” means of communication and frequency with partners, and agents who offer information on customer needs and idea are analyzed. Table 4 shows the result of estimation. Only two variables such as “Face-to-face ($p<0.061$)” and “E-mail ($p<0.028$)” become positively significant, while “When jointly developing, our company offers ideas and customer needs to partner ($p<0.017$)” become negatively significant. This result shows that SMEs obtain information via face-to-face and e-mail tend to achieve more open innovation.

Table 4. Means of communication, frequency, and Informer of customer needs and idea

				Observations	=	38
				Prob > Chi2	=	0.0934
				Pseudo R2	=	0.3841
				Log likelihood	=	-16.091381
Open Innovation	Coefficient	Std. Err.	z-value	p-value		Marginal Effect
ln (operation of year)	20.48303	19.03797	1.08	0.282		4.830633
ln (capital)	-0.252242	0.2590039	-0.97	0.33		-0.0594877
No. of employee	0.0001417	0.0005184	0.27	0.785		0.0000334
Face-to-fFace	1.326376	0.7075673	1.87	0.061	*	0.3128071
Phone	0.8063665	0.5741126	1.4	0.16		0.1901701
E-mail	1.447592	0.6570917	2.2	0.028	**	0.3413941
Frequency of development with partners	0.420518	0.4131768	1.02	0.309		0.0991732
Frequency of negotiation with partners by face-to-face	0.3787442	0.3762472	1.01	0.314		0.0893215
When jointly developing, our company offers the idea and customer needs to partner.	-0.5860078	0.2451894	-2.39	0.017	**	-0.1382016
When jointly developing, our company performs a leading role.	0.2179553	0.3332252	0.65	0.513		0.0514017
Manufacturing dummy	1.596883	1.031847	1.55	0.122		0.3766021
Construction_dummy	1.533389	3.168013	0.48	0.628		0.3616281
Information_dummy	0.3233238	1.058631	0.31	0.76		0.0762513
Constant	-159.0891	145.4119	-1.09	0.274		

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%

Source: Authors

(3) Type of information sharing and relationship with partner

In order to examine the type of information sharing with partners, the following variables are added to the explanatory variables: “Customer needs;” “Demand forecast;” “Basic technological information;” “High-tech trend;” “Production machine (software) information;” “Development period information;” “Long-term customer;” and “Dispatching engineer for technical guidance.” The result of estimation is shown in Table 5. Which indicates “Capital ($p<0.014$),” “Demand forecast ($p<0.031$),” “High-tech trend ($p<0.008$),” “Long-term customer ($p<0.008$)” and “Dispatching engineer for technical guidance ($p<0.082$)” become positively significant. “Number of Employee ($p<0.074$),” “Basic technological information ($p<0.028$),” “Production machine (software) information (0.016)” and “Development period information ($p<0.046$)” become negatively significant. The estimation results show that (i) trend of high-technology, (ii) demand are major information, while SMEs obtain information through (i) customers with long-term relationship and (ii) dispatching engineers.

Table 5. Type of sharing information and relationship with partner

				Observations	=	39
				Prob > Chi2	=	0.0006
				Pseudo R2	=	0.7031
				Log likelihood	=	-7.9304228
Open Innovation	Coefficient	Std. Err.	z-value	p-value		Marginal Effect
ln (operation of year)	-31.92128	27.21862	-1.17	0.241		-3.586023
ln (capital)	3.353043	1.361811	2.46	0.014	**	0.3766793
No. of employee	-0.0022797	0.0012758	-1.79	0.074	*	-0.0002561
Customer needs	4.27151	2.81602	1.52	0.129		0.4798595
Demand forecast	7.164621	3.313569	2.16	0.031	**	0.8048703
Basic technological information	-7.679169	3.500162	-2.19	0.028	**	-0.8626744
High-tech trend	6.996751	2.621416	2.67	0.008	***	0.7860119
Production machine (software) information	-7.175403	2.98722	-2.4	0.016	**	-0.8060815
Development period information	-3.968811	1.98591	-2	0.046	**	-0.4458544
Long-term customer	7.245674	2.734415	2.65	0.008	***	0.8139758
Dispatching engineer for technical guidance	7.278651	4.189908	1.74	0.082	*	0.8176803
Manufacturing_dummy	0.5258823	3.138687	0.17	0.867		0.0590774
Construction_dummy	1.468049	2.595155	0.57	0.572		0.1649199
Information_dummy	4.851848	3.644795	1.33	0.183		0.5450544
Constant	170.6825	200.4429	0.85	0.394		

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%

Source: Authors

(4) Organizational capability for succeeding in an open innovation

In this analysis, how organizational capability is related to open innovation is examined. Organizational capability implies internal sources SMEs owned which create innovation, and this consists of three factors such as technology, marketing and finance. The following three variables are selected as explanatory variables: “Production and processing technology ability;” “Marketing research ability;” and “Funding ability.” Table 6 summarizes the result, which indicates “Production and processing technology ability ($p<0.01$)” and “Funding ability ($p<0.057$)” become positively significant.

(5) Managerial characteristics and organizational culture

Here the estimation model focuses on how the managerial system and organizational culture are related to open innovation, that is, innovation is also related to speed of decision-making, sharing information with other sections or departments inside SMEs, the relationship between management and R&D sections or top and middle management. Organizational culture such as open communication inspires innovative feeling of the firm. In order to examine these subjects, the variables are added to the explanatory variables such as “Basic research and the product development research are

cooperated," "The success and the failure factor of its own project are analyzed," "Superior and subordinate's communications are active," "There is place where the new product development is examined exceeding the section," "There is a system that positively offers the other companies its own technology," "We regularly evaluate and review of the customer" and "Customer trusts our company."

The result of estimation is shown in Table 7. The variable such as "There is place where the new product development is examined exceeding the section (<0.06)" and "There is a system that positively offers its own technology to other companies ($p<0.082$)" become positively significant. These indicate that SMEs with open organization or thinking tend to achieve more innovation. The former indicated that to construct the open innovation system, firms need some open foundation, while the latter is a basis for open innovation system with partners outside the SMEs.

(6) ICT use and success factor of ICT use

Lastly, the relationship between ICT use and open innovation is examined. ICT promotes not only to strengthen the relationship among firms with communication technology but also to share information among different sections or department inside firm. The following variables are selected as closely related ICT use, namely "CRM (Customer Relationship Management)," "CTI (Computer Telephony Integration)," "SCM (Supply Chain Management)," "The number of development of new products and new services has increased by IT," "Executives clarified the ICT introduction target," "Executives were familiar with ICT," "ICT personnel exercised the leadership for ICT us," "We have continuously improved the business process and IT," "When ICT was introduced, we reformed organizational structures, systems, and company's rules," "We collected the success cases with the IT introduction," "We invested emphatically in ICT" and "We evaluated, analyzed introduced IT, and used it for the improvement."

The resulted of estimation is shown in Table 8, which indicates the following variables are significant: "The number of development of new products and new services has increased by IT ($p<0.037$)," "Executives clarified the ICT introduction target ($p<0.018$)," "When ICT was introduced, we reformed organizational structures, systems, and company's rules ($p<0.009$)" and "We evaluated, analyzed introduced IT, and used it for the improvement ($p<0.025$)" become positively significant. "ICT personnel exercised the leadership for ICT use ($p<0.028$)," "We have continuously improved the business process and IT ($p<0.069$)" and "We invested emphatically in ICT ($p<0.063$)" become negatively significant. According to these results, four variables related to ICT use promote open innovation. For the successful introduction of ICT, it is

Table 6. Organizational capability

				Observations	=	60
				Prob > Chi2	=	0.0276
				Pseudo R2	=	0.2205
				Log likelihood	=	-33.095835
Open Innovation	Coefficient	Std. Err.	z-value	p-value		Marginal Effect
ln (operation of year)	18.77872	13.55449	1.39	0.166		5.630072
ln (capital)	-0.1869564	0.1666351	-1.12	0.262		-0.0560516
No. of employee	0.0001812	0.0002284	0.79	0.428		0.0000543
Production and processing technology ability	0.6631734	0.2570285	2.58	0.01	**	0.1988269
Marketing research ability	0.2282679	0.2208747	1.03	0.301		0.0684373
Funding ability	0.4050752	0.2124754	1.91	0.057	*	0.1214461
Manufacturing dummy	-0.9650262	0.9592955	-1.01	0.314		-0.2893257
Construction dummy	-0.9940926	1.089501	-0.91	0.362		-0.2980402
Information dummy	-1.02738	1.022523	-1	0.315		-0.3080201
Constant	-142.8525	103.1161	-1.39	0.166		

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%
Source: Authors

Table 7. Managerial characters and organizational culture

				Observations	=	59
				Prob > Chi2	=	0.0442
				Pseudo R2	=	0.2801
				Log likelihood	=	-29.287722
Open Innovation	Coefficient	Std. Err.	z-value	p-value		Marginal Effect
ln (operation of year)	17.91962	13.8313	1.3	0.195		5.071795
ln (capital)	0.0591607	0.1762537	0.34	0.737		0.0167443
No. of employee	-0.0001331	0.0002207	-0.6	0.546		-0.0000377
Basic research and the product development research are cooperated.	-0.3504497	0.2537455	-1.38	0.167		-0.0991879
The success and the failure factor of its own project are analyzed.	0.5127677	0.3355602	1.53	0.126		0.1451288
Superior and subordinate's communications are active.	-0.4765964	0.3330466	-1.43	0.152		-0.1348912
There is place where the new product development is examined exceeding the section.	0.4606179	0.2448558	1.88	0.06	*	0.1303688
There is a system that positively offers its own technology to other companies.	0.3553979	0.2043103	1.74	0.082	*	0.1005884
We regularly evaluate and review of the customer.	0.2588857	0.2507435	1.03	0.302		0.0732725
Customer trusts our company.	0.5946864	0.3980189	1.49	0.135		0.1683143
Manufacture_dummy	0.6816385	0.8838711	0.77	0.441		0.1929244
Construct_dummy	-0.5103776	0.9913338	-0.51	0.607		-0.1444523
Information_dummy	0.0342199	0.8842766	0.04	0.969		0.0096853
Constant	-142.3754	105.7552	-1.35	0.178		

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%
Source: Authors

Table 8. ICT use and success factor of ICT use

				Observations	=	60
				Prob > Chi2	=	0.0099
				Pseudo R2	=	0.4221
				Log likelihood	=	-23.859743
Open Innovation	Coefficient	Std. Err.	z-value	p-value		Marginal Effect
ln (operation of year)	-25.82684	19.39724	-1.33	0.183		-5.6565
ln (capital)	-0.3662901	0.2505521	-1.46	0.144		-0.0802235
No. of employee	-0.0004158	0.0004874	-0.85	0.394		-0.0000911
CRM	-0.4030084	0.5709796	-0.71	0.48		-0.0882654
CTI	0.2114542	1.8515	0.11	0.909		0.0463119
SCM	2.080579	1.696772	1.23	0.22		0.4556808
The number of development of new products and new services has increased by IT.	0.9023916	0.4315238	2.09	0.037	**	0.1976385
Executives clarified the ICT introduction target.	0.9303418	0.3933239	2.37	0.018	**	0.20376
Executives were familiar with ICT.	0.610873	0.4265794	1.43	0.152		0.1337911
ICT personnel exercised the leadership for ICT use.	-0.9524121	0.4334203	-2.2	0.028	**	-0.2085938
We have continuously improved the business process and IT.	-0.7279826	0.399964	-1.82	0.069	*	-0.15944
When ICT was introduced, we reformed organizational structures, systems, and company's rules.	0.9973398	0.3820159	2.61	0.009	***	0.2184337
We collected the success cases with the IT introduction.	-0.4480049	0.4608477	-0.97	0.331		-0.0981204
We invested emphatically in ICT.	-0.9861223	0.5304871	-1.86	0.063	*	-0.2159768
We evaluated, analyzed introduced IT, and used it for the improvement.	1.179137	0.5252596	2.24	0.025	**	0.2582502
Manufacturing_dummy	0.1639907	0.9181609	0.18	0.858		0.0359166
Construction_dummy	-0.9693063	1.054464	-0.92	0.358		-0.2122939
Information_dummy	-0.288999	1.127284	-0.26	0.798		-0.0632955
Constant	197.9671	147.4253	1.34	0.179	*	

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%
Source: Authors

required that top management has to indicate its target, the introduction of ICT must come with the reform of organization, and before or after the introduction of ICT, its effect must be checked all the time.

6. IMPLICATIONS

The following can be mentioned from the above-analyses results. At first, the characteristics of module technological type SMEs which has succeeded in open innovation are the follows: (i) they have high technology of production and

manufacturing as well as the high funding capacity; (ii) The place where new product is not only developed only by persons in charge of research and development section but also by collaboration with sections or departments of firms; (iii) and firms have a system that offers its own technology to other firms or they jointly develop positively with partners. Thus, firms which have the high technology level and organizational culture that enables to collaborate outside as well as inside entities tend to achieve open innovation.

Secondly, partners who collaborate for open innovation are as follows: (iv) they are customers in the region or subsidiary companies. They are related with each other through long-term transactions or engineers dispatched for technical guidance; (v) customer needs and ideas are brought by collaborating the partners while engaging jointly in R&D; (vi) means of communications with these partners are through face-to-face or e-mail, and information needed from partners is forecast or high technology.

Finally, the role of ICT use for open innovation is as follows: (vii) ICT including e-mail is very useful for an increase in the number of new products and services; (viii) there are the following three success factors of ICT use for open innovation:

- Managers have to take a lead for ICT use and show the clear target instead of yielding its lead to other staff.
- Do not invest in ICT excessively, but to evaluate and analyze ICT used. Use ICT for improvement.
- Organize and review the system and rule, and transform organization at a stretch when ICT is introduced.

It should be noted that when ICT is introduced, its objective is to reform organization: or use existing ICT skillfully and use it for the innovation.

7. DISCUSSIONS AND CONCLUSIONS

For open innovation of Japanese SMEs, module technology is also important similar to open innovation of the Chesbrough's type. The cooperation between long-term firms is already formed in Japanese firms, and SMEs with high module technology play the important role and supported open innovation. These firms dispatch engineers to partners and form the place where information is brought which is obtained by either face-to-face communications or e-mail. Information and the idea are used to develop new products in this place. The partners succeeded in open innovation with such firms are not procured from the open market, but from the long-term relationship.

Moreover, ICT is skillfully used for developing new product in such firms.

Therefore, it is important to clarify the target that should be achieved because of the manager initiation, to introduce ICT with the organizational reformation, and to improve existing ICT enough to use it. These are success factors of ICT use of firms which make open innovation possible by using the module technology.

Japanese SMEs cannot disregard open innovation in the future. However, there are various problems to be solved, as Itami (2009) mentioned. These problems can be summarized as follows: (i) whether open cooperation can be constructed; (ii) whether cooperation among organizations can be formed; (iii) who bears costs for constructing collaboration; and (iv) whether mutual trust can be formed.

According to these results, it is important for Japanese SMEs to improve the module technology and to be maintaining the strong point of the technology and the long-term relationship between firms that have been cultivated up to now.

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An Analysis of e-book Market of Japan: Some Types of Diffusion Pattern of e-book Over Two-sided Market

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Kyoto Sangyo University

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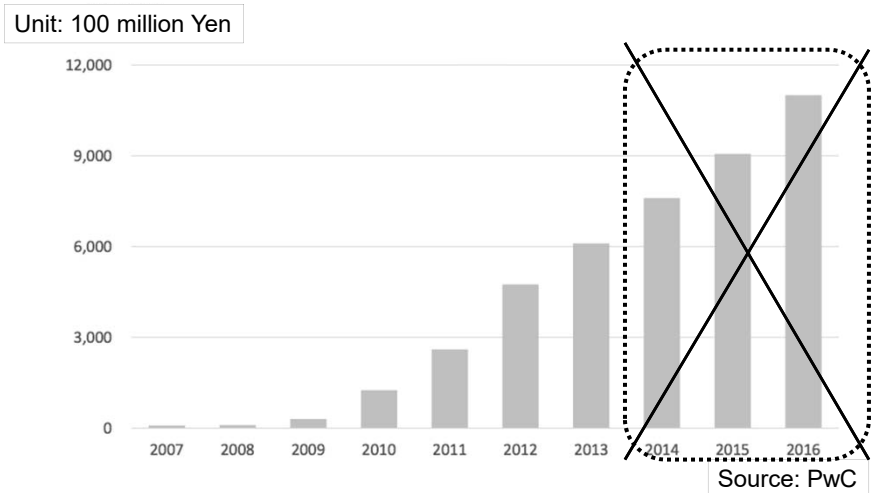
Outlook

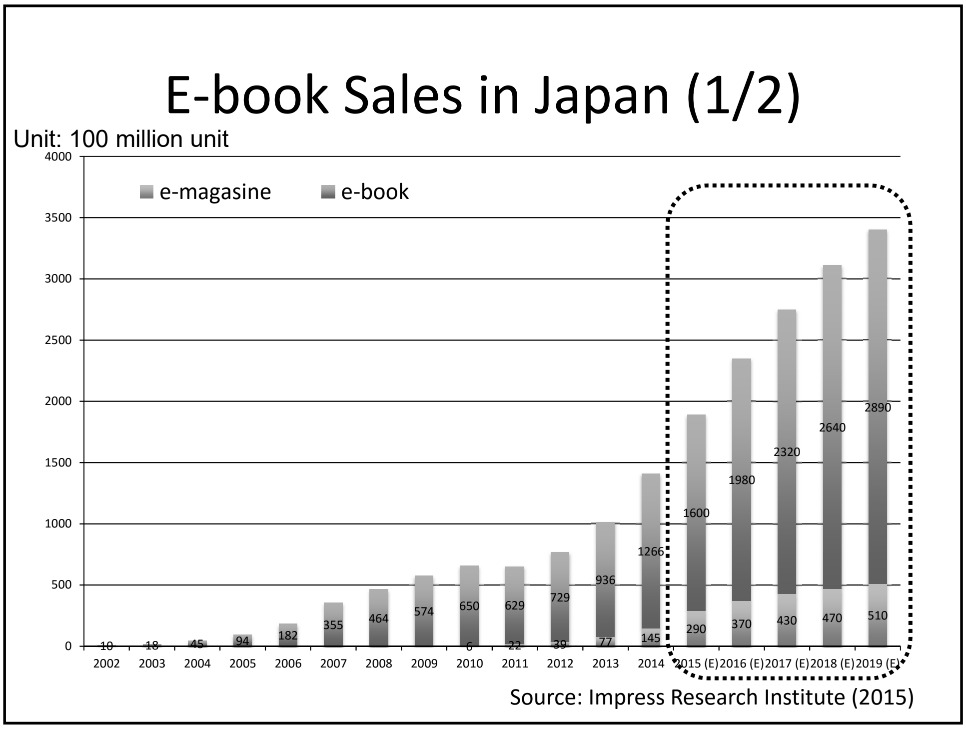
1. E-book Market
2. Mobile Contents Market
3. Music Market
4. E-book Market and Factors
5. Conclusion

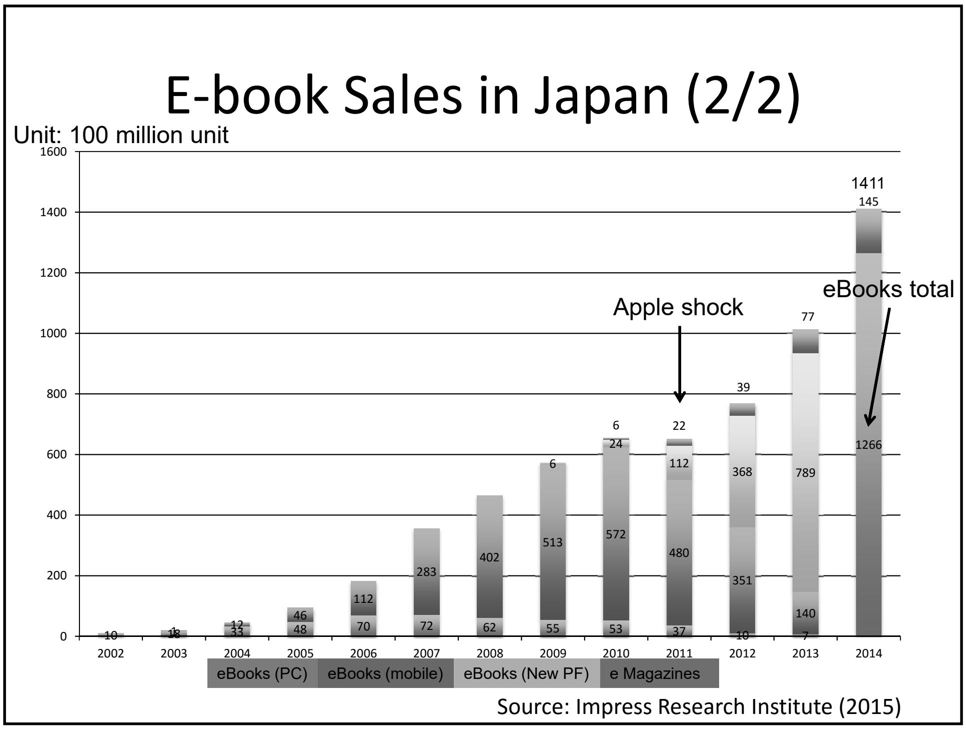
1. E-BOOK MARKET

U.S. e-Book Sales



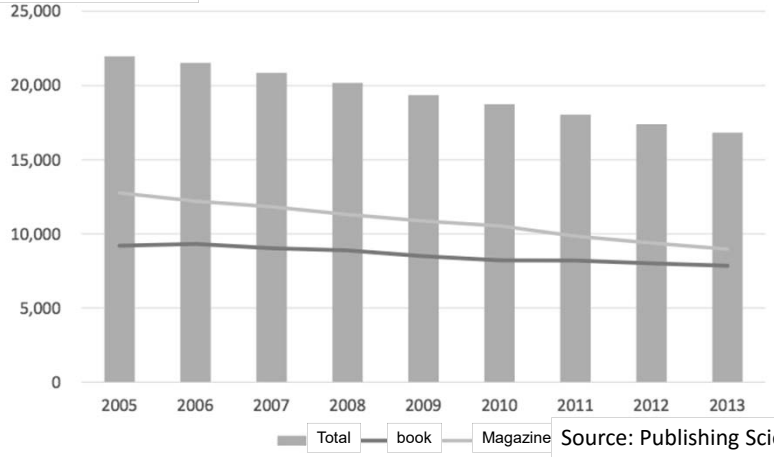
Japanese e-book market ($574 million) was third times as that of the U.S. ($169 Million) in 2009. But E-book market in US stop growing in 2013 and starts to drop in 2015. [4]


E-book Sales in Japan (1/2)
Unit: 100 million unit
e-magasine
e-book
Source: Impress Research Institute (2015)


E-book Sales in Japan (2/2)
Unit: 100 million unit
Apple shock
eBooks total
1411
eBooks (PC)
eBooks (mobile)
eBooks (New PF)
e Magazines
Source: Impress Research Institute (2015)

Sales of Publishing Products

Unit: 100 million Yen

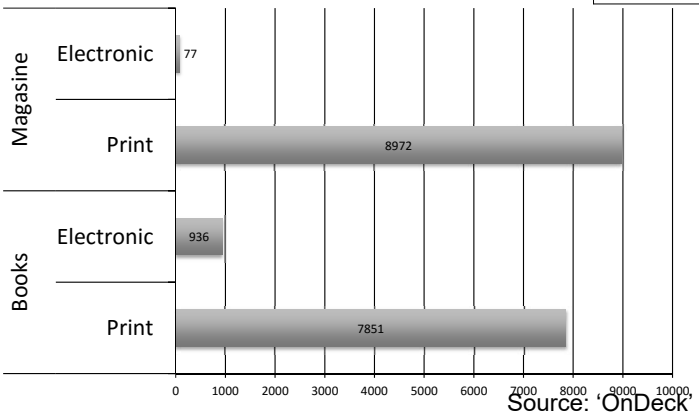


Source: Publishing Science Institute Japan (2014)

Print vs. Electronic ?

	FY 2013	FY 2012
Hachet	33%	30%
Harper Collins	35%	26%
Harlequin	25%	21%
Simon & Schuster	30%	20%

FY 2013 Sales (100 mil. Yen)



Source: 'OnDeck' Report (2014)

-> FY 2013: e-book ratio: 4.3%, e-magasine ratio: 6.5% [Impress]
aprox. 20% in U.S. [AAP/BISG]

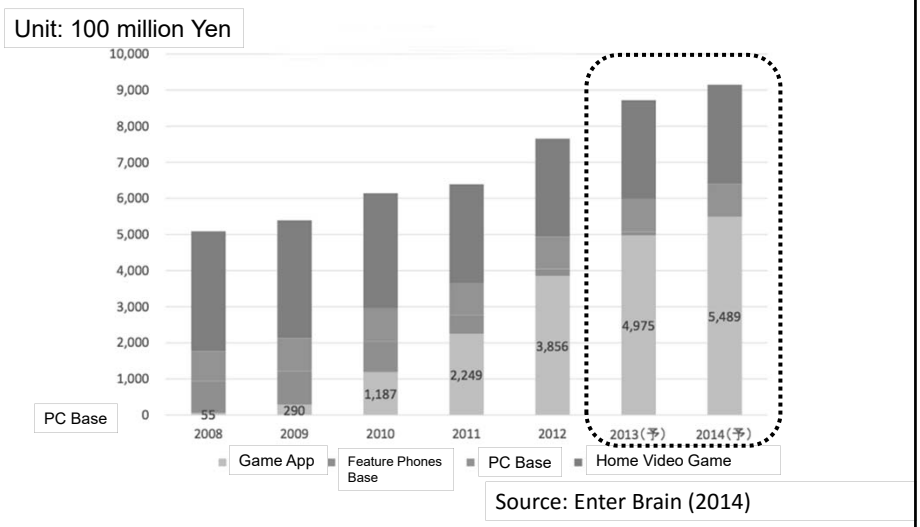
2. MOBILE CONTENTS MARKET

Change of life style

- Average reading time in a week
  FY 2000: 6h. 7sec.
  FY 2010: 2h. 36sec.
- Internet use in a week: 8h.

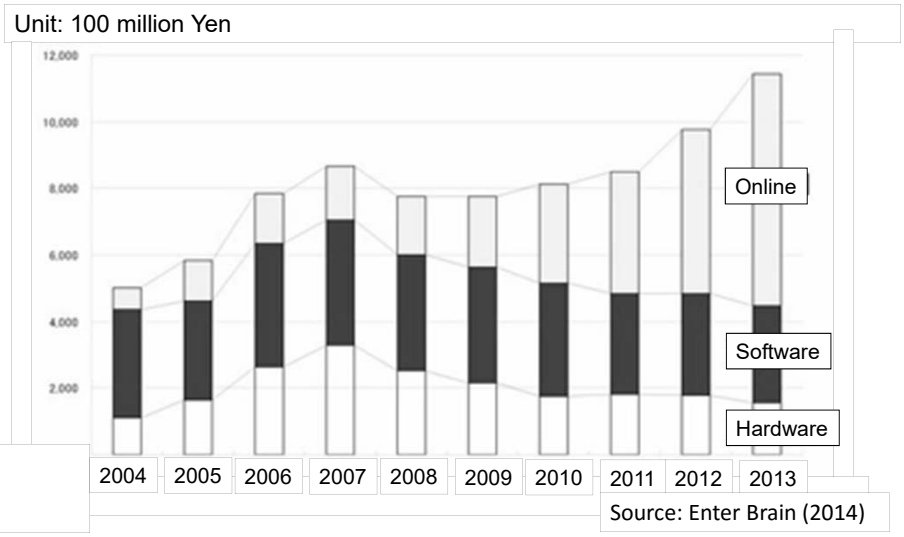
Source: Citizen Holdings (2010)

Game Market in Japan (1/2)



Source: Enter Brain (2014)

Game Market in Japan (2/2)



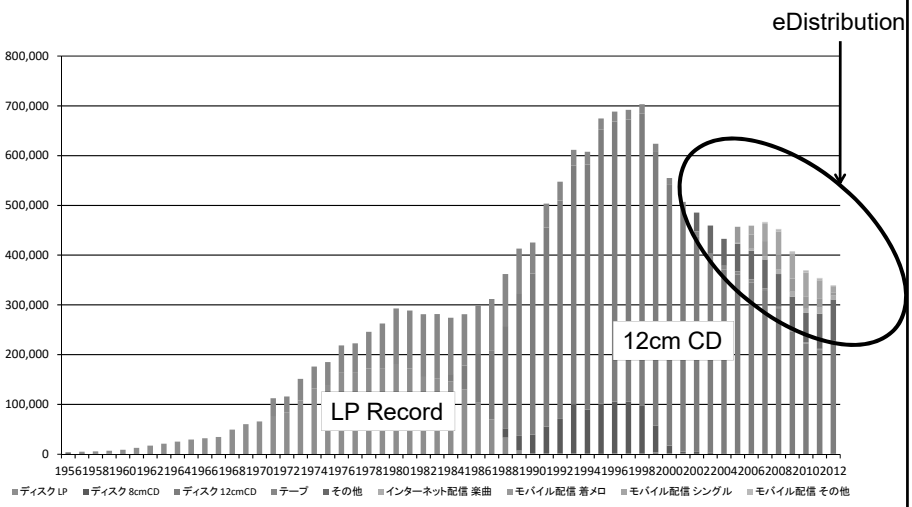
Source: Enter Brain (2014)

Characteristics of Online Games

- Freemium model or Advertising model: 'entrance fee' is free but addicted users pay much.
- Contents itself is purely *customised* for smart phone while most of IPTV, music distribution, e-book is *just conversion* of old media.

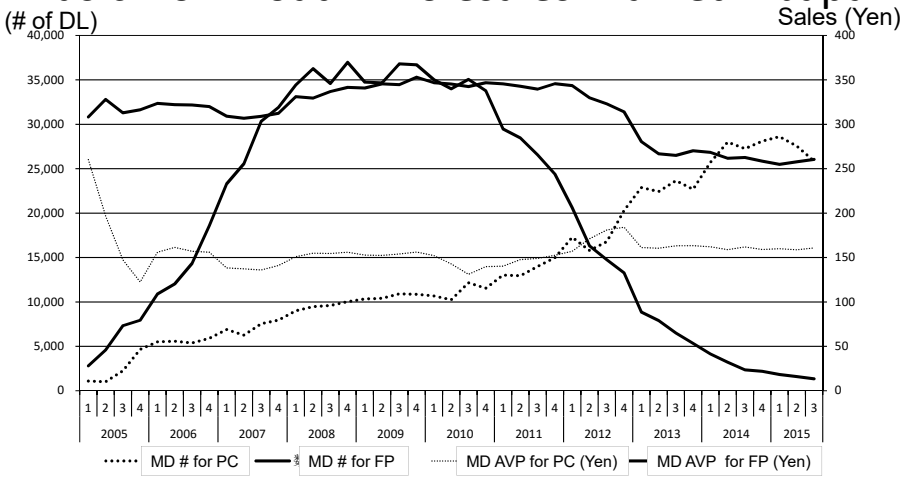
3. MUSIC MARKET

Music Market in Japan



Source: Japan Record Association

Music Download Wholesales Market in Japan



Music Download (MD) for feature phone (-): average unit price: 313.6 Yen
Music Download (MD) for PC/Smart phone (-): average unit price: 157.2 Yen

Source: Japan Record Association (2015)

Music Sales in 2012

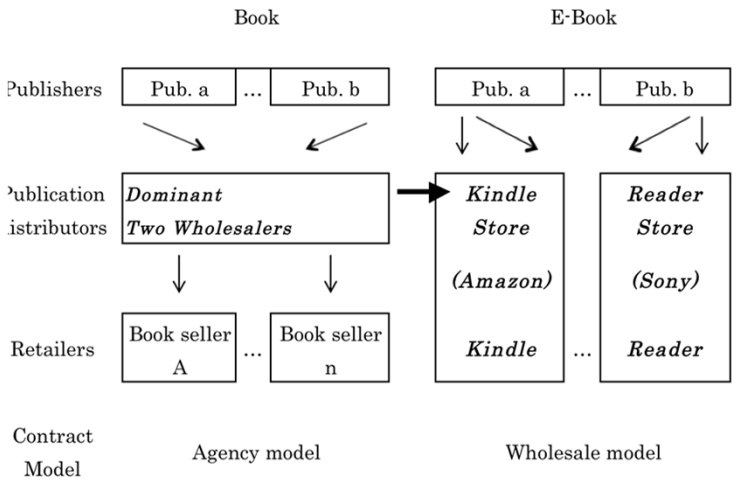
	Sales (Wholesales)			Revenue Share	
	Million USD	Million Local Currency	year-on-year	Package	Download
U.S.	4,372.9	4,372.9	-0.1%	42%	51%
Japan	4,087.7	325,951.6	-7.0%	75%	22%
Germany	1,473.7	1,061.1	-0.2%	78%	15%
U.K.	1,433.7	888.9	-3.1%	58%	32%
France	1,002.2	721.6	-3.7%	71%	19%
Australia	475.2	461.0	5.7%	55%	38%
Canada	434.0	429.7	2.6%	54%	38%
Brazil	262.6	441.2	8.6%	74%	17%
Netherlands	240.2	172.9	-12.1%	71%	14%
Italy	239.9	172.7	-6.4%	68%	20%
South Korea	199.5	221,316.5	6.4%	44%	54%
Spain	190.0	136.8	-3.3%	56%	24%
Switzerland	158.3	140.9	-16.2%	72%	23%
Sweden	155.3	1,009.4	3.0%	45%	44%
Mexico	141.2	1,758.5	5.5%	70%	28%

Source: IFPI, Record Industry in Numbers 2012, METI

-> US/UK type, Continental Euro type

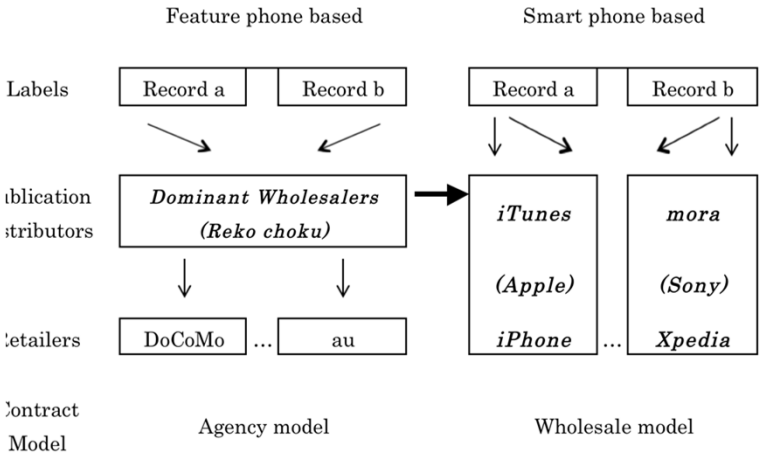
4. E-BOOK MARKET AND FACTORS

Structure of Book Market in Japan



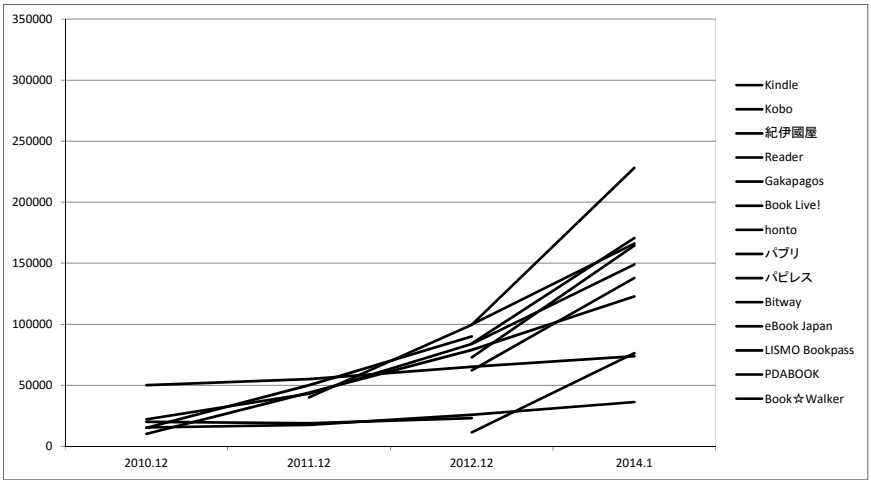
Source: CPRC, Fair Trade Commission Japan (2013)

Structure of Music Market in Japan



Source: CPRC, Fair Trade Commission Japan (2013)

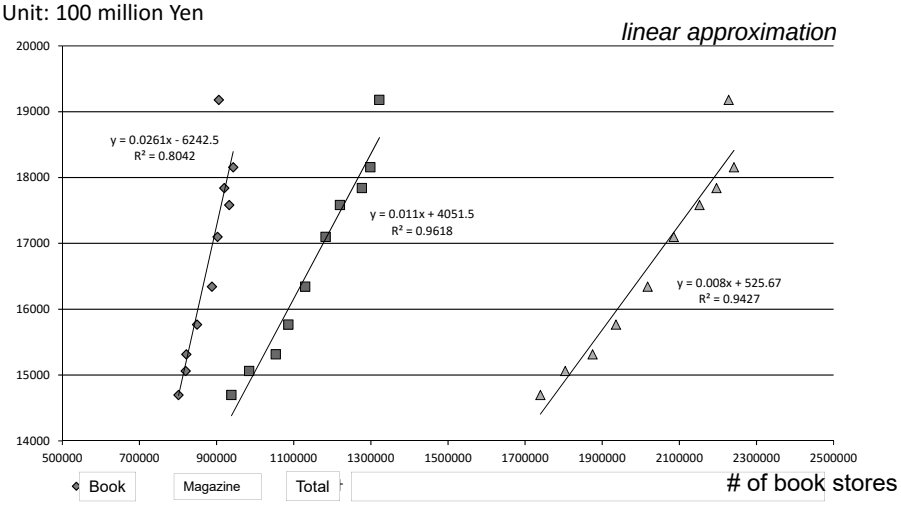
E-Book Titles in Japanese E-book Sellers



Data Source: http://www7b.biglobe.ne.jp/~yama88/

Book Sakes and # of Book Stores

Unit: 100 million Yen

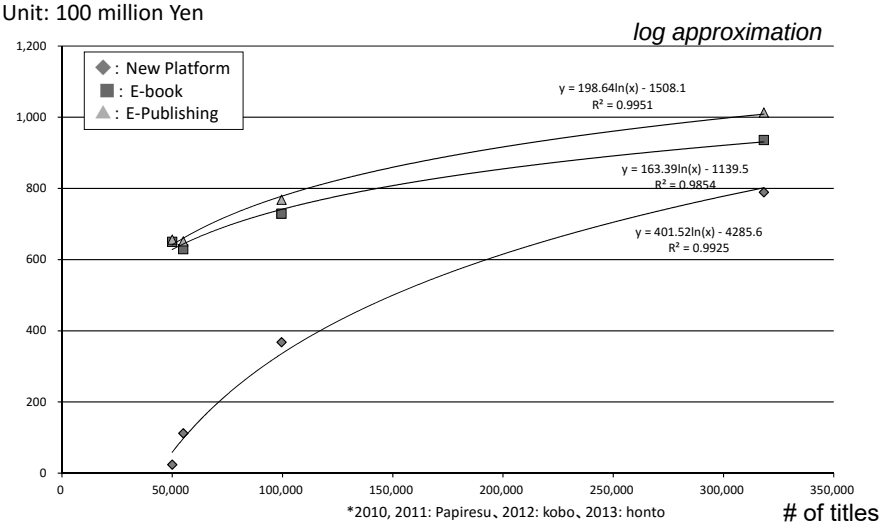


*2010, 2011: Papiresu、2012: kobo、2013: honto

Data Source: http://www7b.biglobe.ne.jp/~yama88/ and Source: Publishing Science Institute Japan

E-book Sales and e-book Titles

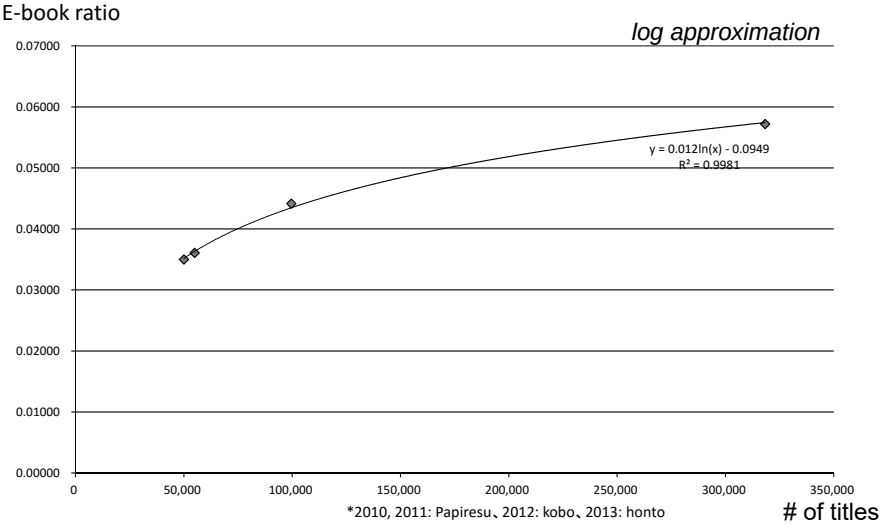
Unit: 100 million Yen



Data Source: http://www7b.biglobe.ne.jp/~yama88/ and Source: Publishing Science Institute Japan

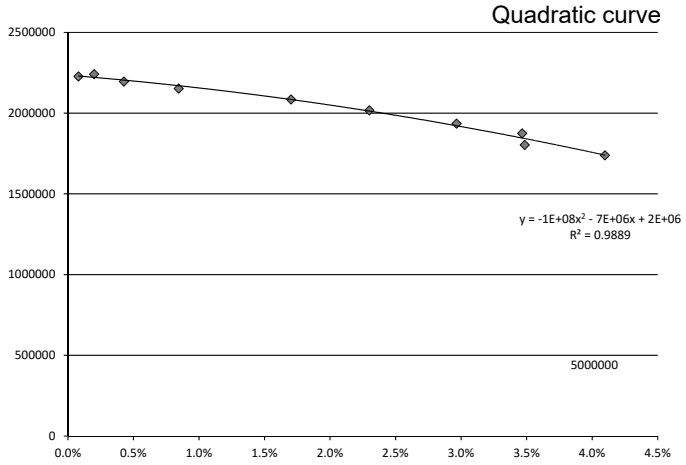
E-book Ratio and E-book Titles

E-book ratio



Data Source: http://www7b.biglobe.ne.jp/~yama88/ and Source: Publishing Science Institute Japan

E-book Ratio and Total Sales of Book Industries



Data Source: http://www7b.biglobe.ne.jp/~yama88/ and Source: Publishing Science Institute Japan

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5. CONCLUSION

Conclusion

- E Distribution in Japan have two types (game and others).
- Market forecast of Impress about Japanese e-book market can be overestimation.
- Though # of e-book title is grow, e-book sales don't catch-up in same speed.
- Market structure of e-book in Japan is very similar with that of music download distribution.
- E Distribution market may have two types in the world.

Keep Innovating.
京都産業大学
2015年、創立50周年

Thank you for your attention!

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Vis. Ass. Prof., National Institute of Informatics
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A STUDY ON THE CORE RIGIDITIES OF JAPANESE ICT COMPANIES BY PATENT ANALYSIS

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Yunju Chen
Shiga University, Japan

Oct. 1, 2015 17th APMC Conference in KAU

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AGENDA

- INTRODUCTION
- LITERATURE REVIEW
- METHODOLOGY
- RESULTS
- DISCUSSION

3

INTRODUCTION

- Most of Japanese ICT companies kept sustaining their competitive advantages until the early 1990s.
- Nowadays, they still suffer from with poor performances at the moment despite various restructuring and massive investment in R&D.

Panasonic SONY SHARP

4

Top 100 Global Innovators in 2013

Geographic distribution of Japan is 28%

Asahi Glass Co., Ltd.	NITTO DENKO CORPORATION
BROTHER INDUSTRIES, LTD.	NTT CORPORATION
Canon Inc.	Olympus Corporation
FUJIFILM Corporation	OMRON Corporation
Fujitsu Limited	**Panasonic Corporation**
Hitachi, Ltd.	Seiko Epson Corporation
Honda Motor Co., Ltd.	Semiconductor Energy Laboratory Co., Ltd.
JATCO Ltd	**Sharp Corporation**
Mitsubishi Electric Corporation	Shin-Etsu Chemical Co., Ltd.
Mitsubishi Heavy Industries, Ltd.	**Sony Corporation**
NEC Corporation	Sumitomo Electric Industries, Ltd.
NGK SPARK PLUG CO., LTD.	TDK Corporation
NIPPON STEEL & SUMITOMO METAL CORPORATION	**Toshiba Corporation**
NISSAN MOTOR CO., LTD.	Toyota Motor Corporation

Criteria:
Volume, Success, Global, Influence

5

The shift of global smartphone market share

- Shipments by vendors

The presence of Korean and Chinese manufacturers arise

Rank	2009	(%)	2011	(%)	2012	(%)	2013	(%)
1	Nokia	41.1	Apple	18.9	Samsung	30.3	Samsung	31.0
2	RIM	19.9	Samsung	18.7	Apple	19.1	Apple	15.6
3	Apple	14.4	Nokia	17.9	Nokia	5.8	Huawei	4.8
4	HTC	6.3	RIM	10.9	RIM	5.0	LG	4.8
5	Samsung	3.4	HTC	9.1	HTC	4.7	Lenovo	4.5
6	Fujitsu	2.8	Sony	4.2	Huawei	4.0	Others	39.3
7	Sharp	2.5	LG	4.0	ZTE	3.9		
8	NEC	2.1	Motorola	3.7	LG	3.8		
9	Panasonic	1.9	Huawei	3.3	**Sony**	**3.6**		
10	Motorola	1.5	ZTE	2.2	Motorola	2.8		

(Source) Gartner ＊RIM: Blackberry

6

Existing hypothesis

- Innovator's dilemma (Christensen, 1997; Christensen and Raynor, 2013)
  - Japanese ICT industry have fallen into an innovator's dilemma by pursuing excessive qualities.
- The change of product architecture (Oshika & Fujimoto, 2006)
  - Architecture of most digital consumer products has been changed from an integral architecture to a module one.
- The commodification of digital product (Nobeoka et al., 2006)
  - Frequent and the rapid price reductions happen in digital consumer product market, Japanese ICT companies have failed to capture value from their newly improved products echoing with their hard efforts.

7

Our alternative hypothesis

- Japanese ICT manufacturers have adopted wrong technology strategies.
  - They have executed massive investment in R&D.
- We compared the smartphone technological trends of Japanese domestic ICT companies with Apple and Samsung, which gain great competitive advantages in smartphone market.

8

Our alternative hypothesis

- We found that there exist significant step-taking differences in the R&D orientation of these two categorized organizations toward feature phone and smartphone market (Park et al. 2014).
- Why such a difference occurs among Japanese domestic and Global excellent ICT companies?
  - We focus on the core rigidities of Japanese ICT companies (Panasonic, Sony and Sharp) and Korean ICT company (Samsung).

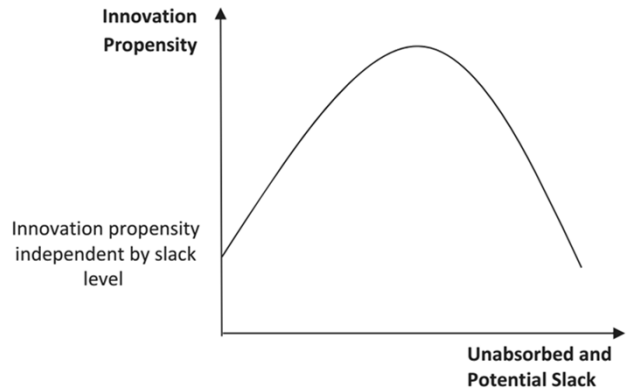
9

LITERATURE REVIEW

- Core rigidities (Leonard-Barton, 1992)
  - In radical environmental changes, innovation, one of the most important issues, reveals how companies should manage the R&D projects of new products and processes. They would be faced with a challenge that the core capabilities simultaneously enhance and inhibit innovation.
  - Because effective competition is based less on strategic leaps than on incremental innovation that exploits carefully developed capabilities. In the other hand, institutionalized capabilities may lead to 'incumbent inertia' in the face of environmental changes. When the core capability becomes rigidity, companies become resistance to change.

10

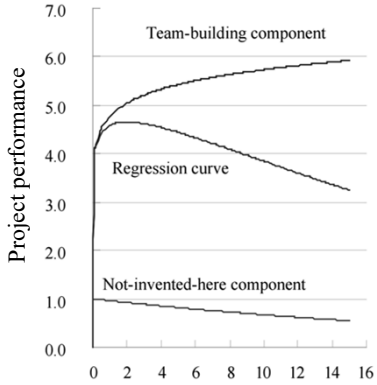
The empirical research of Nohria and Gulati (1996)



There is an inverted U-shaped relationship between the slack resources-capabilities and innovation propensity.

11

The empirical research of Katz and Allen (1982)



Not-invented here component
= project member's mean tenure

Especially, we focus on human resource allocation in R&D project. An inverted U-shaped relationship exists between the project member's mean tenure and R&D project .

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METHODOLOGY

- We define that patent applicants are key persons attaining high scores calculated by centrality of social network analysis（Freeman, 1979）.

- Data
  - Industrial Patent Digital Library (IPDL) in Japan
  - Extracted from 2000 to 2013, which extend 7 years before and after the launch of iPhone in 2007

13

Centralities of Network

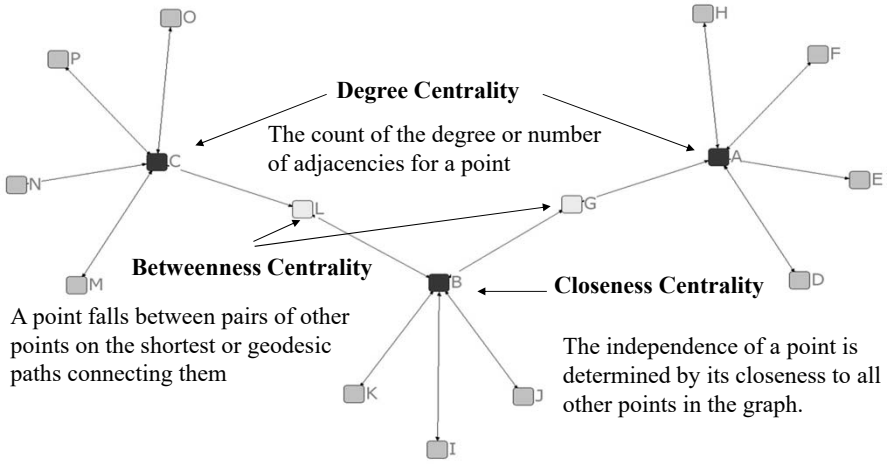

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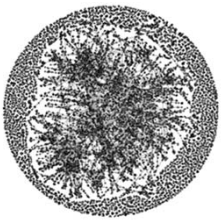
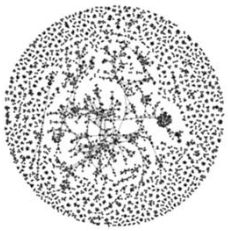
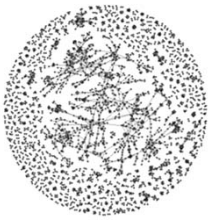
Figure 1 Network of Patent Applicants in 2005



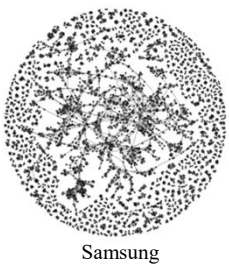
Panasonic



Sony



Sharp



Samsung

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Definition of Core Rigidities

Conditional probability appears where whether or not upper rank j% of person at i year appears upper rank j% of person at i+1 year. When such probability scores are high, they have core rigidities.

$$\text{Core Rigidities} = \text{Conditional Probability}\left(\frac{\text{upper rank j\% of person at i+1 year}}{\text{upper rank j\% of person at i year}}\right)$$

We visualize the human resource reallocation of personnel engaged in R&D project by heat-map. Where the color is dark red in heat-map, it indicates an un-executed reallocation of a core engineer; otherwise, the color is light red, it means a radical change of core member in that year.

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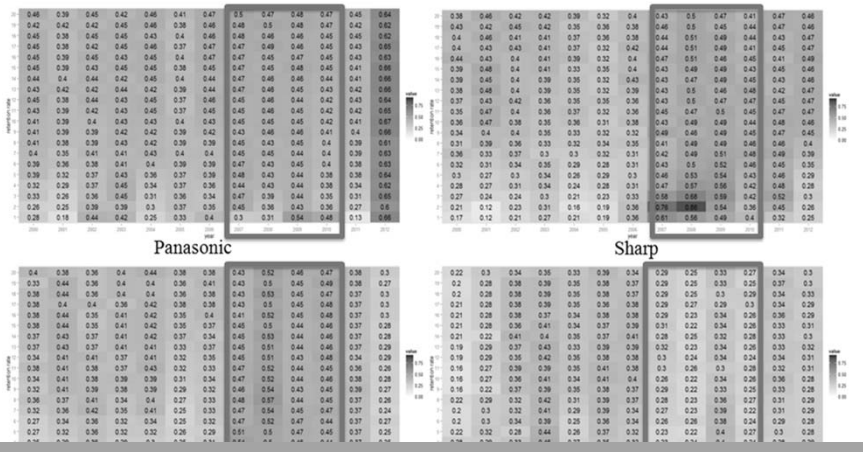
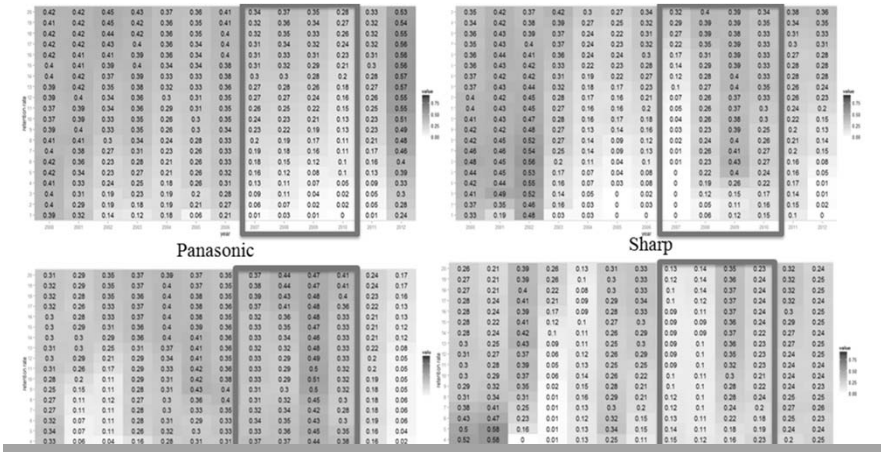
Figure 2 The Evaluation of Core Rigidities by Degree Centrality



Japanese ICT companies seem to be darker than those of Samsung during the years from 2007 to 2010.

17

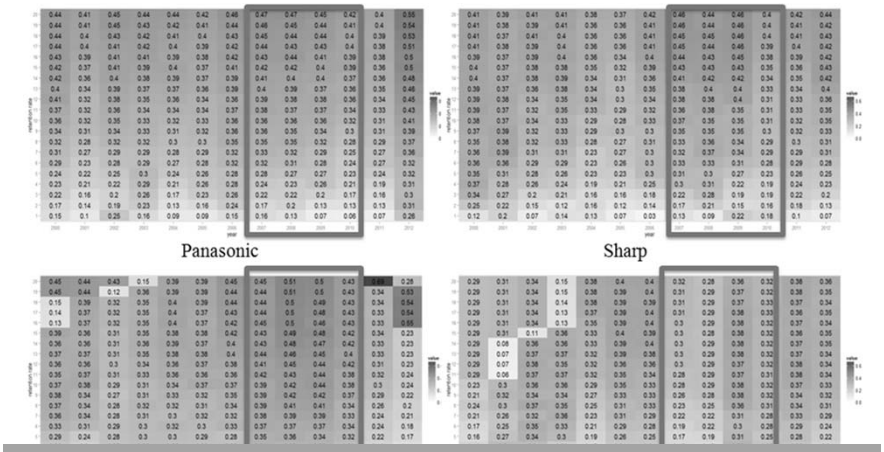
Figure 3 The Evaluation of Core Rigidities by Closeness Centrality



Japanese ICT companies seem to be darker than those of Samsung during the years from 2007 to 2010.

18

Figure 4 The Evaluation of Core Rigidity by Betweenness Centrality



Japanese ICT companies seem to be darker than those of Samsung during the years from 2007 to 2010.

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RESULTS

- From the results shown in Figures 2~4, the colors of Japanese ICT companies seem to be darker than those of Samsung during the years from 2007 to 2010.
- Japanese ICT companies did not make significant changes toward core members of R&D project.
- Briefly speaking, when cell phone market shifted from feature phone to smartphone, the core rigidities of Japanese ICT companies are higher than Samsung's at the early stage. So, Japanese ICT companies had delayed in developing new smartphone.

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DISCUSSION

- We suggest that there is a missing link between the R&D trend of Japanese domestic ICT companies and the market needs. It exists for the core rigidities of Japanese ICT firms in cell phone market.
- Thus, Korean Samsung has recruited new core members in charge of R&D project who could build updated smartphone in answering to such a shift of market structure. Nevertheless, Japanese domestic ICT companies tend to stabilize their same and previously incumbent members of R&D.

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Thank you for your listening.

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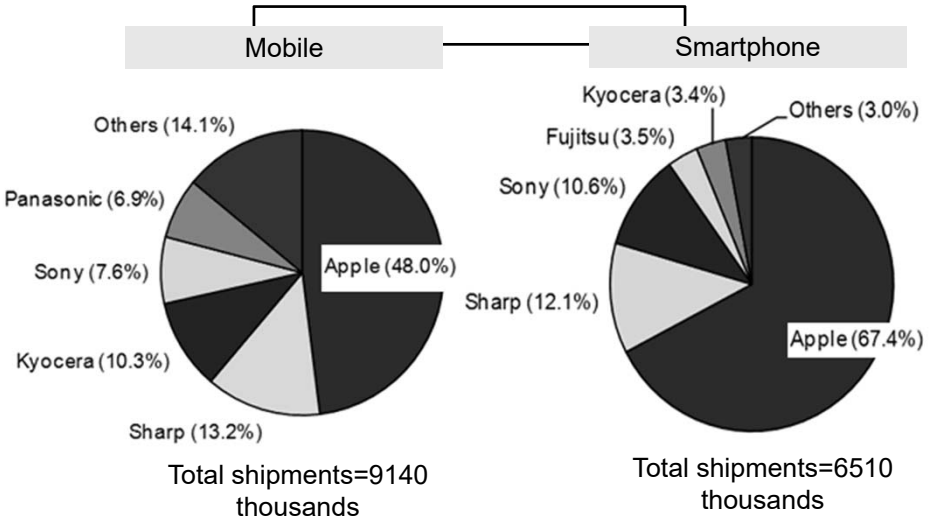
Japan's mobile market share in 2014Q1



Total shipments=9140 thousands

Total shipments=6510 thousands

(Source)IDC Japan

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Research objective

- This research is an **exploratory study** before examining the effectiveness of our alternative view
- **Research objective**

=Compare Japanese ICT companies' R&D orientations and their patent strategies with global companies

  - **Visualization** of patent analysis though text-mining approach.

- Target companies for analysis
  - Japan's smartphone vendors: **Sony, Sharp, Panasonic**
  - Global top share vendors: **Samsung, Apple**

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Outlook of the previous researches 2

- Visualization of patent analysis is an effective method to recognize the dynamics of technology change
  - Previous researches aimed proposing efficient text-mining approaches for creating patent maps, but few researches that link text-mining analysis of patent information with management theories
- The point of view for innovation
  - Incremental innovation: exploitation of existing technology benefits incremental innovations
  - radical innovations: exploration of new technology is especially important

Visualization of technological orientation and strategy by **text-mining analysis**

26

An example of patent document

- Patents are classified according to 3 type of code(IPC, FI and F-term) and archived in IPDL(Industrial Patent Digital Library).

[**Jamming of communication**]

IPC: H04K 1/00 Secret communication

FI: H04K 1/00 Secret communication

└ **A** Changing the carrier frequency

F-term: 5J104

(Ciphering device, decoding device and privacy communication)

BA00 COMMUNICATION CONFIGURATIONS

└ BA04 Multiplex communications

EA00 MANAGEMENT OF SECURITY INFORMATION

└ EA19 Using asymmetric cipher systems for ciphering

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F-term related to smartphone

F-term	Summary of contents
5K127	Telephone function
5K027	Telephone circuits
5K067	Mobile radio communication systems
5K201	Telephonic communication services
5K023	Telephone set structure
5K101	Telephonic communication linked with other devices
5C122	Studio devices
5B084	Information transfer between computers
5E501	Digital calculator user interface
5C164	Two-way televisions, distribution of moving picture or the like

(Source) Patenttecsha (2012)

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Creating self-organizing maps

- The methods
  - Extracting F-terms from patent documents → clustering the data → forming a semantic network → creating a patent map (according to Kim et al.(2008))
  - The F-terms of each company in each year are put together in one SOM
  - Each company's F-terms are compared with **Apple**'s to check their similarity with Apple.
- Data:
  - Apple's top 100 most frequently used F-terms related to smartphone.
- Feature:
  - More multidimensional data analysis than correspondence analysis.

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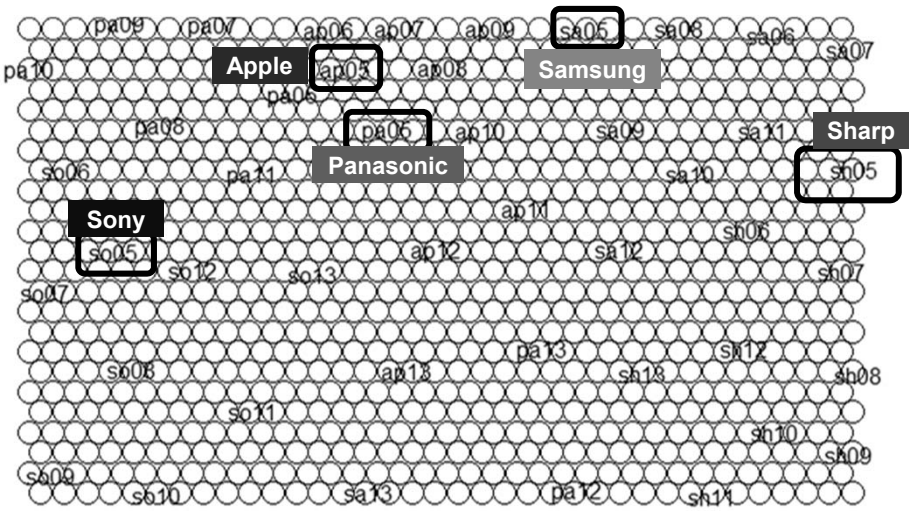
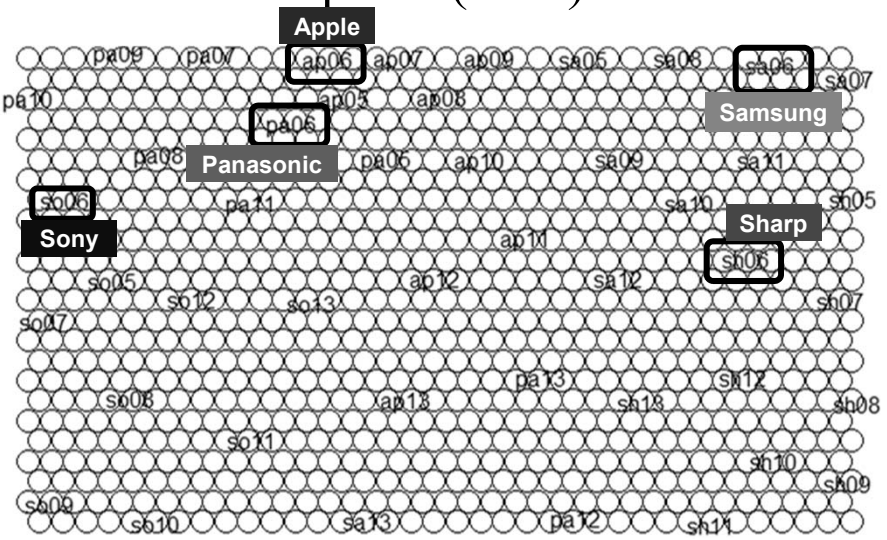
SOM of 5 companies(2005)



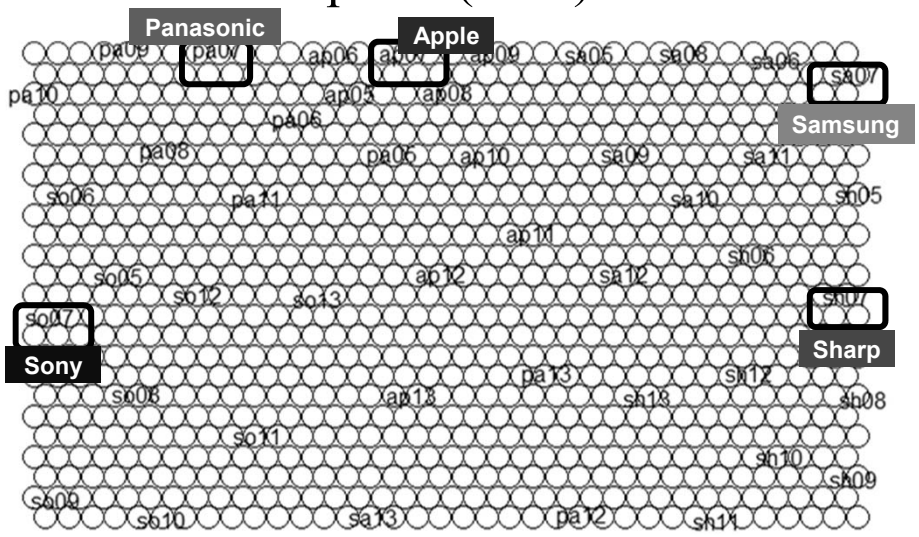
30

SOM of 5 companies(2006)



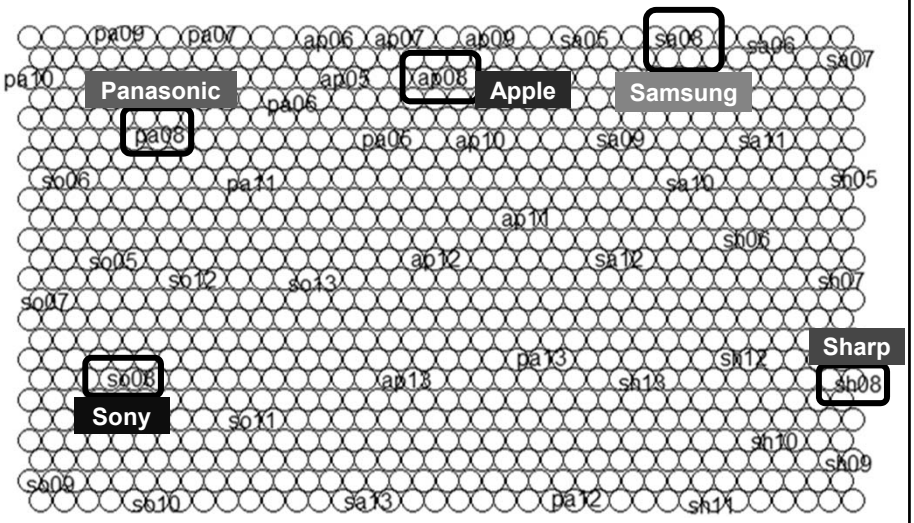
31

SOM of 5 companies(2007)



32

SOM of 5 companies(2008)



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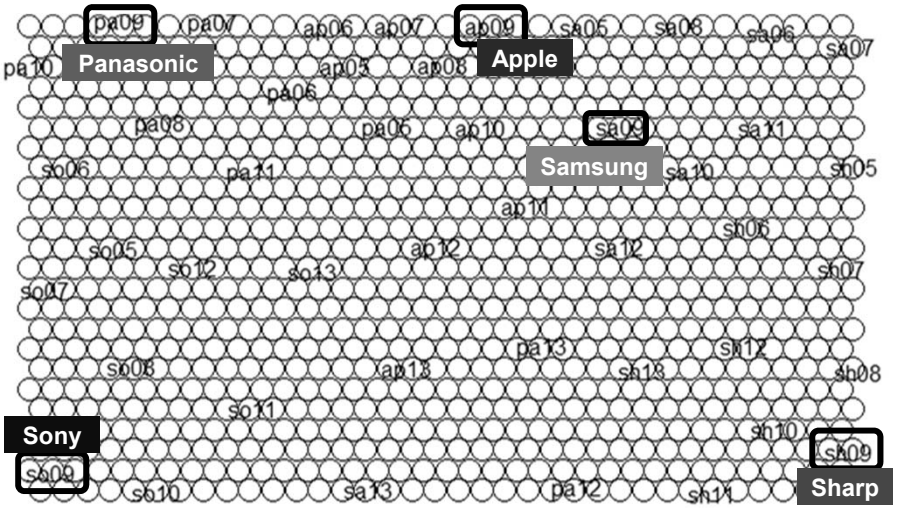
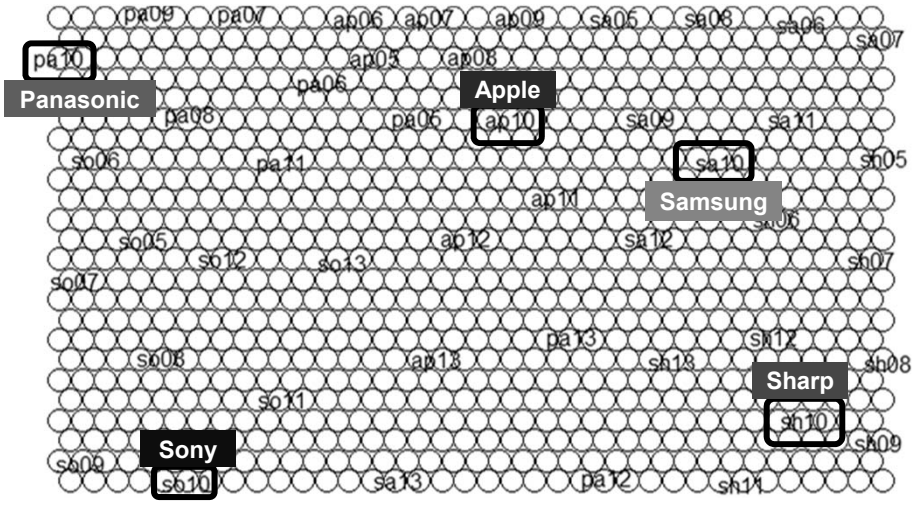
SOM of 5 companies(2009)



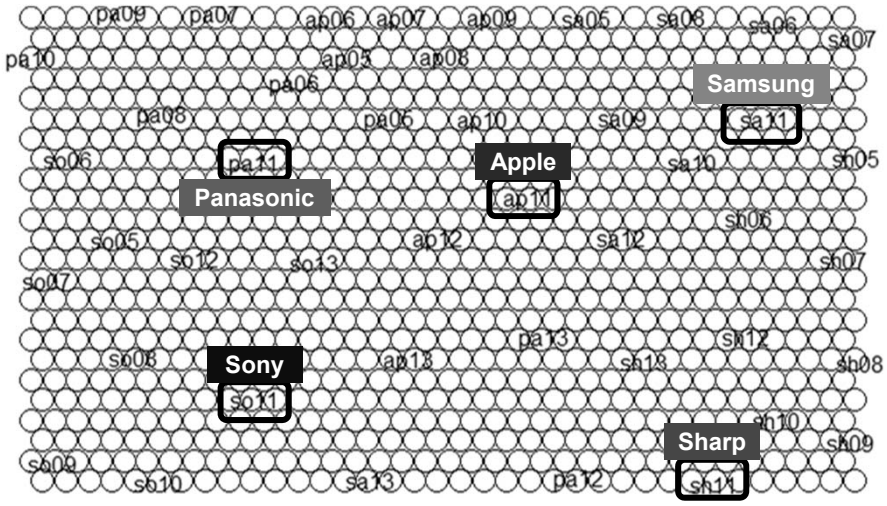
34

SOM of 5 companies(2010)



35

SOM of 5 companies(2011)



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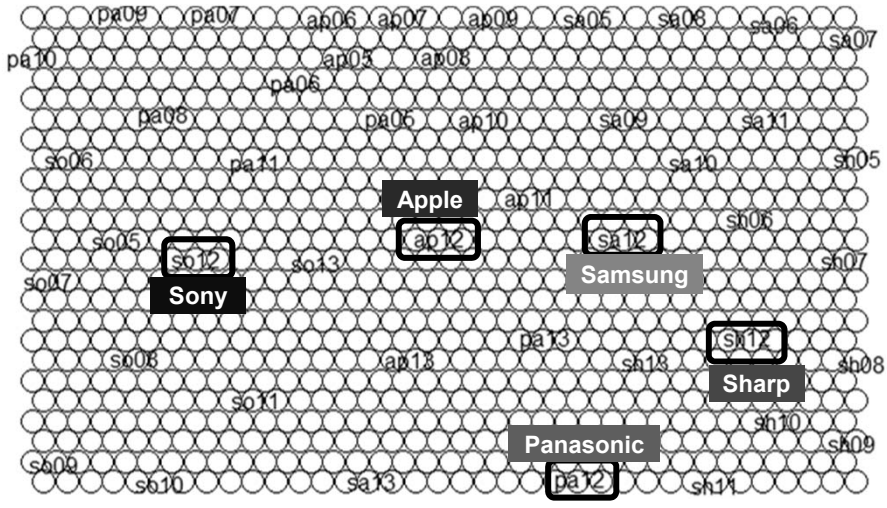
SOM of 5 companies(2012)



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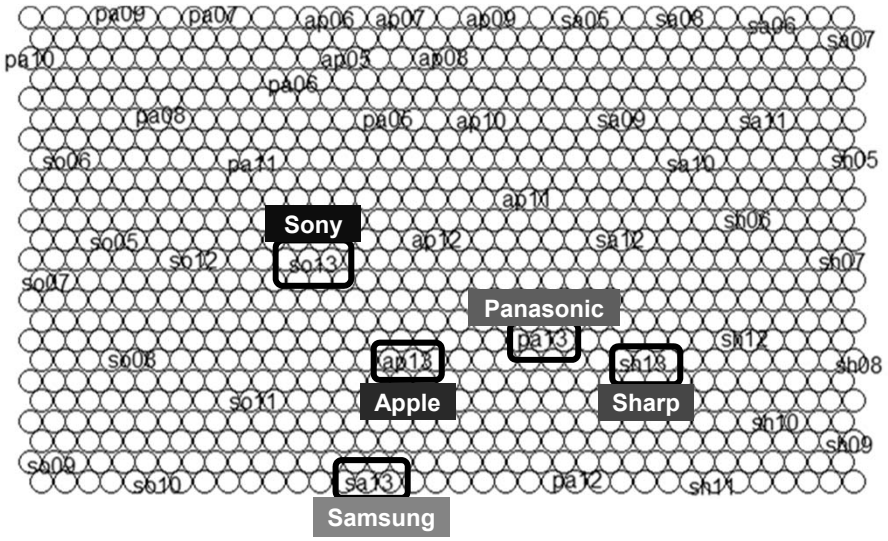
SOM of 5 companies(2013)



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Summary of the results of SOM

- If the technology base is set on Apple's, besides Panasonic, the technologies developed in other companies have low similarity with apple's from 2005 to 2007
- **Panasonic** did not change its R&D orientation until 2010, and it started to develop other kinds of technologies from 2011
- **Samsung** started to approach to Apple's technologies from 2008
- The R&D orientations of **Sony** and **Sharp** are quite different from Apple's. Sony and Sharp's SOMs show slight changes during the whole period.
- All companies tried to approach to Apple's technologies, and it shows a strong trend in 2012-2013

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Discussion

- Differences among the 5 companies in the market are identified by correspondence analysis and SOMs.

(in SOM's case, the differences with Apple's technological strategy)

Japanese ICT companies	Samsung
The R&D orientations are different from Apple's in 2007-2010	The R&D orientation became similar to Apple's from 2008
insufficient response to the change in mobile phone (smartphone) market	Quick response to the change of market and acquire competitive advantage

40

Conclusion

- We experimentally visualized the R&D orientations and patent strategies of Japanese and global ICT companies by text-mining analysis.

Apple & Samsung	Sharp & Panasonic
Exploration type	Exploitation type
Implementing various attempts for adapting to change of the market	Utilizing their own past strategies rather than adapting to the market changes

If smartphone technologies are different from feature phones', Japanese ICT companies may have mismatched their R&D strategies with market needs

The following section of from the conference is dedicated to MISNC2015.

The slides are reproductions of the Keynotes presentations

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- Matsuyama University's International Research Collaborations Grant (松山大学学術研究国際交流助成制度)
- Matsuyama Convention Bureau (松山観光コンベンション協会助成)
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- Donation from Yamatoya (大和屋本店)

WELCOME TO MISNC 2015 AT DOGO ONSEN

"MADE IN VIETNAM" LEAN MANAGEMENT MODEL AND THE IMPORTANT ROLE OF "TAM THE" FOR THE DEVELOPMENT OF ENTERPRISES

Nguyen Dang Minh

Vice Dean, Faculty of Business Administration
Leader of "Made in Vietnam" Lean Management Application Research Group
University of Economics and Business
Vietnam National University- Hanoi, Vietnam)

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Presentation Contents

1. Overview of enterprises in Vietnam

2. Struggle for finding suitable "Made in Vietnam" Lean management model

3. 'Made in Vietnam' Lean Management Philosophy

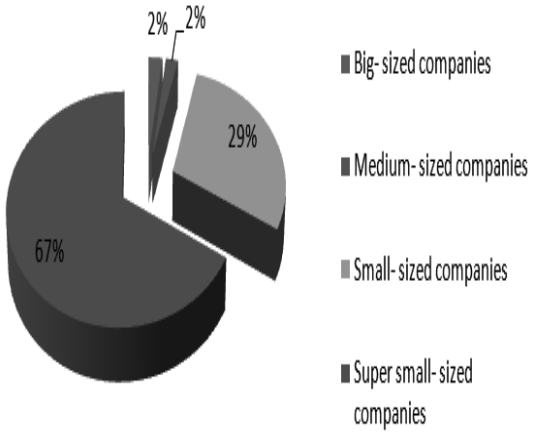
4. 'Made in Vietnam' Lean management Model

5. 'TAM THE'- Key Factor for for the successful implementation of the Model

1. Overview of enterprises in Vietnam

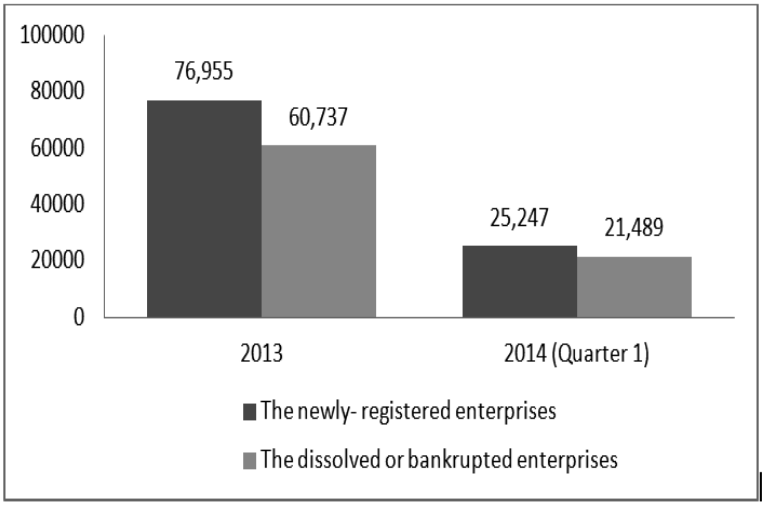
- SMEs are 97% of the total number of Vietnamese enterprises (VCCI, 2014)

- There is an increasing number of small and super small- sized enterprises



1. Overview of enterprises in Vietnam

- **Vietnamese enterprises experienced great difficulty during 2011-2014.**
- **Increasing number of dissolved and bankrupted enterprises**



1. Lean management implementation in Vietnam

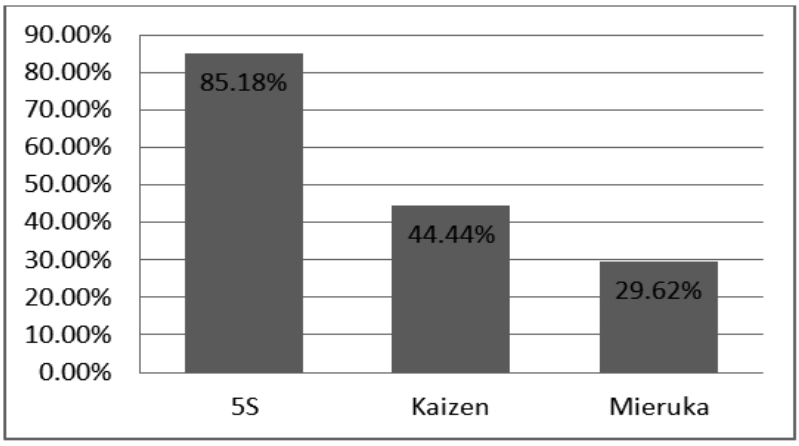
General context

- **Lean management has been introduced in Vietnam for *nearly 20 years***
- **The number of enterprises applying lean management *account for about 1%* of the total enterprises.**
- ***No implementation of suitable model has been introduced so far*; enterprises apply lean management mechanically based on foreign-country model**

1. Lean management implementation in Vietnam

Current status of lean management's implementation in Vietnam

- *The majority of surveyed enterprises employ the basic tools of lean management which are 5S, Kaizen and Mieruka. (investigation for 300 companies)*



(Source: Nguyen et al, 2014)

2.3. Why Conventional Lean Management model (JP model) is not easy?

- Lack of detailed Philosophy for Vietnamese Enterprises
- Lack of Management Model for Vietnamese Enterprise
- Enterpries have not applied LM as company-wide program
- Employees are not aware of important role of LM
- Top managers do not have long term commitment in LM application
- Lack of good attitute for applying LM
- Enterprises have not developed good policy for faciltating LM implementation
- Employees are not aware of the benefits of LM for themselves

2. Struggle for finding suitable "Made in Vietnam" Lean management Philosophy and Model

Nearly 8 Years of working in Toyota (Japan, UK, Australia, China, America …)

(Application of Lean Managament in Japan, UK, Australia, China …)

Return to Vietnam

I

Investigated nearly 300 enterprises for developing "Made in Viet Nam" Lean Management Philosophy and discovering "TAM THE"

Teaching/ Consulting Lean Management for Enterprise Managers

Establishment of a Research group "Application of Lean Management for Vietnam" for sharing ideas

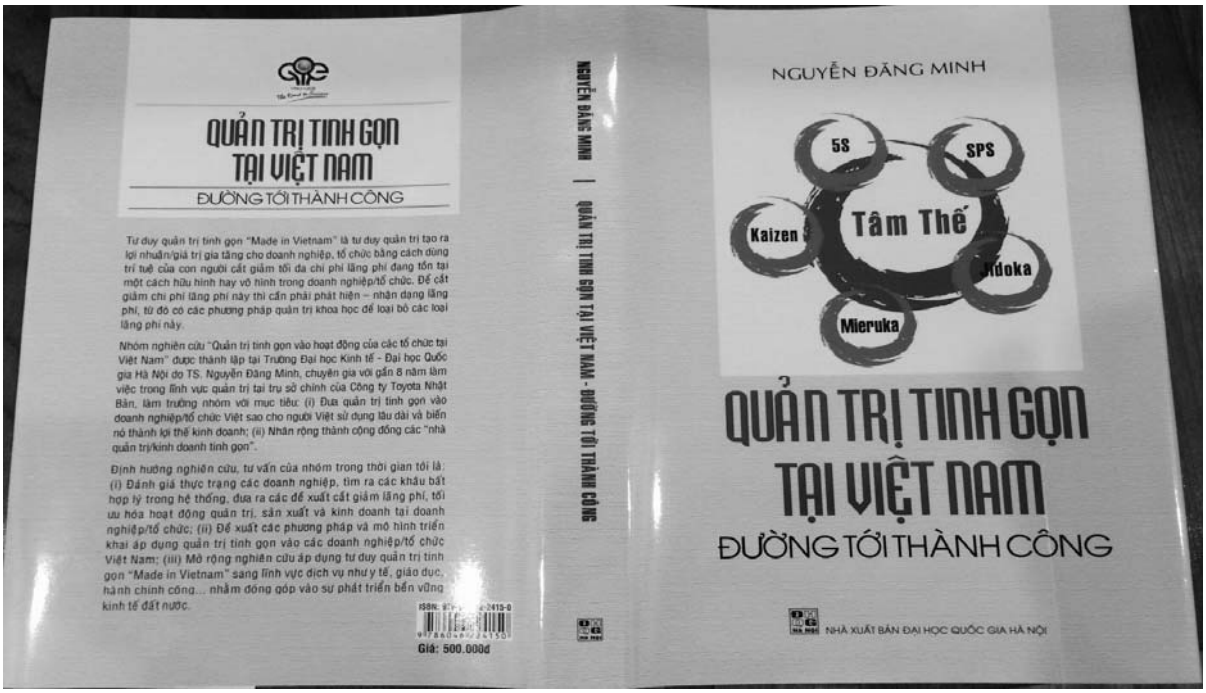
Organizing conferences/workshops on Lean Management discussing the model for enterprises

Organize 2014 Conference on “Made in Vietnam” Lean Management: Current situation and Solution

Organize 2015 Conference on “Made in Vietnam” Lean Management: Practical Model for Vietnamese Enterprises

2015 Conference on "Made in Vietnam" Lean Management: Practical Model for Vietnamese Enterprises

Publication of Book: 'Lean Management in Vietnam - The Road to Sucess'



3. 'Made in Vietnam' Lean Management Philosophy

3. 'Made in Vietnam' Lean Management Philosophy

Profit = Revenue – Expenses (1)

Expenses = Actual Expenses + Waste Expenses (2)

Waste Expenses = Visible Wastes + Invisible Wastes (3)

Source: Nguyen Dang Minh, 2014 (Book in Vietnamese: Lean Managemet in Vietnam –The road to success)

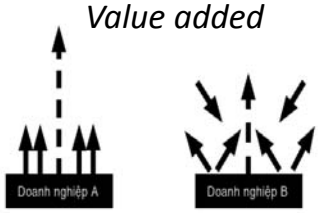
Actual Expenses: Expenses that ensure activities for maintaining business activities

Visible Wastes

- Inventory, motion, waiting, over-production, defects, etc.

Invisible Wastes

- Thinking pattern (i.e thinking to develop the economy..)
- Working methodology (i.e working processes/ procedure
- Opportunities



Ex: Invisible waste of not having the same thinking pattern

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3. 'Made in Vietnam' Lean Management Philosophy

Profit = Revenue – Expenses (1)

Expenses = Actual Expenses + Waste Expenses (2)

Waste Expenses = Visible Wastes + Invisible Wastes (3)

Source: Nguyen Dang Minh, 2014 (Book in Vietnamese: Lean Managemet in Vietnam –The road to success)

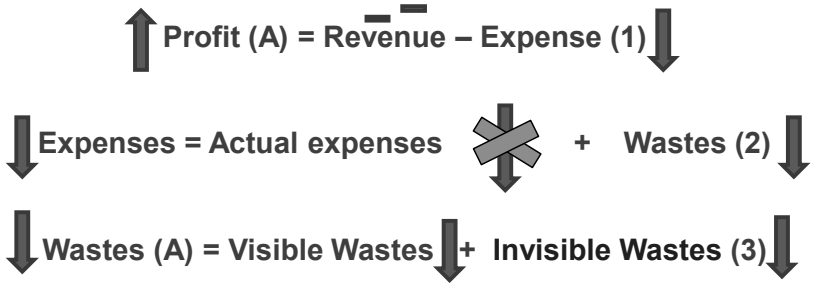
To increase Profit, at the same time:

1. *Keep Revenue constant or increase Revenue gradually*
2. *Reduce and/or Eliminate Waste (Visible waste and Invisible waste) as much as possible*

→ ***New "Made in Vietnam" Lean Management philosophy: A philosophy that creates "happiness" (value added or profit gained) based on human talents to reduce/eliminate wastes (invisible and visible waste) as much as possible.***

3. 'Made in Vietnam' Lean Management Philosophy

- **An Engine of facilitating application of Lean management**



A = A1 + A2 + A3 + A4 (4)

Source: Nguyen Dang Minh, 2014 (Book in Vietnamese: Lean Managemet in Vietnam –The road to success)

A: Profits/ value added gain from reducing/eliminating wastes

A1: Distributed to Main participants (Persons/Groups reducing wastes)

A2: Welfare to the enterprise's employees

A3: Used to Increase the products/services' quality and/or Cut down prices

A4: Kept as Profits for further investment in the business

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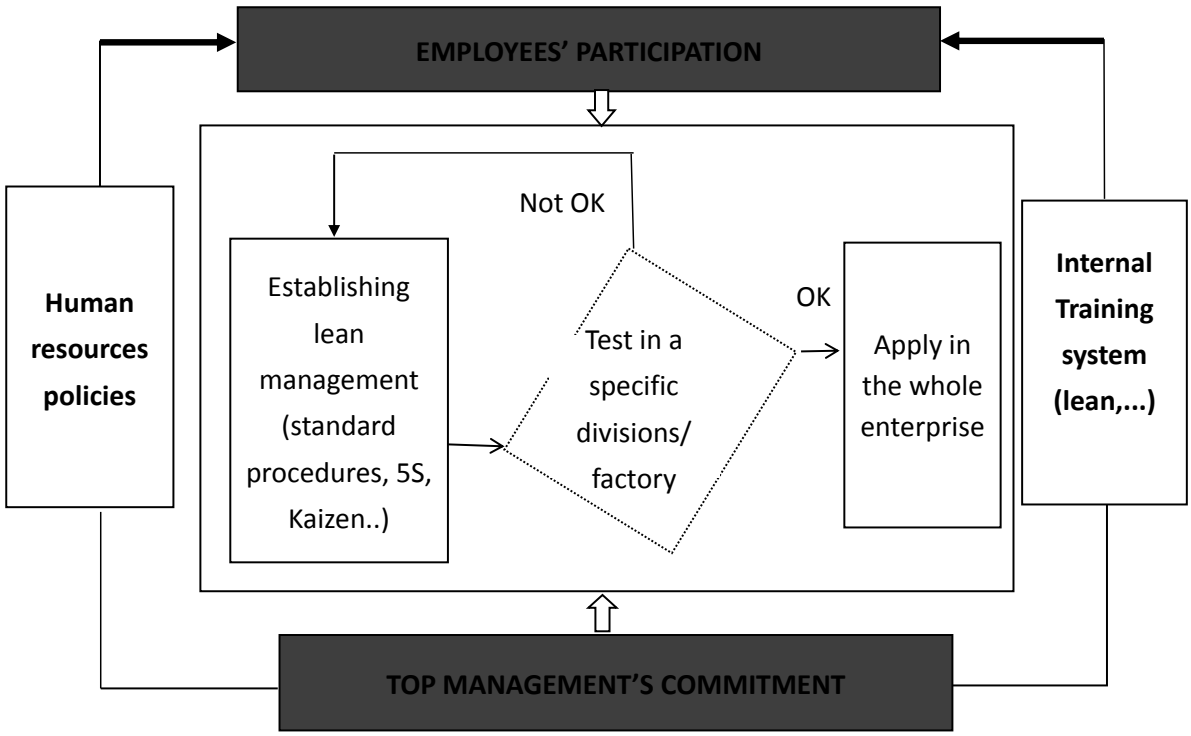
4. 'Made in Vietnam' Lean management Model

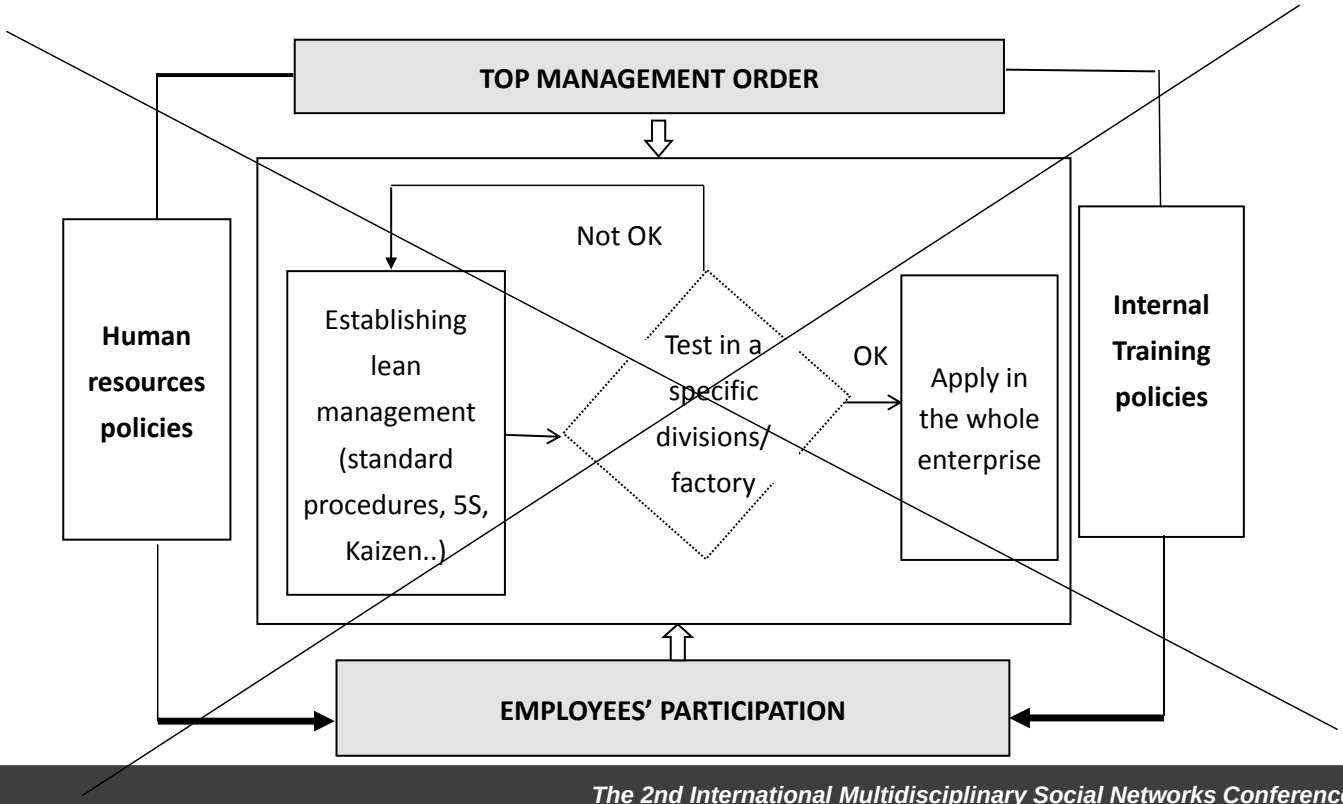
4. 'Made in Vietnam' Lean management models

Made in Vietnam Model for Lean implementation in Vietnam



4. 'Made in Vietnam' Lean management Models

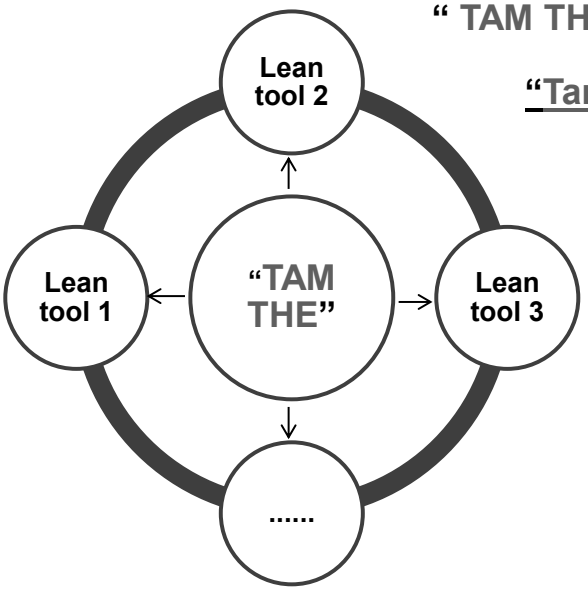
Be careful of the Model for lean implementation in Vietnam (NG)



5. 'TAM THE' - Key Factor for the successful implementation of the Model

5. 'TAM THE'- Key Factor for the successful implementation of the Model

4.2 Key factor for the successful of Lean implementation (*new finding*)



" TAM THE" = THAU 1 + THAU 2 + Y (Vietnamese term)

"Tam the" of people:

i) THAU 1 (Deep understanding 1):

Doing job (lean tools...) benefits themselves

ii) THAU 2 (Deep understanding 2):

Only doing work seriously could help people to improve their practical capacity

iii) Y (attitude and behavior):

Good attitude/positive behavior to work

Thus, people will apply positive energy and best performance to their tasks.

5. 'TAM THE'- Key Factor for the successful implementation of the Model

ACCEPTANCE OF THE PAPER

Maribor, 24. 03. 2015

Dear Colleague,

I am pleased to inform you that your paper has been accepted for publication in the '*International Journal of Simulation Modelling*', Volume 14, Number 2 (June 2015). Thank you for your contribution to the journal. One complete copy of the journal will be sent to the corresponding author of the paper.

Code of paper: **IJSIMM 304-2014**

Title: A NEW APPLICATION MODEL OF LEAN MANAGEMENT IN SMALL AND MEDIUM SIZED ENTERPRISES

Author(s): Nguyen Dang Minh
University of Economics and Business, Vietnam National University, Hanoi, Vietnam

Abstract: *Although Lean management has been implemented by Vietnamese small and medium sized enterprises (SMEs) for more than ten years, the success rate as well as the sustainable effectiveness achieved by these firms remains limited. As revealed by the survey, the current model of implementation mainly focuses on Lean management tools such as 5S, Kaizen (continuous improvement) and Mieruka (visual management). A better implementation model is proposed with the focus laid on the central factor of "Tam the"- a Vietnamese word refers to the deep understanding of employees and managers about the benefits of their tasks and Lean management for themselves. A simulation model run by Crystal Ball software confirms the higher effectiveness of the proposed model, which provides scientific evidence to persuade practitioners to swiftly employ the new model of implementation.* 33 refs.

Key Words: Lean management, Simulation, SMEs, Tam the

Sincerely yours,

Prof. Dr. Borut Buchmeister
(Editor-in-Chief)

IJSIMM
Borut Buchmeister s. p.

"TAM THE" has been recognized as a management term written in Vietnamese published on IJSIMM international journal (ISI; Impact factor 2.08). (http://www.ijsimm.com/)

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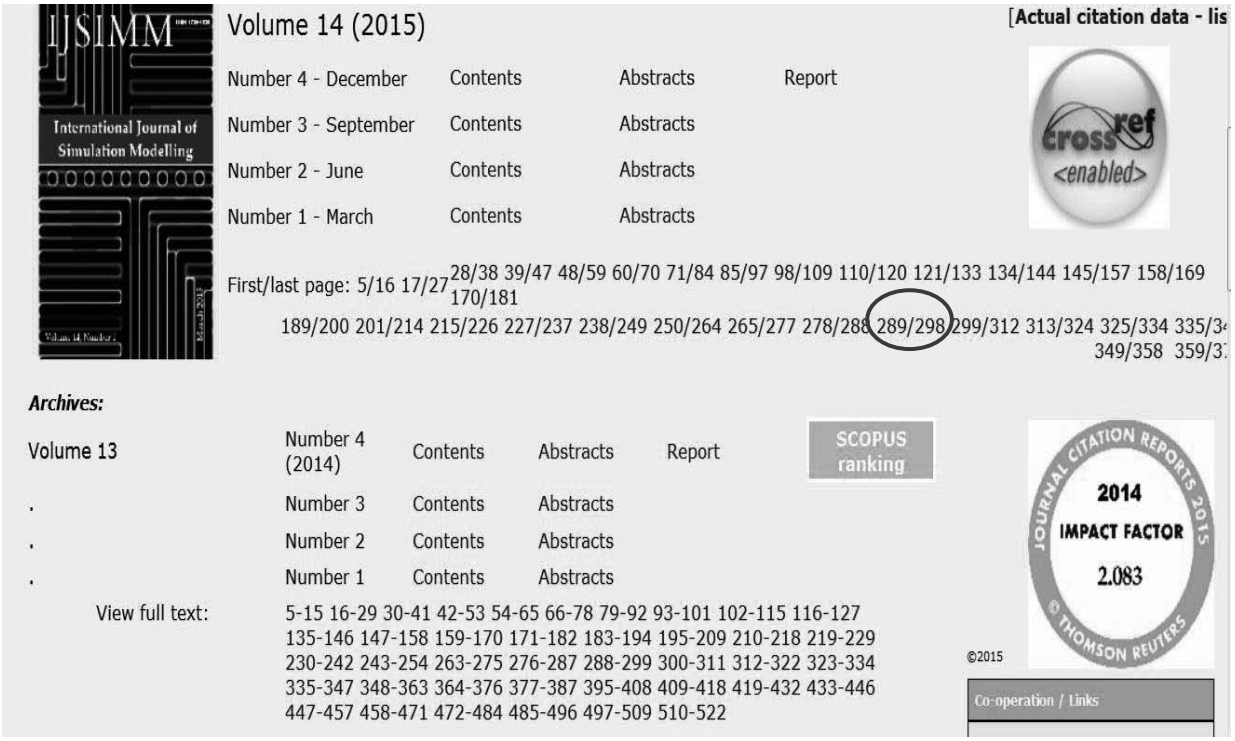
Publication of 'Tam the ' on IJSIMM journal



IJSIMM

International Journal of Simulation Modelling

Volume 14 (2015) [Actual citation data - lis

Number 4 - December	Contents	Abstracts	Report
Number 3 - September	Contents	Abstracts	
Number 2 - June	Contents	Abstracts	
Number 1 - March	Contents	Abstracts	

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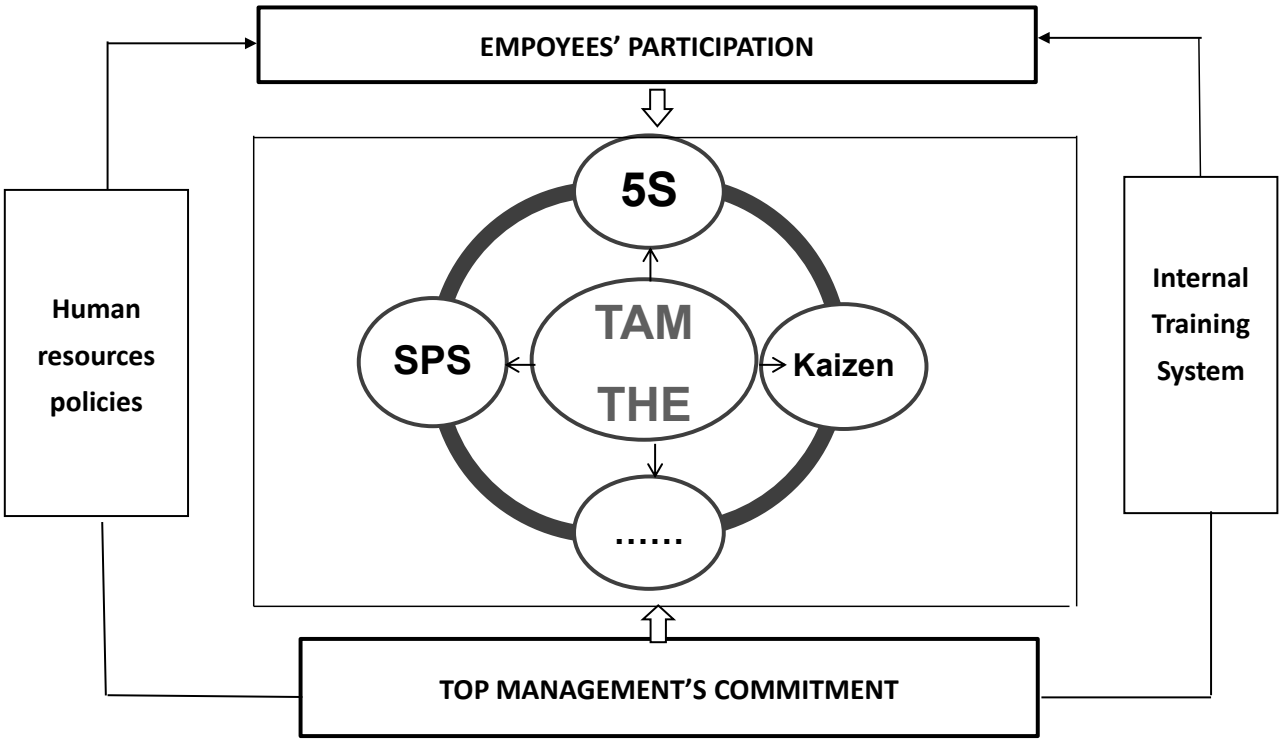
Volume 14: Number 2: June 2015

pp 185-374

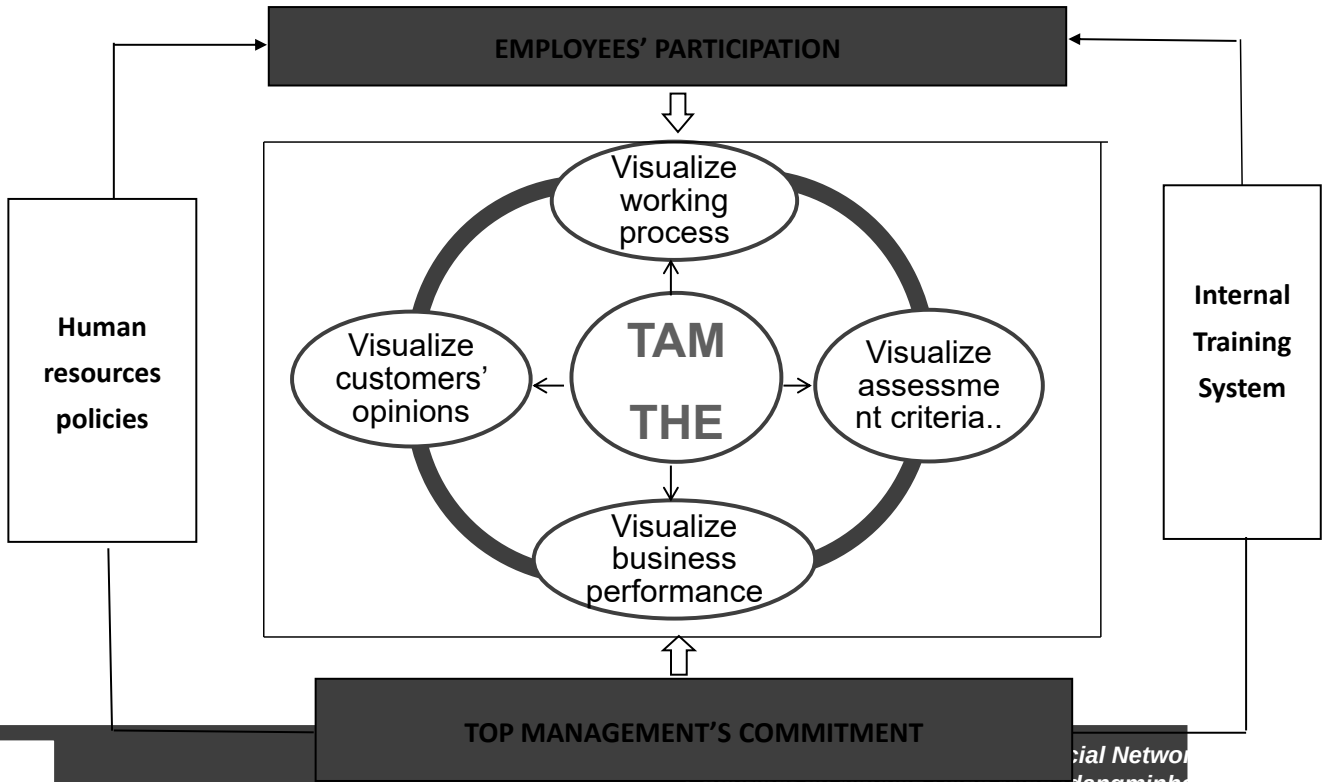
5. 'TAM THE'- Key Factor for the successful implementation of the model

The Role of TAM THE for 'Made in Vietnam' Lean Management Model

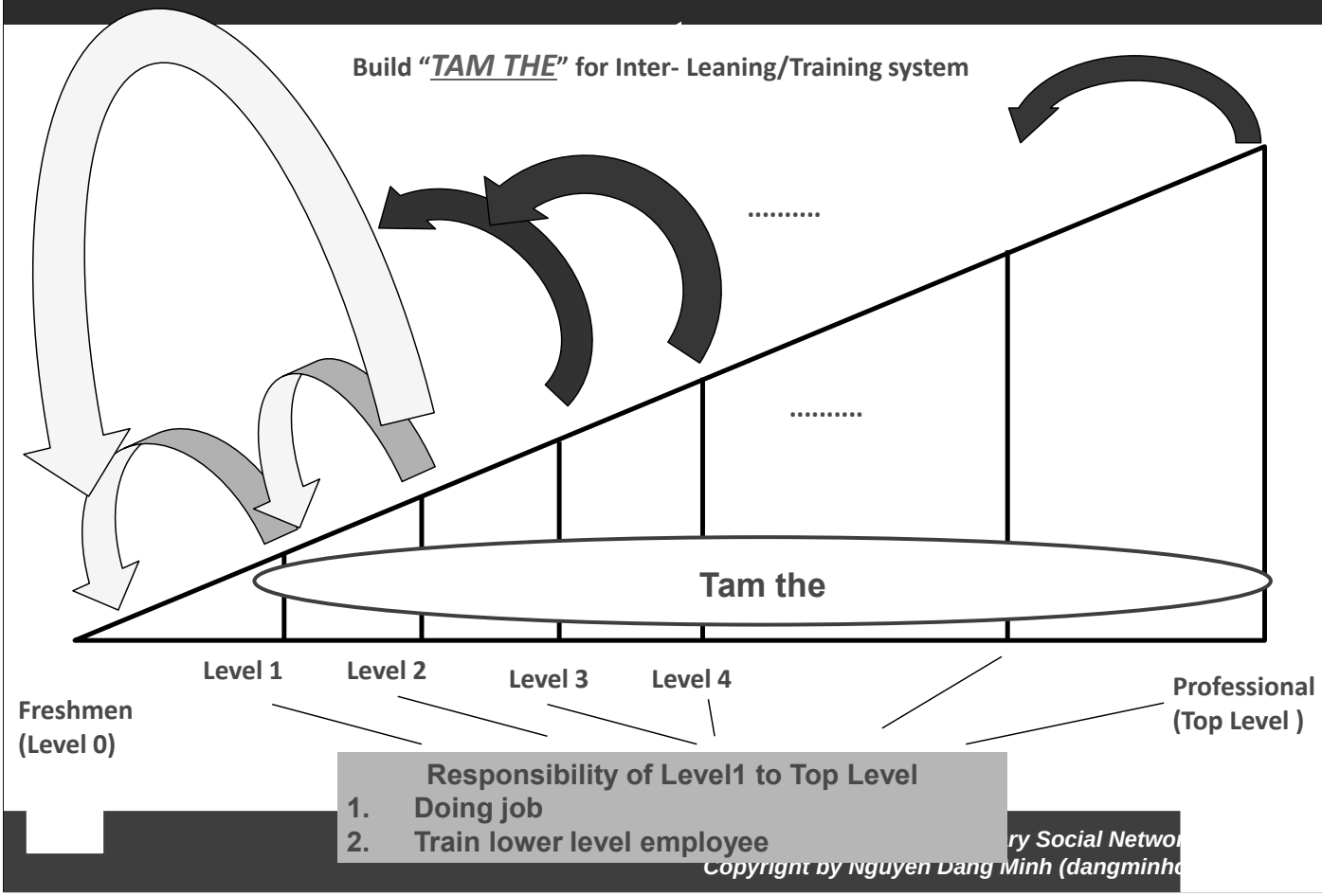


5. 'TAM THE'- Key Factor for the successful implementation of the model

4.4 New Model for Visual Management's implementation



Internal education trainning

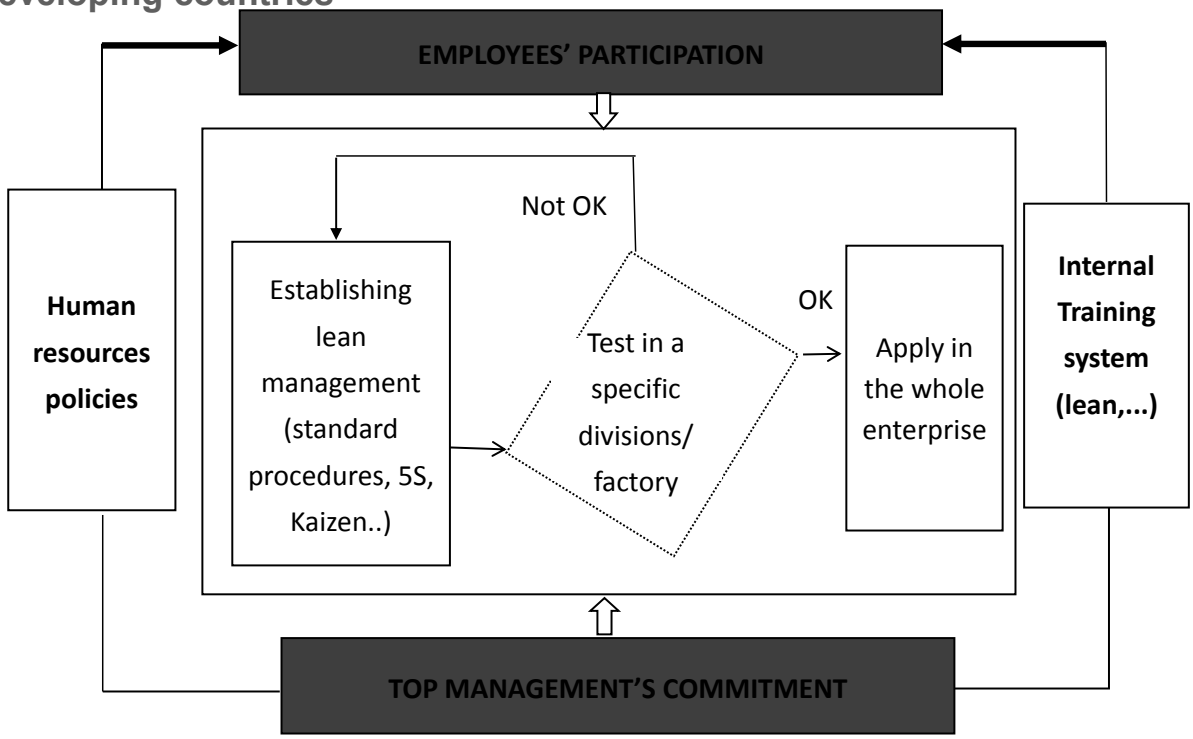


Implications and Conclusions

- **Wastes in 'business development philosophy', 'Methodology'.. are much bigger than any other wastes. Developing countries should reduce those wastes as much as possible for**
- **The 'Made in Vietnam' Lean philosophy and Model can be applied not only for manufacturing Enterprises, but can be applied for other industries such as services, health care, government organizations…**
- **Vietnamese enterprises should start from applying the suggested model from basic step in creative way**
- **Not only Vietnamese enterprises but also foreign enterprises could learn from the suggested model to adapt their lean management implementation.**

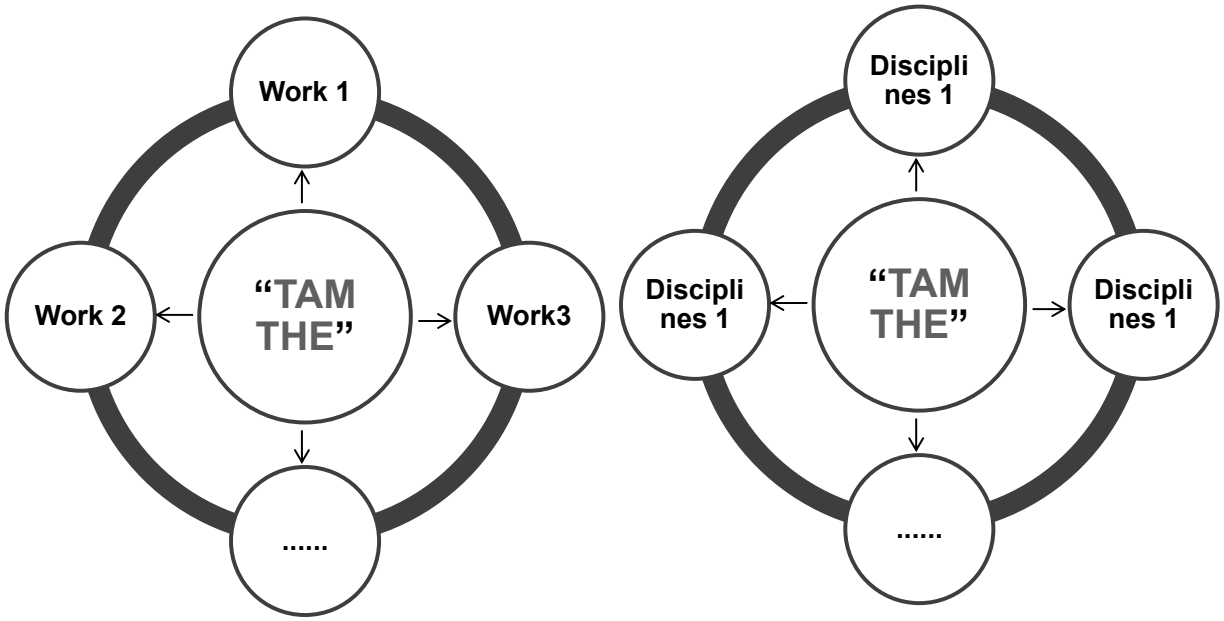
'Made in Vietnam' Lean management models

Made in Vietnam Model for Lean implementation can be applied in both developed and developing countries



Implications and Conclusions

- "TAM THE" is considered as the key factor not only for lean application but for other works and disciplines in both developing and developed countries.



Thank you very much for your attention

Nguyen Dang Minh

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Antecedents of Consumers' Video-sharing Behavior on Social Media

September 2, 2015

JoongHo Ahn* and Sehwan Oh**

* Graduate School of Business, Seoul National University
** College of Economics & Business Administration, Kyungpook National University

Research Motivation

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- **Rising online video consumption**

  - 189 million Americans enjoyed 49.1 billion videos as of October, 2013 (comScore Inc., 2013)

  - Online video will be more popular than Facebook and Twitter by 2017 (Cisco, 2013)

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Video-sharing Social Media

SNU BUSINESS SCHOOL

Popularity

- More than 1 billion unique users visit YouTube each month
- Over 4 billion hours of video are watched each month on YouTube
- 72 hours of video are uploaded to YouTube every minute
- 70% of YouTube traffic comes from outside the US

Reliability

- YouTube has sophisticated technology to count views consistently
- If this technology detects that there has been an attempt to inflate a video's view count artificially, that video's view count will be frozen

Source: YouTube press release

3

Research Question

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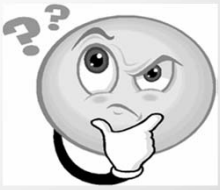
- Limited knowledge on why consumers share video contents on video-sharing social media
- *What are the factors to affect consumer's consumption and sharing of video contents on social media? What are **the antecedents of video-sharing activities** by video viewers?*



4

Agenda

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- Literature Review
- Hypotheses Development
- Research Methodology
- Analysis Results
- Discussion & Conclusions

5

Literature Review

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Engagement and sharing behavior

- **Engagement**
  - "a consumer based measurement that regards interaction with an aspect of a brand or media property" (Ghuneim, 2008)

Typology of customer engagement and measures

Degree of engagement	Status of customer	Measure
Low	Adoption	Bookmarking, Tagging, Adding to group
Medium	Collaborative filtering	***Rating***, Voting, ***Commenting***, Endorsing, Favouritising
High	Content creation	Uploading (User Generated Content), Blogging, Participating in fan community, Creating mash-ups, Podcasting, Vlogging
Highest	Social	Adding Friends, Networking, Creating fan community

Source: Ghuneim (2008)

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Literature Review

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Engagement and sharing behavior

- **Engagement on videos**

  - Simply the number of views can't measure viewer's engagement on videos (Stein, 2013).

- **Suggested metrics for viewer engagement on videos**

  - ***Play time*** (Balachandran et al., 2012, 2013; Dobrian et al., 2013).
  - ***Ratings, comments***, and favorites (Kaushik, 2009)

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Literature Review

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Engagement and sharing behavior

- **Outcome of engagement**

  - Satisfaction, trust and commitment (Bowden, 2009; Brodie et al., 2013; Gummerus et al., 2012).

  - Consumer satisfaction is positively associated with behavioral intention such as re-purchase, positive word-of-mouth and recommendation (Cronin Jr et al., 2000; Richard L. Oliver, 1980; Patterson & Spreng, 1997; Tam, 2004).

  - Video viewers' attitude to video content influences their intention to forward it (Hsieh, Hsieh, and Tang, 2012)

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Literature Review

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Video content and sharing behavior

- **Hedonic versus Utilitarian video contents**

  - Various kinds of video contents, covering instrumental contents (utilitarian goods) and contents for fun (hedonic goods)
  - Hedonic consumption refers to "consumers' multisensory images, fantasies and emotional arousal in using products." (Hirschman and Holbrook, 1982)

- **Emotional videos and sharing behavior**

  - Emotions stimulate message recipients' forwarding behavior (Dobele et al., 2007)
  - Emotionally-charged messages tend to be forwarded (Hung-Chang et al., 2007; Phelps et al., 2004; Stieglitz & Dang-Xuan, 2013).
  - Videos which have emotional responses from viewers are likely to be shared (Nelson-Field et al., 2013)

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Hypotheses Development

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Measures for analysis

Metrics of viewer engagement on videos

Metrics	Description	Related study
Average play time	The ratio of play time to the total running time per video (= play time / running time)	Balachandran et al. (2012), Balachandran et al. (2013), Dobrian et al. (2013)
Comments	The number of comment counts per video	Ghuneim (2008), Peterson (2007), Kaushik (2009)
Like Ratio	The ratio of like counts to the total valence counts (= like counts / (like counts + dislike counts)) per video	Ghuneim (2008), Kaushik (2009)

Variable for hedonic versus utilitarian videos

- Hedonic videos: Videos on music and movie channels
- Utilitarian videos: Videos on education channels

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Hypotheses Development

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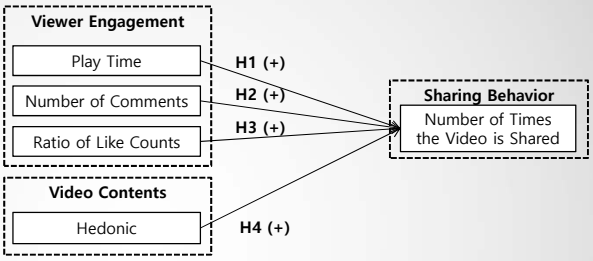
Hypotheses



H1. *Average play time of a video in total running time is positively related with the number of times the video is shared.*

H2. *The number of comment counts on a video is positively related with the number of times the video is shared.*

H3. *The ratio of like counts to the total number of like and dislike counts on a video is positively related with the number of times the video is shared.*

H4. *Hedonic video contents have the high propensity to be shared than utilitarian video contents.*

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Research Methodology

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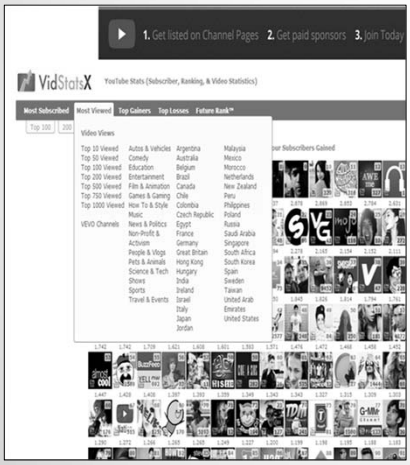
Data Collection



Top 100 channels in views by music, movie, and education

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Research Methodology

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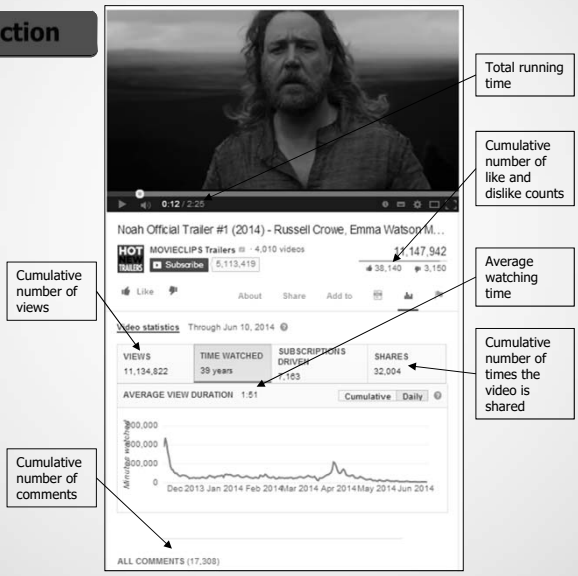
Data Collection



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Research Methodology

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Key Variables

Variable	Description and measure
$Views_{i,t}$	Cumulative number of views of a video clip *i* at time *t*
$Sharing_{i,t}$	Cumulative number of times the video clip *i* is shared at time *t*
$AvgWatching_{i,t}$	Average watching time to the total running time of a video clip *i* at time *t*
$Comment_{i,t}$	Cumulative number of comments of a video clip *i* at time *t*
$LikeRatio_{i,t}$	The number of like counts to the sum of like and dislike counts of a video clip *i* at time *t*
$Hedonic_i$	Dummy variable for hedonic contents (1 if contents categories are music and movies ; 0 if content categories are education)
$RunningTime_i$	Running time of a video clip *i*

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Research Methodology

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Sample Data

- **Period: July to October, 2014**
- **Duration: 10 weeks (70 days)**
- **Frequency: Weekly (transformed from daily data)**
- **Controls**
  - Language: English
  - Running time: under 8 min.
  - Cumulative number of shares: over 0
- **Number of videos**
  - Education: 107
  - Movie: 325
  - Music: 409

Strongly balanced panel data
(10 weeks X 841 videos)

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Research Methodology

SNU BUSINESS SCHOOL

Descriptive statistics at the first week

Category	Variable	N	Mean	Std. Dev.	Min	Max
Education	$Views_{i,t}$	107	108979	357261.8	226	3000000
	$Sharing_{i,t}$	107	90.8	288.9	0	2235
	$AvgWatching_{i,t}$	107	0.57	0.18	0.22	0.97
	$Comment_{i,t}$	107	253.8	690.1	0	5035
	$LikeRatio_{i,t}$	107	0.96	0.11	0	1
	$RunningTime_i$	107	260.4	114.5	33	474
Movie	$Views_{i,t}$	325	133306	290777.3	1338	2700000
	$Sharing_{i,t}$	325	229.6	663.6	2	8846
	$AvgWatching_{i,t}$	325	0.74	0.11	0.22	1
	$Comment_{i,t}$	325	146.2	274.8	0	2377
	$LikeRatio_{i,t}$	325	0.92	0.09	0.44	1
	$RunningTime_i$	325	123.7	42.4	31	428
Music	$Views_{i,t}$	409	242285	1172976	251	1.80e+07
	$Sharing_{i,t}$	409	762.8	3497.9	0	39678
	$AvgWatching_{i,t}$	409	0.47	0.14	0.14	0.92
	$Comment_{i,t}$	409	469.7	2145.7	0	33611
	$LikeRatio_{i,t}$	409	0.90	0.11	0	1
	$RunningTime_i$	409	239.9	85.1	14	468

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Research Methodology

SNU BUSINESS SCHOOL

Correlations of key variables

	[1]	[2]	[3]	[4]	[5]	[6]
[1] $\ln(Sharing_{i,t})$	1					
[2] $\ln(Views_{i,t-1})$	0.8816***	1				
[3] $AvgWatching_{i,t-1}$	**0.2941*****	0.3653***	1			
[4] $LikeRatio_{i\,t-1}$	**0.2692*****	0.2476***	0.2786***	1		
[5] $\ln(Comment_{i,t-1})$	**0.8444*****	0.9270***	0.3973***	0.2966***	1	
[6] $\ln(DaysAfterRelease_{i,t})$	0.0709***	0.0958***	0.0040	0.0046	0.0473***	1

*** p<0.01, ** p<0.05

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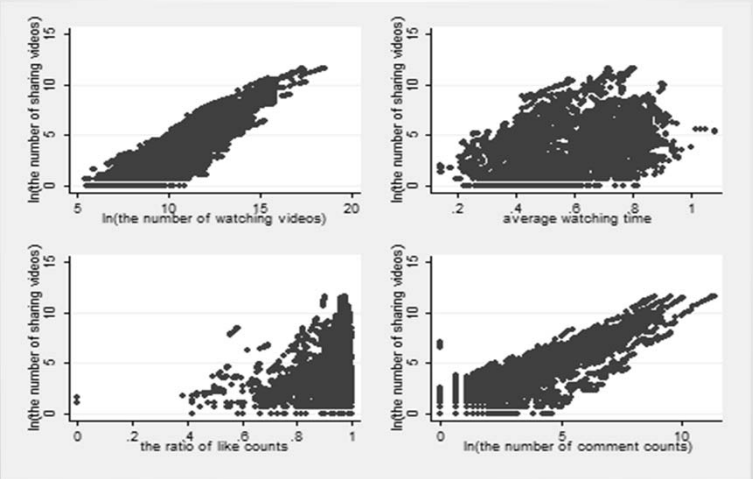
Research Methodology

SNU BUSINESS SCHOOL

Scatter plots of key variables



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Research Methodology

SNU BUSINESS SCHOOL

Analysis model

Equations for the relationship of viewer engagement on sharing video clips:

$$ln(Sharing_{i,t}) = \beta_0 + \beta_1 * AvgWatching_{i,t-1} + \beta_2 * ln(Comment_{i,t-1}) + \beta_3 * LikeRatio_{i,t-1} + \beta_4 * ln(DaysAfterRelease_{i,t}) + \beta_5 * ln(Views_{i,t-1}) + u_{i,t} + \varepsilon_{i,t}$$

$$ln(Views_{i,t}) = \beta_0 + \beta_1 * AvgWatching_{i,t-1} + \beta_2 * ln(Comment_{i,t-1}) + \beta_3 * LikeRatio_{i,t-1} + \beta_4 * ln(DaysAfterRelease_{i,t}) + \beta_5 * ln(Sharing_{i,t-1}) + u_{i,t} + \varepsilon_{i,t} \quad (1)$$

Equations for comparison of hedonic versus utilitarian contents in sharing:

$$ln(Sharing_t) = \beta_0 + \beta_1 * ln(Views_{t-1}) + \beta_2 * Hedonic + \beta_3 * ln(RunningTime_{t-1}) + \varepsilon_t$$

$$ln(Views_t) = \beta_0 + \beta_1 * ln(Sharing_{t-1}) + \beta_2 * Hedonic + \beta_3 * ln(RunningTime_{t-1}) + \varepsilon_t \quad (2)$$

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Analysis Results

SNU BUSINESS SCHOOL

	DV: $ln(Sharing_{i,t})$					
	FE			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
$AvgWatching_{i,t-1}$	**2.010*** (0.101)**	-	-	**2.146*** (0.119)**	-	-
$LikeRatio_{i,t-1}$	-	**1.343*** (0.127)**	-	-	**2.737*** (0.188)**	-
$ln(Comment_{i,t-1})$	-	-	**0.061*** (0.008)**	-	-	**0.076*** (0.009)**
$ln(Views_{i,t-1})$	0.547*** (0.008)	0.549*** (0.009)	0.516*** (0.009)	0.575*** (0.010)	0.586*** (0.010)	0.539*** (0.011)
$ln(DaysAfterRelease_{i,t})$	0.020*** (0.004)	0.022*** (0.004)	0.023*** (0.004)	0.027*** (0.005)	0.023*** (0.005)	0.030*** (0.005)
Constant	-3.058*** (0.099)	-3.122*** (0.143)	-1.786*** (0.081)	-3.456*** (0.120)	-4.803*** (0.202)	-2.115*** (0.099)
N	7569	7569	7569	6728	6728	6728
R^2	0.7136	0.7807	0.7837	0.7134	0.7672	0.7836

Note: standard errors in parentheses
*** p<0.01, ** p<0.05

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Analysis Results

	DV: $ln(Sharing_{i,t})$								
	Movie			Music			Education		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$AvgWatching_{i,t-1}$	**4.25*** (0.183)**	-	-	**1.73*** (0.133)**	-	-	**2.15*** (0.696)**	-	-
$LikeRatio_{i,t-1}$	-	**5.40*** (0.375)**	-	-	**2.56*** (0.190)**	-	-	**1.69* (0.996)**	-
$ln(Comment_{i,t-1})$	-	-	**0.03*** (0.008)**	-	-	**0.30*** (0.020)**	-	-	**0.10 (0.069)**
$ln(Views_{i,t-1})$	0.64*** (0.011)	0.60*** (0.012)	0.56*** (0.013)	0.51*** (0.015)	0.55*** (0.015)	0.43*** (0.018)	0.59*** (0.053)	0.60*** (0.055)	0.51*** (0.060)
$ln(DaysAfterRelease_{i,t})$	0.02*** (0.006)	0.01** (0.006)	0.02*** (0.007)	0.02*** (0.006)	0.01** (0.006)	0.01*** (0.006)	0.07*** (0.026)	0.07*** (0.026)	0.08*** (0.026)
Constant	-6.11*** (0.193)	-7.52*** (0.372)	-2.29*** (0.116)	-2.09*** (0.140)	-3.93*** (0.214)	-1.40*** (0.140)	-4.89*** (0.640)	-5.32*** (1.193)	-3.33*** (0.440)
N	2600	2600	2600	3272	3272	3272	856	856	856
R^2	0.7952	0.7663	0.7459	0.6191	0.6231	0.6214	0.3948	0.3894	0.3874

Note: standard errors in parentheses
*** p<0.01, ** p<0.05

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Analysis Results

Viewer engagement and video-sharing behavior

Measure of engagement	Hypotheses	Category		
		Music	Movie	Education
Average watching time	H1	Supported	Supported	Supported
The ratio of like counts	H2	Supported	Supported	Supported
The number of comment counts	H3	Supported	Supported	Not supported

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Analysis Results

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Hedonic versus utilitarian contents

DV: $ln(Sharing_{i,t})$	$Hedonic_i$	$ln(Views_{i,t-1})$	$ln(RunningTime_{i,t-1})$	Constant	N	R^2
Week 3	**1.101*** (0.099)**	0.951*** (0.017)	0.528*** (0.056)	-9.689*** (0.361)	841	0.8189
Week 4	**1.001*** (0.101)**	0.934*** (0.017)	0.548*** (0.057)	-9.557*** (0.367)	841	0.8107
Week 5	**1.038*** (0.101)**	0.926*** (0.016)	0.554*** (0.057)	-9.569*** (0.367)	841	0.8125
Week 6	**1.071*** (0.102)**	0.923*** (0.016)	0.560*** (0.058)	-9.617*** (0.369)	841	0.8141
Week 7	**1.039*** (0.102)**	0.919*** (0.016)	0.569*** (0.058)	-9.591*** (0.368)	841	0.8153
Week 8	**1.033*** (0.102)**	0.916*** (0.016)	0.568*** (0.058)	-9.568*** (0.368)	841	0.8167
Week 9	**1.039*** (0.102)**	0.914*** (0.016)	0.572*** (0.058)	-9.584*** (0.368)	841	0.8183
Week 10	**1.060*** (0.102)**	0.911*** (0.016)	0.573*** (0.058)	-9.585*** (0.369)	841	0.8188

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Robustness Check

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Robustness tests for AvgWatching and LikeRatio

$$ln(Sharing_t) = \beta_0 + \beta_1 * AvgWatching_{t-1} + \beta_2 * LikeRatio_{t-1} + \varepsilon_t \quad (3)$$

DV: $ln(Sharing_t)$	$AvgWatching_{t-1}$	$LikeRatio_{t-1}$	Constant	N	R^2
Week 2	**2.642*** (0.390)**	**3.913*** (0.689)**	-1.377** (0.619)	841	0.1106
Week 3	**2.749*** (0.402)**	**4.316*** (0.735)**	-1.732*** (0.655)	841	0.1169
Week 4	**2.646*** (0.403)**	**4.718*** (0.740)**	-1.958*** (0.657)	841	0.1218
Week 5	**2.794*** (0.410)**	**4.589*** (0.755)**	-1.882*** (0.670)	841	0.1216
Week 6	**2.914*** (0.415)**	**4.647*** (0.766)**	-1.970*** (0.680)	841	0.1252
Week 7	**2.996*** (0.418)**	**4.660*** (0.769)**	-1.988*** (0.682)	841	0.1280
Week 8	**3.073*** (0.420)**	**4.736*** (0.775)**	-2.071*** (0.687)	841	0.1313
Week 9	**3.161*** (0.423)**	**4.772*** (0.781)**	-2.129*** (0.692)	841	0.1340
Week 10	**3.235*** (0.426)**	**4.760*** (0.791)**	-2.139*** (0.700)	841	0.1353

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Robustness Check

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Robustness tests for Comments

$$ln(Sharing_t) = \beta_0 + \beta_1 * ln(Comment_{t-1}) + \varepsilon_t \quad (4)$$

DV: $ln(Sharing_t)$	$ln(Comment_t)$	Constant	N	R^2
Week 2	**0.871*** (0.020)**	0.673*** (0.080)	841	0.7037
Week 3	**0.879*** (0.019)**	0.613*** (0.081)	841	0.7149
Week 4	**0.872*** (0.019)**	0.665*** (0.082)	841	0.7154
Week 5	**0.872*** (0.019)**	0.672*** (0.083)	841	0.7151
Week 6	**0.870*** (0.019)**	0.702*** (0.084)	841	0.7072
Week 7	**0.869*** (0.019)**	0.729*** (0.084)	841	0.7110
Week 8	**0.873*** (0.019)**	0.726*** (0.084)	841	0.7143
Week 9	**0.876*** (0.019)**	0.730*** (0.085)	841	0.7156
Week 10	**0.874*** (0.019)**	0.746*** (0.085)	841	0.7144

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Discussion and Conclusion

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- **Understanding antecedents of video-sharing behavior**
  - In spite of proliferation of video-sharing social media, there has been limited research on motivations and antecedents of consumer's video sharing behaviour.
  - Jansen, Sobel, and Cook (2011) acknowledged that previous research on social media mainly focused on social networking activities, not information sharing.
- **Effects of viewer engagement and hedonic contents in diffusion**
  - Viewer engagement on videos affects video-sharing behavior.
  - In terms of video contents, emotionally-charged video contents tend to be shared than other monotonic utilitarian video contents.
- **How to quantify viewer engagement**
  - As online videos emerge as effective tools of marketing campaign, advertisers are eager to quantify customer engagement on video ads.
  - Empirically testing the effect of viewer engagement on sharing videos

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Thank you

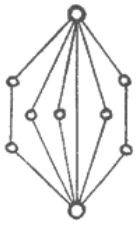
Networks of me: The Insights and Challenges of Presenting Online Egocenteric Data

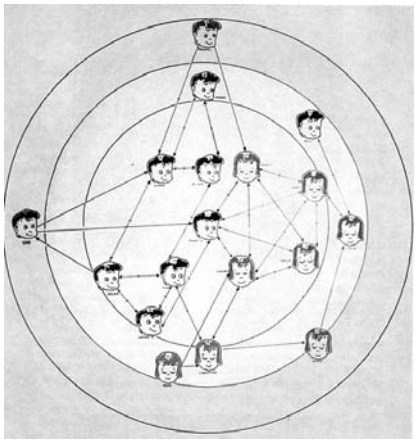
Bernie Hogan
Research Fellow, Oxford Internet Institute
University of Oxford

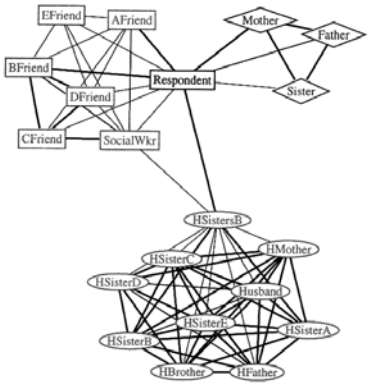
September 1, 2015
MISNC 2015
Matsuyama, Japan

1

Visualizing Personal Networks





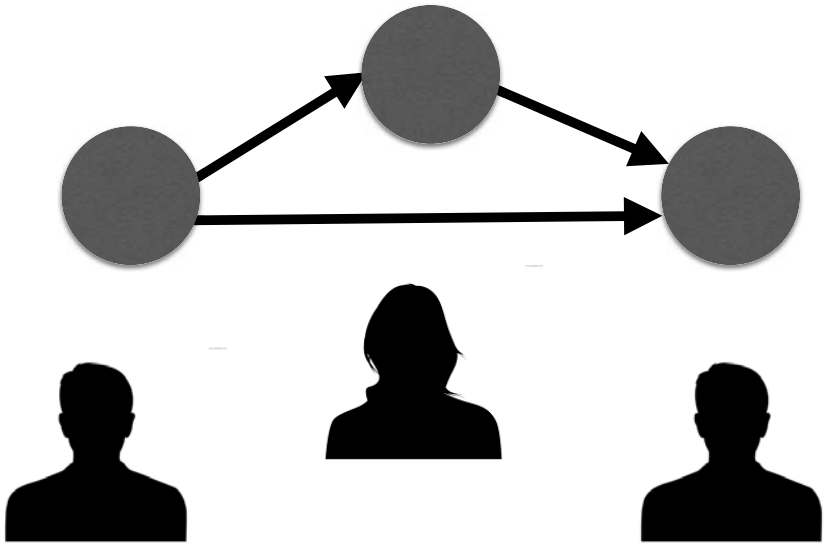


"Imagery has, and has always had, a key role in network research. From the beginning images of networks have been used both to develop structural insights and to communicate those insights to others."

Freeman, L. 2002. "Visualizing Social Networks". Journal of Social Structure

2

Is the world made of networks?



Or do we make networks of the world?

3

facebook

Facebook helps you connect and share with the people in your life.

4

Social Network Site Fundamentals (From Hogan and Wellman 2014)

A `User` Table

Homer
Marge
Bart
Lisa
Maggie

A `Friend` Table

Homer	Bart
Homer	Maggie
Marge	Maggie
Marge	Bart
Marge	Lisa
Lisa	Maggie

Directed: Information Privilege

Homer ⟶ Marge

"Homer follows Marge"

Undirected: Information Access

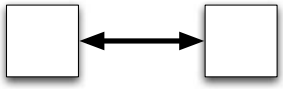
Homer ⟷ Marge

"Homer and Marge know each other"

7

facebook

LinkedIn

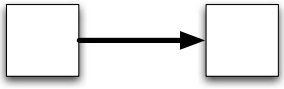


Information Access

Identity Management

twitter

Google+



Information Privilege

Information Management

8

Three Flavours of Facebook Data Research

Within Company	*Via APIs*	*Spidering/Scraping*
Data access granted to researchers. Typically large scale, often using text mining / SNA.	Data access granted by user to third party. Requires permissions from Facebook and currently requires app approval for most things.	No access granted beyond public availability. Can be complex in order to circumvent privacy restrictions. Rarely done in academia.

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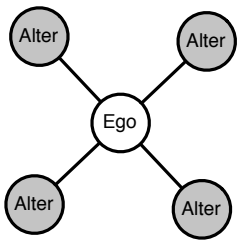
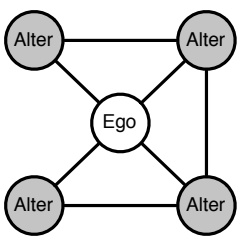
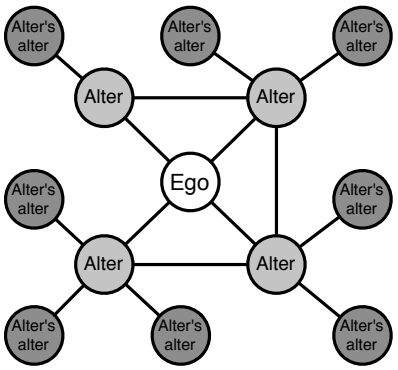
Personal Network Structures



Ego's Friend List
(Degree 1.0)



Alter-Alter ties
("Degree 1.5")

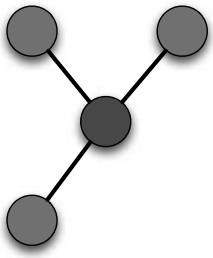


Alter's Friend List
("Degree 2.0")

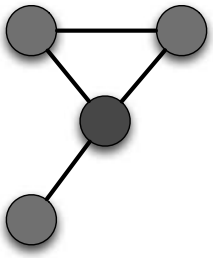
10

Ego

The Old System

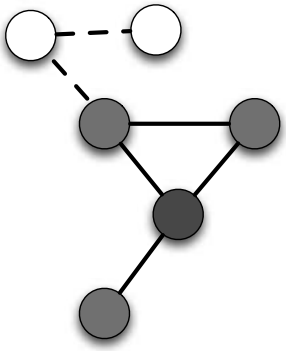


and “alters”



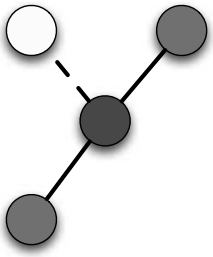
and ties
between alters

But only if ego
knows both

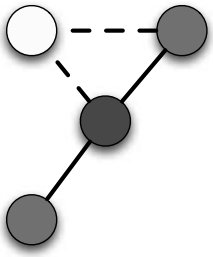


Ego

The New System

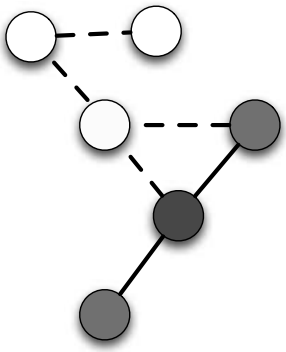


and “alters”
who also add the app



and only ties
between these alters

How to add all
one’s friends?



A Non-exclusive Evolution of Facebook Egonets

TouchGraph - 2008
Friendwheel - 2008
NameGenWeb - 2009
NetVizz - 2009
WolframAlpha - 2011
Algopol - 2013
CollegeConnect - 2014

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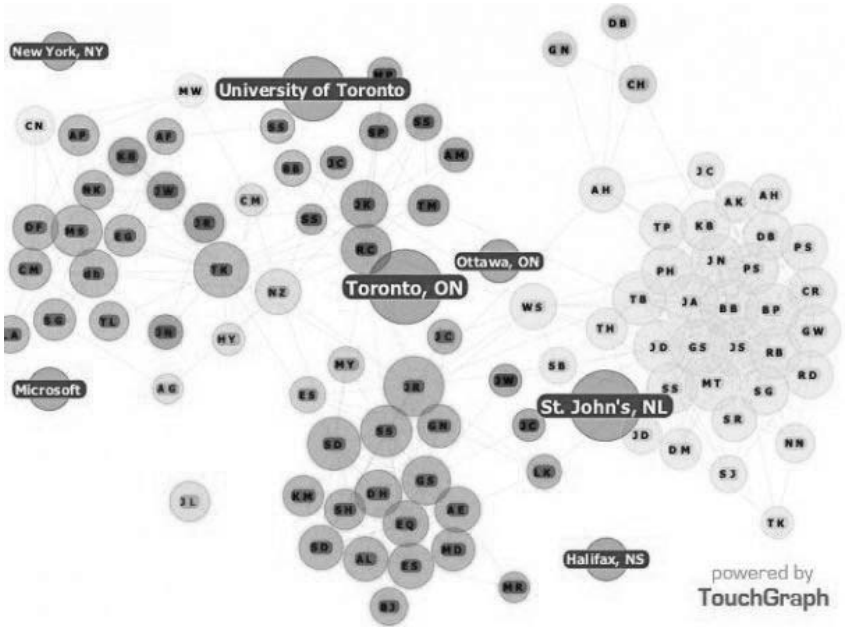
Touchgraph



- A java based program to show networks in general
- A facebook version only did partial queries.
- Enough to suggest structure but not guarantee it.
- No clear “viral” features.

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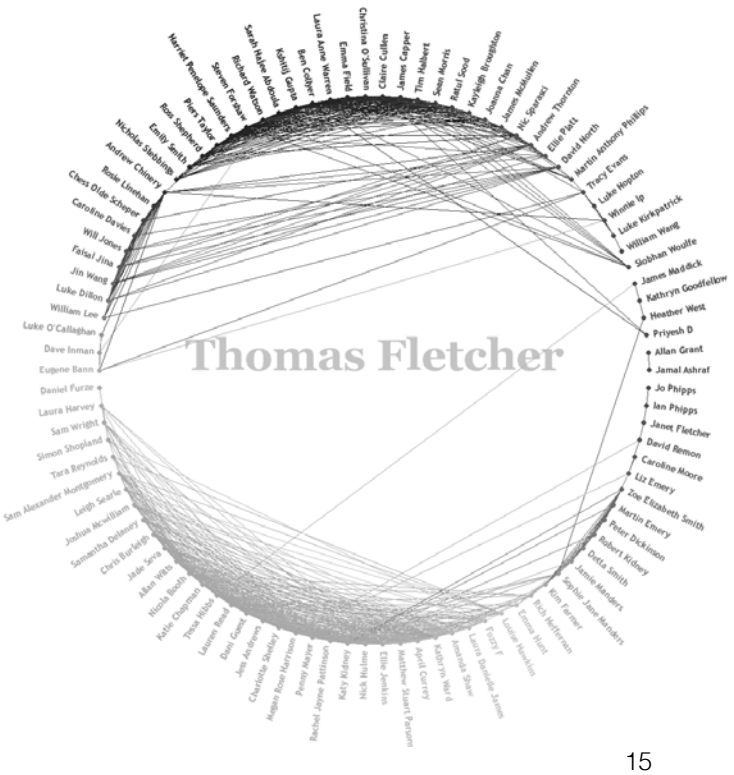
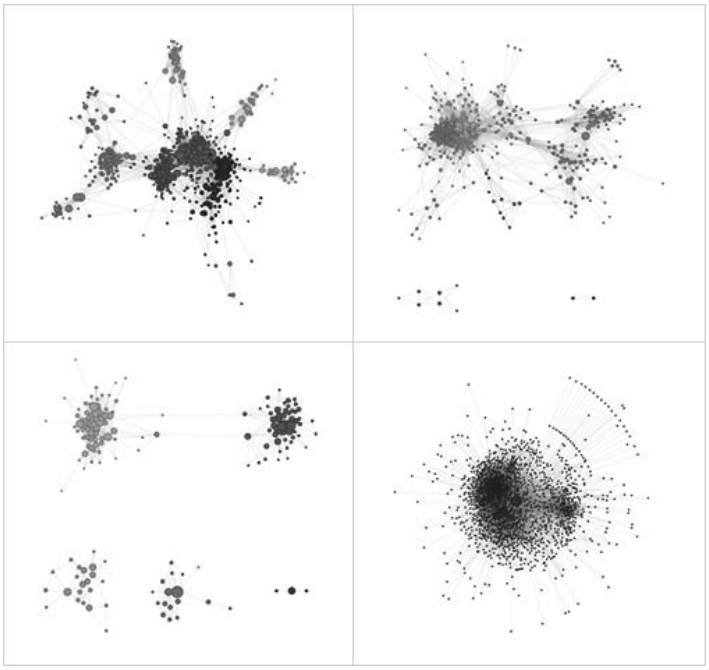
Fletcher's Friendwheel

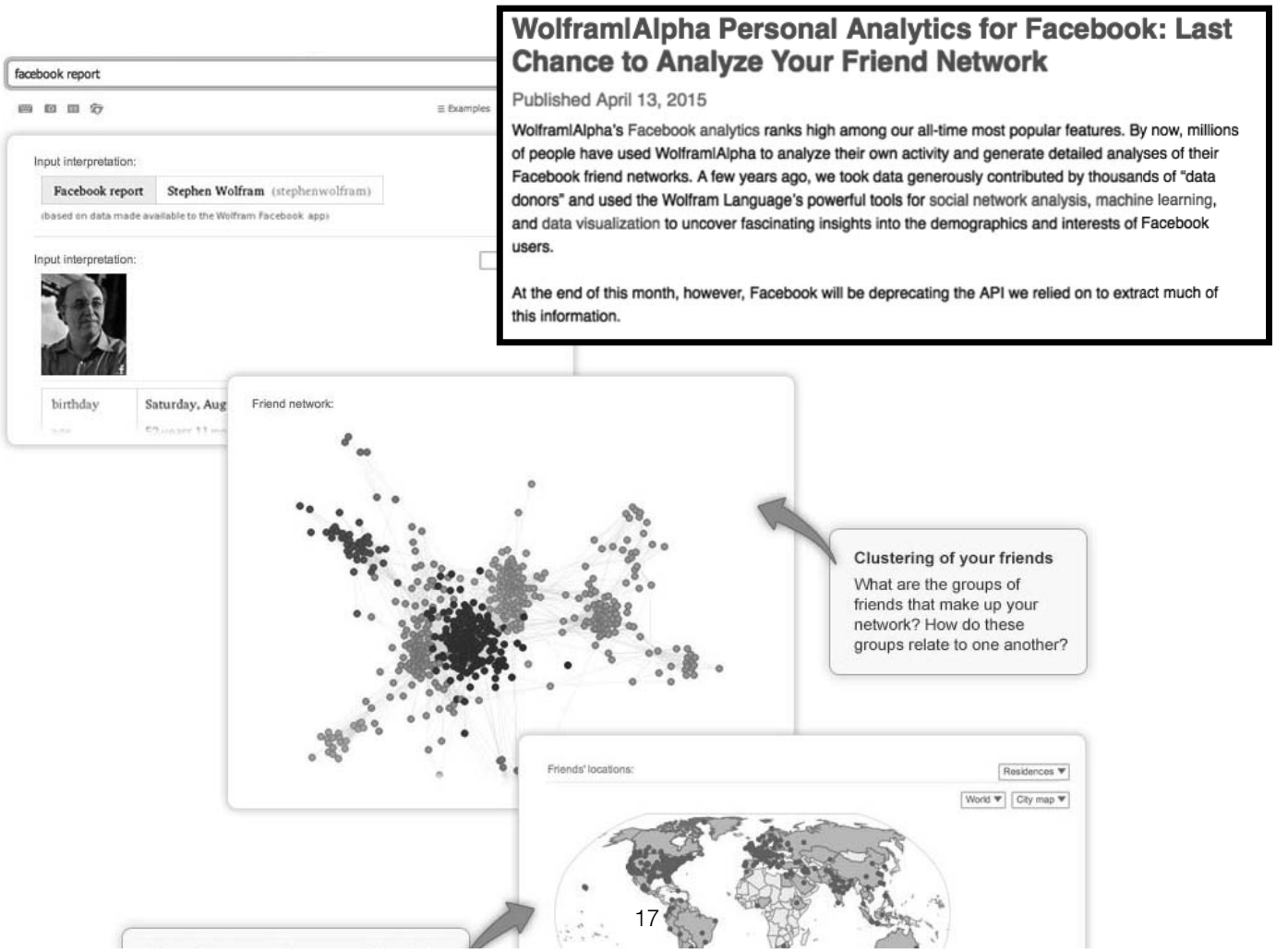


- Attractive
- Didn't make a lot of sense structurally
- Later versions tried some sorting.
- Popular likely because it was 'pretty'
- Easily shared

Wolfram Alpha



- Captured up a ton of metrics about people and their friends.
- Provided these back to the user as reflective analytics.
- Included a basic sociogram in d3
- Promoted sharing and hit over 1 million users.



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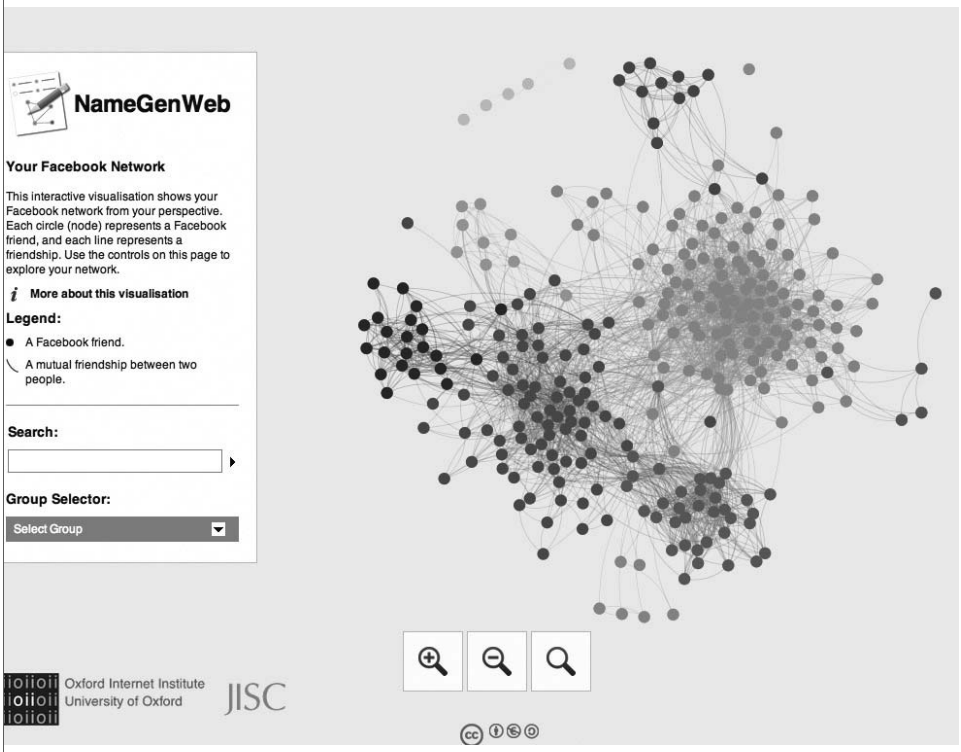
NameGenWeb



- My program. First simply as a means to download a network for analysis. Subsequently included a visualization.
- Popular with social network analysts as a teaching tool.
- No easy way to create images (until too late…)

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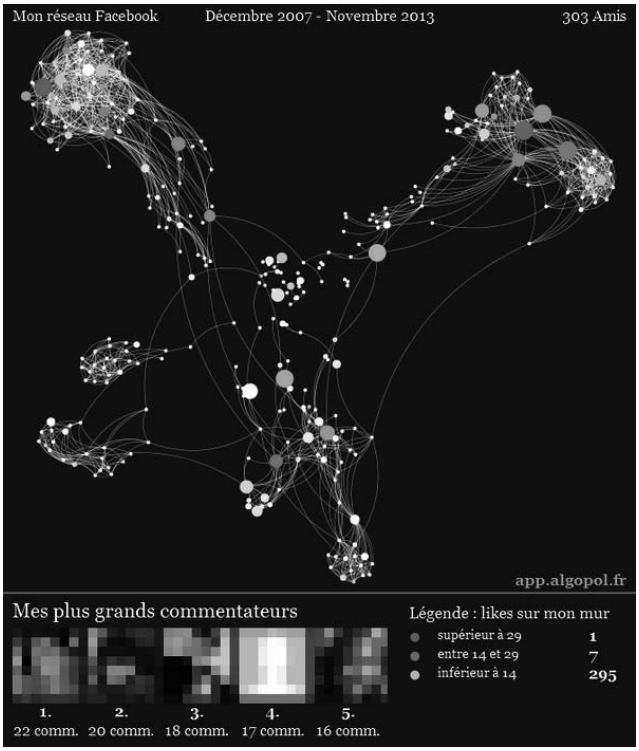
ALGOPOL



- Like NameGenWeb, a sigma.js based visualisation alongside many metrics.
- Less focus on aesthetics and more on dynamic filtering.

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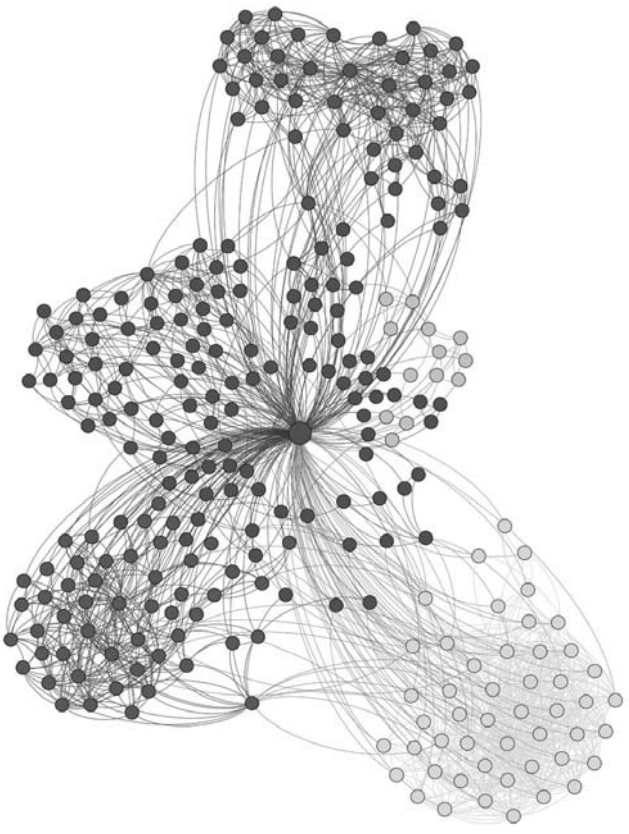
NetVizz



- Perhaps the most reliable Facebook network downloader.
- No visualisation component, but did allow for the downloading of group network data (which was somewhat suspect).

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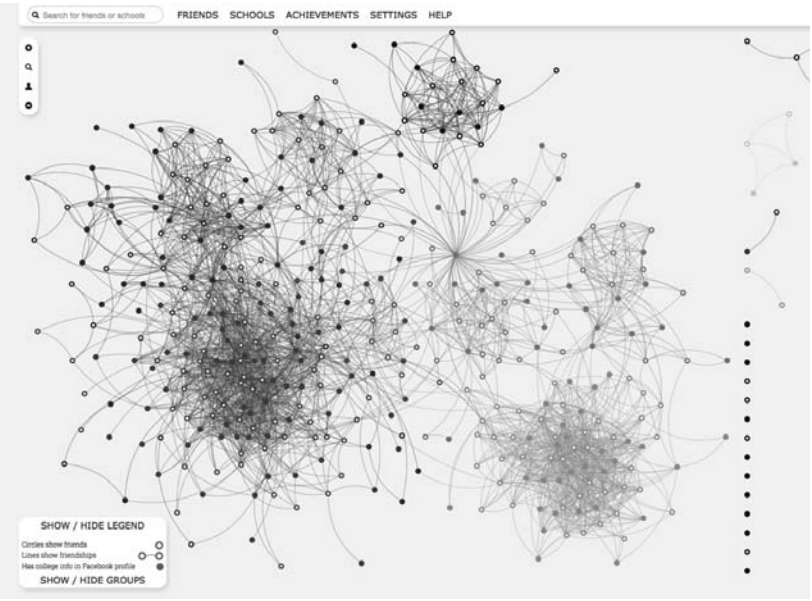
CollegeConnect



- Late entry to Facebook network downloading.
- Application focused on surfacing school information for prospective students.
- Finally after years of work, could demonstrate how visualisation helped with information-seeking tasks.

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…And then there were none.

- May 1, 2015 Facebook disabled the use of OpenGraph 1.0.
- They argued this was a move for privacy.

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Major Changes to Facebook API

Graph API + FQL (2008)

- User could get list of friends under basic permissions.
- Facebook API available in numerous languages (php / javascript \ python \ ruby).
- Facebook supported FQL for extensive querying

OpenGraph 2.1 (2015)

- Programs can only view friends of user who also added program
- FQL deprecated
- GraphSearch not available
- Applications require approval.

24

How could they do this?

- Recall that SNS comprise two tables, where the second was linking the profiles in the first?
- That table links Facebook IDs, and these are Facebook's property.
- Through their interpretation of Section 230, they can have their cake and eat it to.

Section 230 of the Communications Decency Act

From Wikipedia, the free encyclopedia

Section 230 of the Communications Decency Act of 1996 (a common name for Title V of the Telecommunications Act of 1996) is a landmark piece of Internet legislation in the United States, codified at 47 U.S.C. § 230. Section 230(c)(1) provides immunity from liability for providers and users of an "interactive computer service" who publish information provided by others:

> No provider or user of an interactive computer service shall be treated as the publisher or speaker of any information provided by another information content provider.

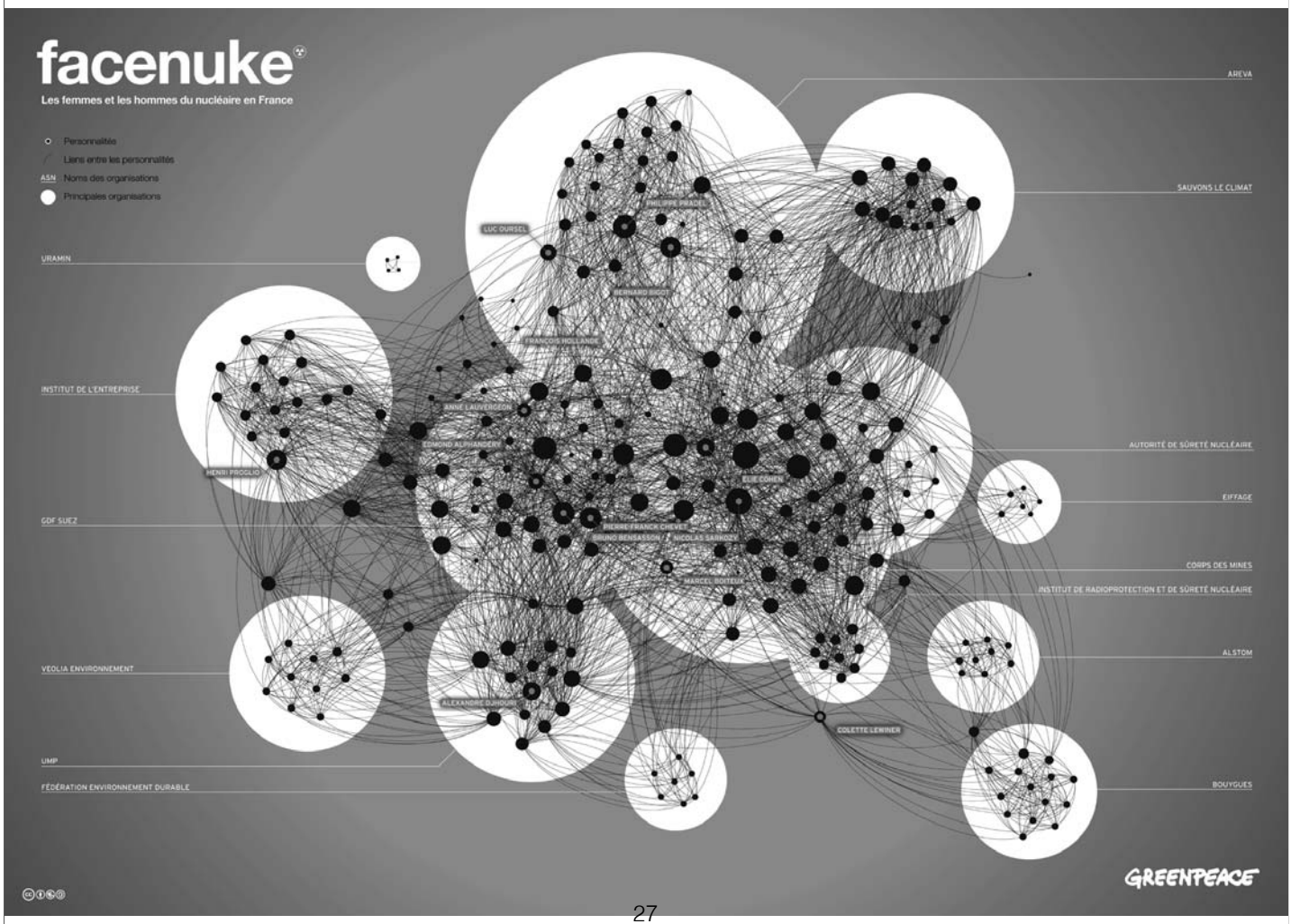
In analyzing the availability of the immunity offered by this provision, courts generally apply a three-prong test. A defendant must satisfy each of the three prongs to gain the benefit of the immunity:

1. The defendant must be a "provider or user" of an "interactive computer service."
2. The cause of action asserted by the plaintiff must treat the defendant as the "publisher or speaker" of the harmful information at issue.
3. The information must be "provided by another information content provider," i.e., the defendant must not be the "information content provider" of the harmful information at issue.

25

Facebook aren't alone, just ahead of the curve.

26



27

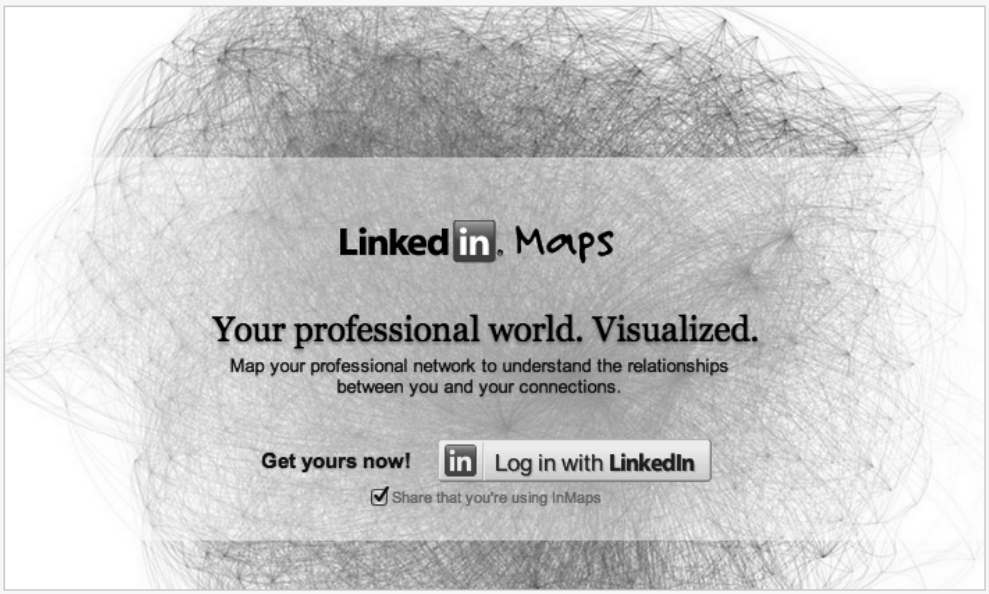
Enterprise LinkedIn inmaps

LinkedIn Is Quietly Retiring Network Visualization Tool InMaps

Posted Sep 1, 2014 by ***Ingrid Lunden*** *(@ingridlunden)*

896 SHARES

Next Story



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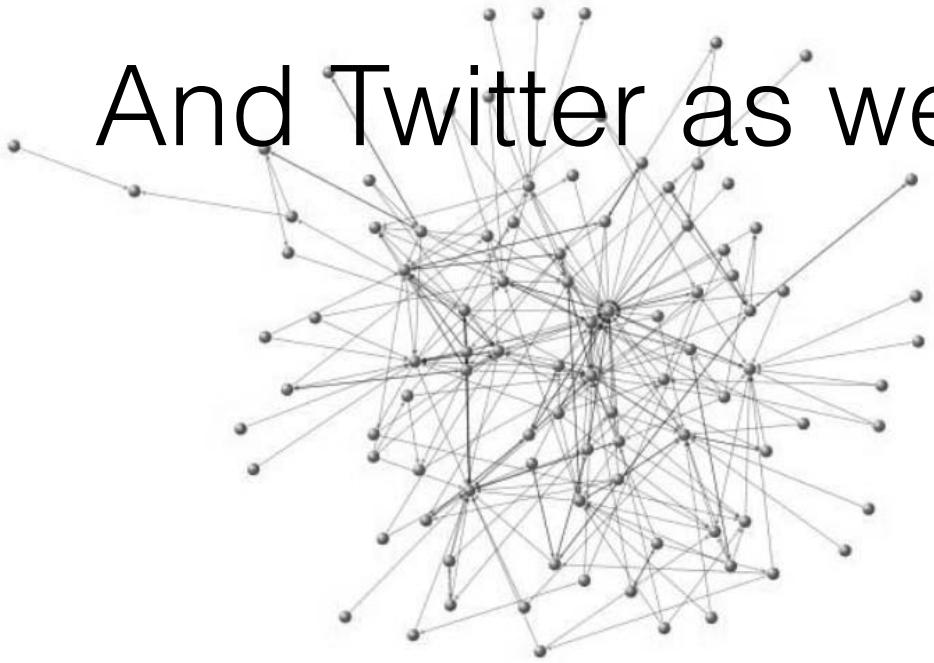
And Twitter as well



From Pavan, E. “Collective Action and Web 2.0 An Exploratory Network Analysis of Twitter Use During Campaigns”. Sociologica 3/2013.

29

Essays

Comment on Elena Pavan/1

Considering Platforms as Actors

by Bernie Hogan

doi: 10.2383/75767

> “Twitter is not merely the conduit for discussion, but an actor in these discussions. Twitter’s actions, such as tweaking the API, sorting discussions, filtering communication, and deciding what is trending have an effect on the agency of political actors and the agency of researchers intending to study such actions.”

30

How did we get here?

- Relational objects do not make sense to people:“2 to make and 1 to break” is different from one-to-one owner-to-property.
- Robots are easier to work with than cyborgs. That is, Machine learning is easier to test than ensembles of visualizations.
- Researchers always assumed that these objects should be available, and thus never made the case to users.
- People are really sloppy with their privacy. Just notice how many screenshots from the above programs have names. I have redacted, google images didn’t.
- Companies are legitimately concerned about this data being used as a dumb pipe. Imagine a NameGenWeb > Google Social Circles importer

31

What are we missing out on?

32

First absence: Social Capital

- Brooks et al., 2014 demonstrated how network structure makes a significant impact on bonding social capital.
- In forthcoming work with Ellison I show how visualisations can help with information seeking tasks.
- Neither paper is possible anymore. But more importantly, neither is the ability to harness this social capital or study it in the same way.

33

Second Absence: Fertile interactivity

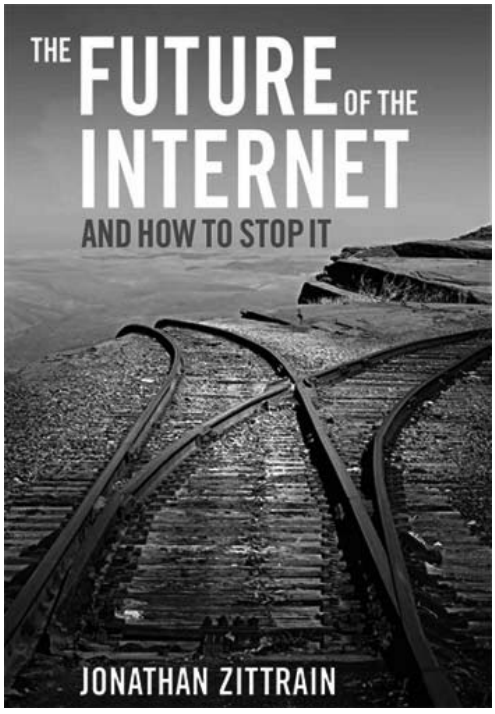
- Have you seen a wedding planner on Facebook?
- What about a program that tracks concerts seen by your friends?
- How do you know how to create lists of people?

34

On the other hand, what's worse?

- In Russia, all these ties are far too easily accessed:
  - Consider that ***Odnoklasniki*** and ***VK*** basically allowed anyone to see any friend. This is rather useful for the state.
- In China, ***Sina Weibo*** visualizations have not shown such friend graphs to be persuasive either. But in theory they are at least partially available. And definitely available to the party.
- Are these networks being used to track dissidents? Are they used to spur commerce? Who gets a say?

35



Sadly, the future is now.

We no longer have *generative* social networks, but corporate means for greater ad targeting and personalization.

These can be accessed behind a silver mirror by corporations and the state, but not by those who created the networks in the first place.

36

Solutions?

- Demonstrate to people that access to friend graphs is both enlightening and can be done responsibly.
- Continue to do research on what platforms still allow access.
- Do not assume that 'privacy' only means keeping secret, but also privatising, as in making a commodity.

References

Jeong, G., Ellison, N., Greenhow, C., Hogan, B. 2016 [Forthcoming]. "First-Generation Students and College: The Role of Facebook Networks as Information Sources". 19th ACM Conference on Computer-Supported Cooperative Work and Social Computing. San Francisco.

Brooks, B., Hogan,B., Ellison, N., Lampe, C. and Vitak, J. 2014. "Assessing structural correlates to social capital in Facebook personal networks". Social Networks. 38:1-15.

Hogan, B. 2014. "From invisible algorithms to interactive affordances: data after the ideology of machine learning". Bertino, E. and Matei, S. (eds) Roles, Trust, and Reputation in Social Media Knowledge Markets. Cham, Switzerland: Springer. Pp. 103-119.

Hogan, B., and Wellman, B. 2014. "The relational self-portrait: Selfies meet social networks." In Graham, M. and Dutton, W. H. (eds). Society and the Internet. Oxford, UK: Blackwell Publishing. Pp 53-66.

Hogan, B. 2013. "Comment on Elena Pavan/1: Considering Platforms as Actors". Sociologica 3/2013. doi: 10.2383/75767

Thank You.
Questions?

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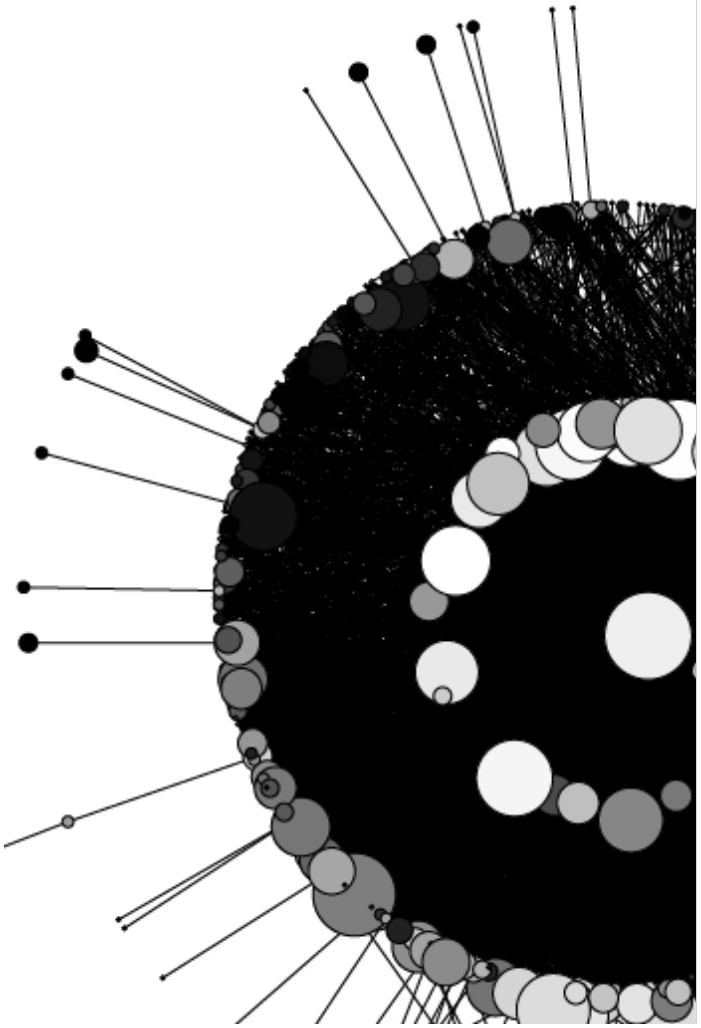


39

Appendix

Jeong et al., 2016. CSCW

	Before	After	p-value	Mean (sd)
Availability	3.90 (0.80)	3.87 (0.63)	0.836	3.88 (0.64)
Comfort	4.35 (0.42)	4.42 (0.46)	0.386	4.38 (0.39)
Closeness	4.11 (0.49)	3.90 (0.65)	0.106	4.00 (0.49)
Understandability	4.12 (0.56)	4.41 (0.45)	0.002**	4.26 (0.47)
Expertise	3.93† (0.69)	4.29† (0.43)	0.014**	4.11 (0.47)
Reliability	4.19 (0.55)	4.38 (0.44)	0.053	4.29 (0.45)

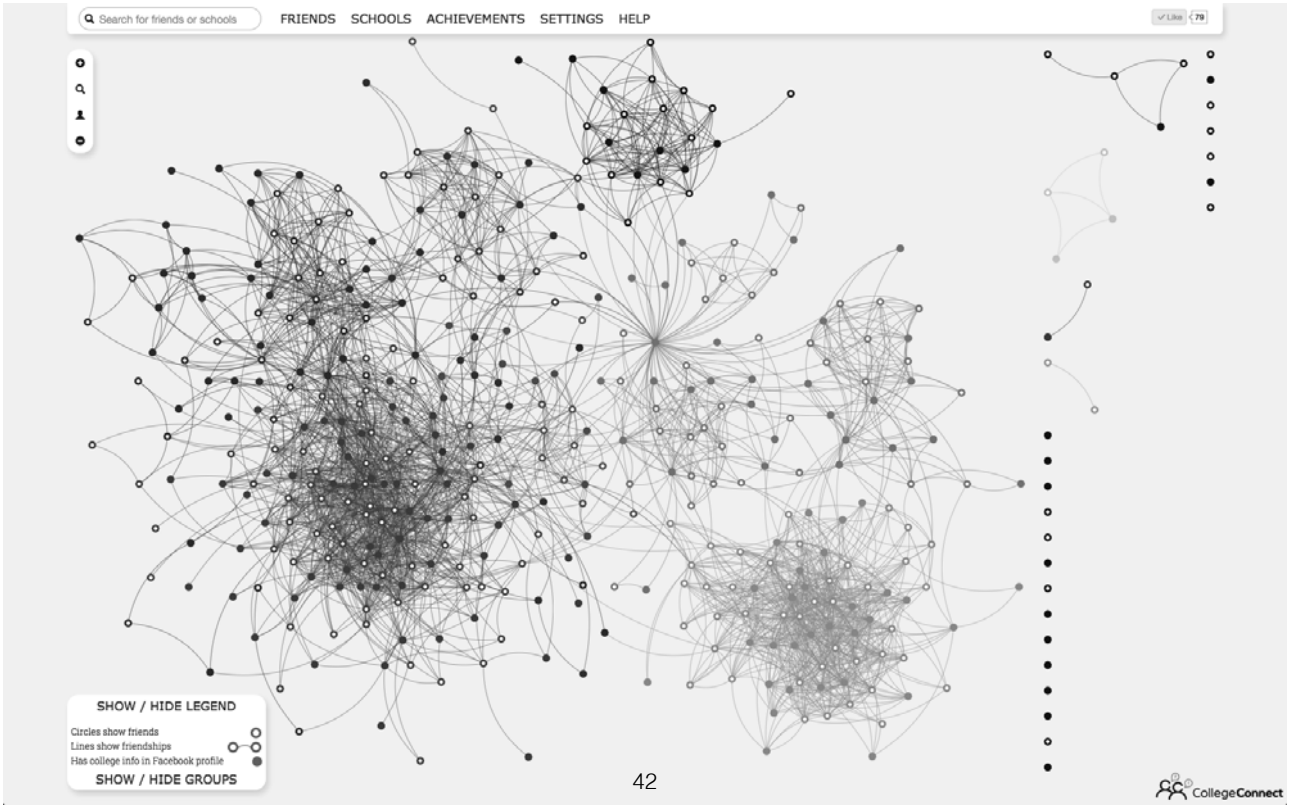
Note: †These values not significantly different after Bonferroni correction.

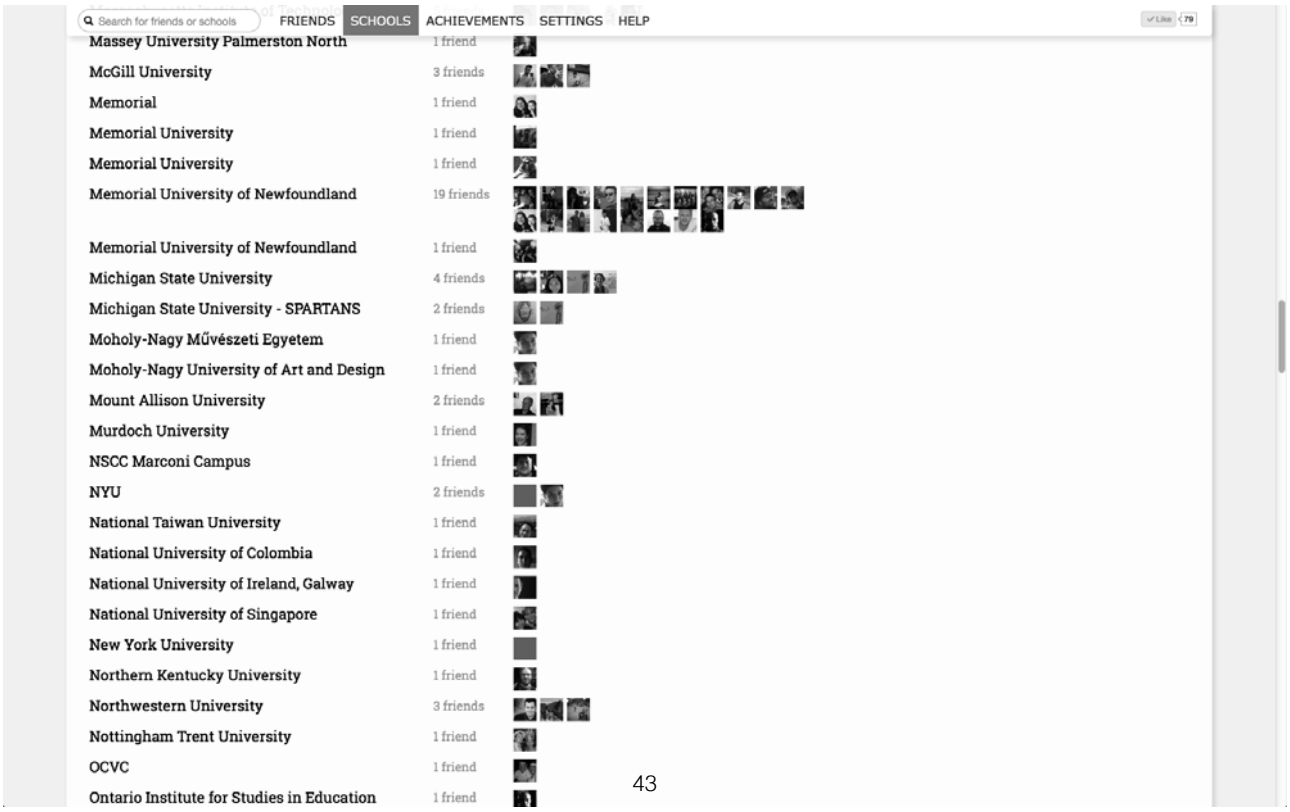
Table 2. Ratings between pre- and post-visualization

	High level of FB friend college resource (n=14)			Low level of FB friend college resource (n=10)		
	Before	After	p-value	Before	After	p-value
Availability	4.04 (0.61)	3.95 (0.59)	0.624	3.69 (1.02)	3.75 (0.70)	0.786
Comfort	4.42 (0.40)	4.51 (0.40)	0.491	4.24 (0.43)	4.30 (0.54)	0.630
Closeness	4.21 (0.51)	4.12 (0.55)	0.515	3.95 (0.44)	3.59 (0.69)	0.125
Understandability	4.31 (0.44)	4.43 (0.49)	0.122	3.85† (0.62)	4.38† (0.42)	0.005**
Expertise	4.11 (0.57)	4.26 (0.53)	0.265	3.67† (0.78)	4.32† (0.25)	0.028**
Reliability	4.44 (0.38)	4.43 (0.48)	0.850	3.85† (0.59)	4.31† (0.38)	0.015**

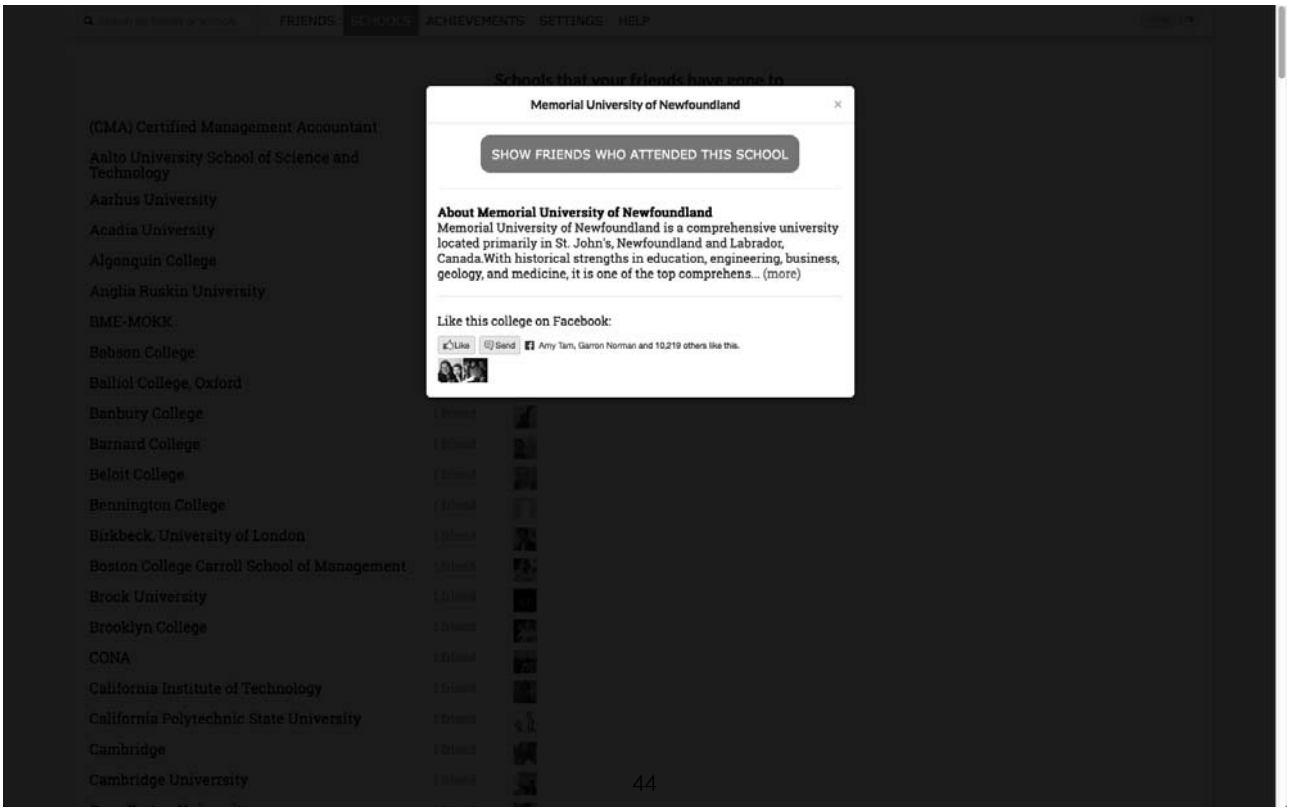
Note: These values not significantly different after Bonferroni correction.

Table 4. Low Facebook Friend College Resource vs. High Facebook Friend College Resource

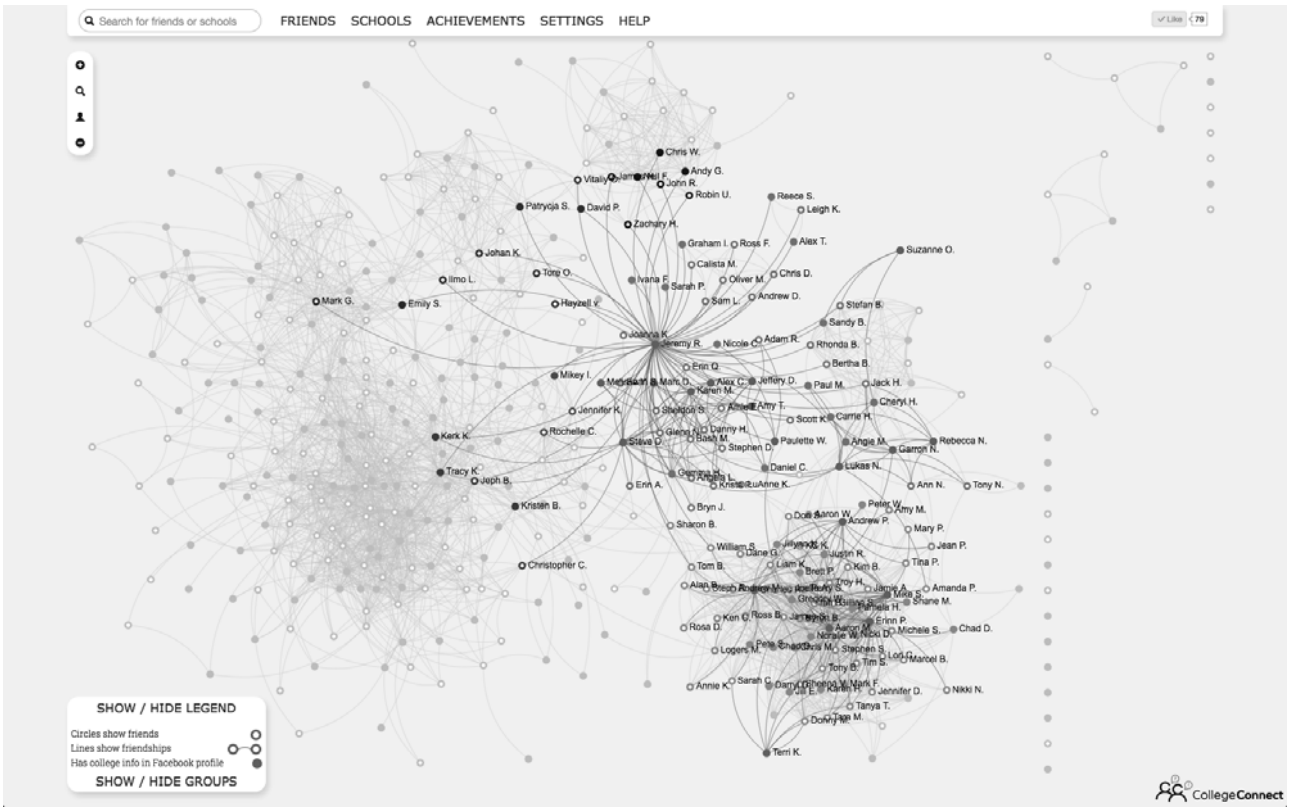



Search for friends or schools
FRIENDS
SCHOOLS
ACHIEVEMENTS
SETTINGS
HELP
Massey University Palmerston North 1 friend
McGill University 3 friends
Memorial 1 friend
Memorial University 1 friend
Memorial University 1 friend
Memorial University of Newfoundland 19 friends
Memorial University of Newfoundland 1 friend
Michigan State University 4 friends
Michigan State University - SPARTANS 2 friends
Moholy-Nagy Művészeti Egyetem 1 friend
Moholy-Nagy University of Art and Design 1 friend
Mount Allison University 2 friends
Murdoch University 1 friend
NSCC Marconi Campus 1 friend
NYU 2 friends
National Taiwan University 1 friend
National University of Colombia 1 friend
National University of Ireland, Galway 1 friend
National University of Singapore 1 friend
New York University 1 friend
Northern Kentucky University 1 friend
Northwestern University 3 friends
Nottingham Trent University 1 friend
OCVC 1 friend
Ontario Institute for Studies in Education 1 friend

43


Memorial University of Newfoundland
SHOW FRIENDS WHO ATTENDED THIS SCHOOL
About Memorial University of Newfoundland
Memorial University of Newfoundland is a comprehensive university located primarily in St. John's, Newfoundland and Labrador, Canada.With historical strengths in education, engineering, business, geology, and medicine, it is one of the top comprehens... (more)
Like this college on Facebook:
Like
Send
Amy Tam, Garron Norman and 10,219 others like this.

44


Search for friends or schools
FRIENDS
SCHOOLS
ACHIEVEMENTS
SETTINGS
HELP
SHOW / HIDE LEGEND
Circles show friends
Lines show friendships
Has college info in Facebook profile
SHOW / HIDE GROUPS
CollegeConnect

Opinion Spammers and Fake Word-of-Mouths:

Issues and Challenges

Chih-Chien Wang
National Taipei University, Taiwan

1

Background

Due to the development and popularity of Internet application, consumers now go online to **consult others' opinions** before making their purchase decision,

and **share their consumption experience** to others after consuming products or service.

2

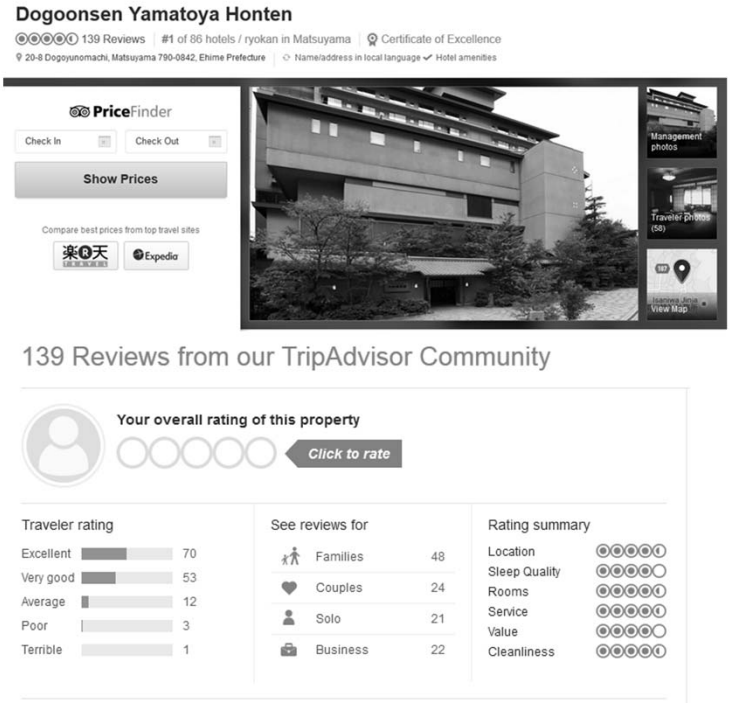
Word-of-Mouth / Product Review

The shared consumption experiences are named as

word-of-mouths (WOMs)

or product reviews.

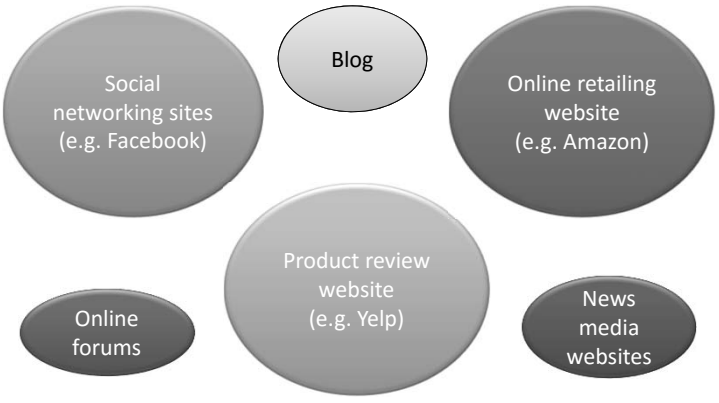
3



Word-of-mouth

Platforms to publish WOMs/product reviews

There are a lot of online platforms to publish WOMs and product reviews.



6

WOMs are more persuasive

WOMs are usually regarded as **more persuasive than advertising** communication by firms,

- since people tend to believe the **recommendations from WOMs are unbiased**,
- and **reject the advertising claim** from firms when they believe the message in advertising is just a sale communication.

7

Background

Muherjee et al. (2012)

- Consumers usually consult online word-of-mouths before purchase. Thus, positive WOMs can results in financial gains and fames for product/service providers.
  - This provides strong motivation for product/service providers to create spam reviews.
- Opinion spamming refers to deliberately mislead WOM audience by providing unfair reviews.

8

The existence of fake reviews

- In the past few years, people realize the significant influence of word-of-mouths or product review on the sale of product/service.
- However, many product reviews are not written by ordinary customers, but by fake review spammers (Mukherjee et al., 2011).
- Some people/companies try to game the opinionated social media by opinion spamming (e.g. writing fake reviews) to promote/demote some target products/service (Mukherjee et al., 2012).

9

No quality control to screen WOMs

- Word-of-mouths are user generated content
- There is almost no screen mechanism and no quality control to screen WOMs.
  - Anyone can write anything on the Internet
  - Spammer can post fake reviews due to no screen mechanism
- People should sense the existence of fake review

10

Fake product review

- Some **unethical firms** now hire **opinion spammers** to create a significant amount of positive comments on their products or service, and/or create negative opinions/comments to their competitors.
- When the cyberspace is full of **fake reviews**, consumers will be misleaded by the fake reviews.
  - Such spam reviews should be detected and filtered to keep the trustworthy of the social media.

11

An important issue for Internet users

Is this review real or fake ?

12

The next question:

Who is sending the "fake product reviews"

?

13

Another question:

The review is so biased. But, why so many people say this review is useful?

14

Is this an answer?

http://yd.sina.cn/article/detail-iavxeafs0745990.d.html

15

A Real Case of sending
fake product review
in Taiwan

16

Fake Review from S company

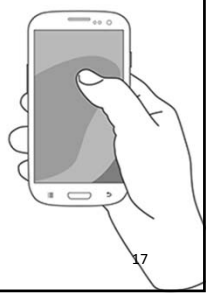
In October 2013,

Taiwan Fair Trade Commission (a government department) fined **an international leading mobile phone company (S company)** and its subsidiary company

NT$ 13,000,000 (US$ 400,000)

due to their unfair behavior of

sending fake product reviews in Taiwan



17

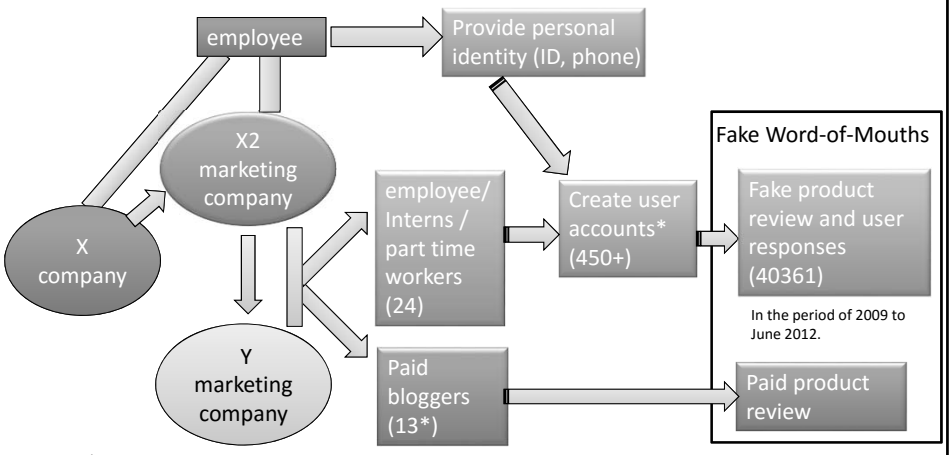
In the period of 2009 to 2012

- The company S
- hired
  - More than 24 part time workers
- used
  - more than 450 accounts
  - to make 40361 fake product review and fake responses.

18

Fake product reviews by S mobile phone company in Taiwan

S2 is a subsidiary company of S company



A company is a marketing company not owned by S company

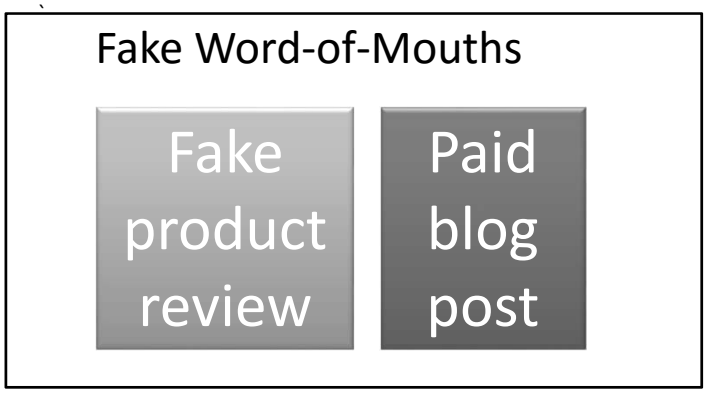
The number of user accounts and paid blogger were data of 2012 and leaked out by anonymous hacker, which did not appear in the official decision statement of Taiwan Fair Trade Commission . 19

In this case, we got to know how a company creates fake opinions

20

Fake opinions/ Fake word-of-mouths

There are two kinds of fake word-of-mouths in this case:



21

Paid blog post

22

Pay money to bloggers

- S Company pay money to bloggers to write blog post
  - Some bloggers are opinion leaders in the field.
  - The bloggers' introduction to product are usually detailed and persuasive.
  - Thus, blog articles are useful to market the product
  - **However, bloggers write by their own words**. The company cannot control the content of the blog.

23

Cost of paid blog post

- Cost of paid blog post in this case was from NT$5000 (about US 150) to NT$25000 (about US 750) **per article**

24

Some bloggers disclosure the companies' sponsorship to the blog post

It is not unethical if bloggers disclosure that they receive sponsorship from the company.

- **But the disclosure may damage the credibility of the bloggers.**
  - **some blogger choose not to disclosure the sponsorship**

25

Fake product review

26

How S company create fake review

- Hire workers to write product review
  - Step 1: Hire interns and part time workers
  - Step 2: Create accounts
    - Need personal identity data (ID card, phone number, email,….)
    - These real identities may be real data from employee, interns, and part time workers of the company
  - Step 3: post fake reviews
  - post fake responses

27

Not only fake review, but also fake response

- Fake responses:
  - They give fake responses to review
    - To create an impression that the product of S company is popular
    - To create an impression that the fake review for the product of S company is useful.
    - To defense when negative product reviews appear
    - To attack competitors, or weaken positive opinions to the competitors' product

28

Why the case of S company is leaked out?

- A hacker hacked into the information systems of company S and leaked out the fake reviews written by the company S.
- The online virtual community discussed a lot about this case.
- Taiwan Fair Trade Commission investigated the case.
- The company S admitted that these fake product reviews were marketing activities of the company.

29

This is the only "confirmed case
But it is not the only case

We believe that some companies hire writers to create fake product review but not be caught.

30

Another "unconfirmed case"

In Taipei City Mayoral Election 2014, Both two major candidates (KO Wen-Je and LIEN Sean) were questioned that they hired workers to spam fake opinions to attack their competitor.

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31

During Taipei Mayoral Election

- KO Wen-Je were questioned to use some accounts to attack LIEN Sean
  - http://www.ettoday.net/news/20141118/427438.htm
- LIEN Sean were questioned that some of their Internet supporters were pseudo accounts maintained by the election team since these account login using the same IP addresses.
  - http://www.appledaily.com.tw/realtimenews/article/new/20140916/470772/
- Both KO Wen-Je and LIEN Sean denied the existence of fake opinion spamming in their teams.

32

Purposes of fake review

33

Fake review influence consumers' judgement to the product by the following ways.

- Make a great first impression
- Form a majority opinion
- Defense for negative opinions
- Attack competitors

34

First impression

- First impression is important to shape consumers' attitude to the product.
- Product review immediately after (or even before) the new product launch can help to create the first impression to the product.
- It is not good if the first comment to the product is negative. Thus, the company may hire someone to write positive product review when the product is available in the market

35

Majority opinion

- Hung number of fake review create the mainstream opinion
- Consumers' conformity personality lead them to believe the mainstream opinions and ignore the minor opinions.
- People are afraid to reveal their consumption experience when their real experience is different from the mainstream opinion.
- Thus, fake review may help to form a positive majority opinion to the product.

36

Defense

- Fake review can be used to reduce the credibility of the negative review to the product
  - Fake response and fake responses may challenge the real negative product review, that will reduce the trustworthy of the real negative product review.
  - People may not believe the real product review since the comments from the real product review are different from the fake reviews.

37

Attack

- Demote competitors' products
  - Fake reviews demote competitors' product by unfair comparison between self company's products and competitors' product.
  - Fake responses may question the positive reviews of competitors' products, and support the negative reviews of competitor's products, that will demote competitors' product.

38

Detecting and preventing of fake review
are important issues for word-of-mouths research

Detection Prevention

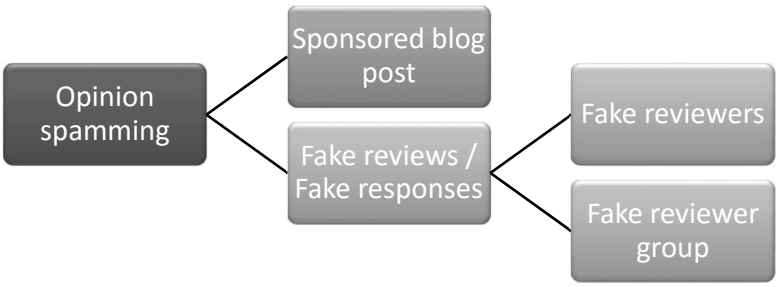
39

Anti-opinion spamming

- Detecting opinion spamming becomes an important issue
- We need to detect
  - Fake reviews
  - Fake reviewers
  - Fake reviewer group (spammer groups)
    - a group of reviewers writing fake reviews together to promote or demote target products/service
    - Fake reviewer group is more damaging than individual fake reviewer.
    - Some fake reviewers may create multiple accounts to write fake reviews. It is not easy to distinguish a single person with multiple accounts from a group of real persons.

40

Opinion spamming



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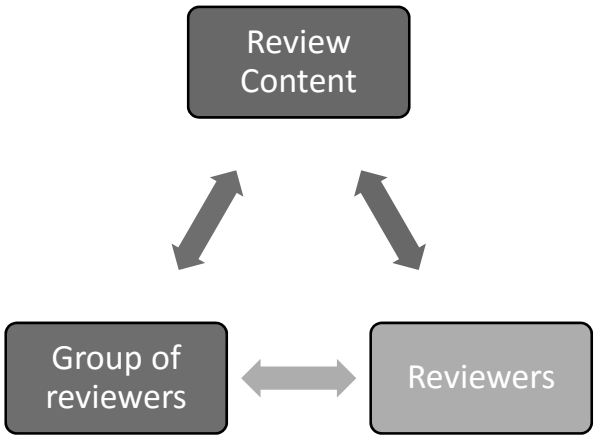
Detect opinion spamming by

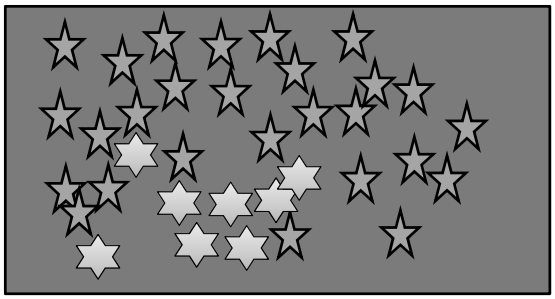


42

It is difficult to detect fake review and fake review spammers

- Even people are aware of the existence of fake reviews, they cannot easily judge if reviews are real WOMs from consumers or fake reviews from the opinion spammers.
- Do you know which ones are real / fake ?

or



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Detect fake review

44

Type of fake review (Jindal and Liu, 2008)

Untruthful opinion

- Give unfair positive review to promote self product
- Give unfair negative review to demote competitors' product

Just rating

- providing no or few comments
- Just rate the product to leverage the average rating

Duplicate review

- Duplicate review or near-duplicate review
- To leverage the average rating

The only fake review can be detected

45

It is a challenge to detect untruthful opinion

- Which review is untruthful?
  - Detecting fake review is a difficult task
  - The fake review looks like an ordinary review.
  - It is very difficult to label fake review just by reading each review.

46

Just rating, with no or few comments

- Both ordinary reviews and fake reviews may be just rating with no written comment. It is not easy to distinguish them.
- Ordinary customers may just rate the product/service since they have no time or do not want to write comments to the product/service

47

Detect Spam Reviews by content similarity

- Duplicated or near duplicated reviews are easier to detect than all other types of fake reviews.

48

Similarity Ratio of Reviews

- Ordinary reviewers write one review to reveal their consumption experience.
  - However, spammers have to write a lot of fake review.
- Spammers will not rewrite the whole review since rewriting a review is time-consuming.
- To save time, spammers may duplicate previous review as new review. They may rewrite some content of the new review (not exactly copy).
  - Thus, similarity ratio could be used as an evidence to detect fake review.

49

Detect Spam Reviews Similarity of Contents

- Why fake reviewers post duplicated content? Why don't they post a totally new post?
  - Because they post fake review to earn money. It is easier to post revised fake review rather than a totally new fake review.
  - It is not easy to create a lot of pseudo consumption experiences.

50

So, we can only detect the product reviews with similar contents.

51

Detecting fake reviewer

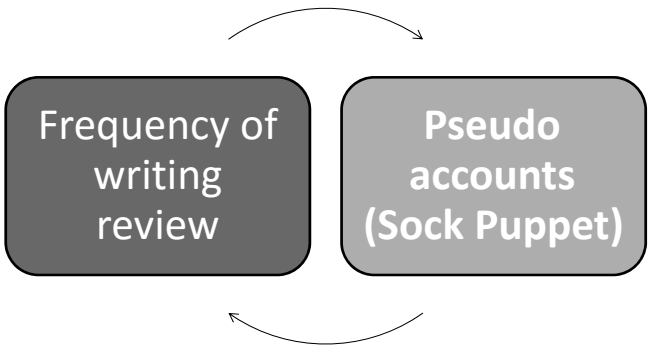
52

Detecting Fake Reviewers

- Detecting suspicious reviewers is not a easy task.
- Fake review spammers act just like normal reviewers to avoid be detected (Wang et a. 2012).

53

Two approaches to detect fake reviewers



54

Frequency of writing review

- Fake reviewers only review a small amount of product
  - A reviewer can be a fake reviewer if he does not regularly write reviews.
  - Writing review is a "job" rather than their interesting. So, fake reviewers will not write review to other products which do not pay for review.
- However, consumers may only have a few consumption experience to the product/service. Thus, some ordinary reviewers also do not regularly write reviews because of their limited consumption experience.

How to Spot a Fake Review on Amazon
http://www.wikihow.com/Spot-a-Fake-Review-on-Amazon
http://www.nytimes.com/2012/08/26/business/book-reviewers-for-hire-meet-a-demand-for-online-raves.html

55

Detecting sock puppet or Pseudo ID (假分身、假帳號)

- A **sock puppet** is an online identity used for purposes of deception.
- The possibility is high for a reviewer to be a fake reviewer if sock puppet is used.
  - However, some users use sock puppet due to privacy consideration. Thus, not all sock puppet accounts are all used by fake reviewers.
  - Besides, some fake reviewers used real personal identities (provide by their company employee) to write fake reviews. So, they do not use sock puppets.

56

So, It is not easy to detect fake reviewer

57

Detecting fake reviewer group

58

Fake reviewer groups

- Fake reviewer groups are more damaging than individual fake reviewers as they can control the sentiment due to the large amount of reviewers in the groups.
- The influence of a single fake reviewer is lower than a group of fake reviewers

59

Fake reviewers usually work together

- Fake reviewers do not usually work alone. They work collaboratively to manipulate the opinion in cyberspace.
- Some fake reviewer accounts are operated by the same person. These accounts look like a group.
  - Fake review spammers would not make enough money if they only write one review for a product (Mukherjee et al., 2011). Thus, to earn enough money, they may create multiple accounts to write fake review to the same product.

60

Find fake reviewer group Muherjee et al. (2012)

- Labeling fake reviewer groups is easier than labeling individual fake reviewers.
  - If we find a lot of reviewers are doing the same thing, they maybe belong to a fake reviewer group
- However, detecting fake reviewer group is still not a easy task.

61

Difficult to find fake reviewer group

- Fake reviewers will try to hide themselves.
  - The fake reviews may be regarded as helpful review by other users since no one know these reviewers are fake reviewers.
  - Other fake reviewer spammers may vote the fake reviews as helpful.
  - The fake review groups may control the majority opinions.
    - Fake reviews may look like more “real” than ordinary reviews

62

Abnormal behavior of fake review spammers

- In most cases, none of the individual reviews appear deceptive. However, all these review behaviors occurring together strongly reveal something suspicious.

Fake reviewer group members are doing the similar things, such as

- All members give the same target products the highest score
- All members provide reviews to the target product within a short period
- Each of the members only review the target products
- All members are among the early reviewers for the target products

63

Indicators for Group Spam Behavior

- Post Frequency
- Post time
- Rating
- Content similarity
- Group size
- Number of reviewed product/services
- Network analysis

64

Indicators for Group Spam Behavior: Frequency

- Opinion spamming is now a business.
- The fake reviewer groups regards writing fake review as a job – they write fake review to get paid from product/service providers.
- To earn enough money, fake review groups spam fake reviews frequently. The high frequency of review spamming make it possible to detect fake review groups.

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Indicators for Group Spam Behavior: Post Time

- Short post time interval
  - Spam group members likely work together in posting review for the target product/service during a short time interval
- Early post time
  - Beside, first impressions are most lasting. To make the biggest impact, spammers usually post early. Spam group members are usually among the very first reviewers to review the products/service to hijack the sentiment on the products/service.

66

Indicators for Group Spam Behavior: Rating

- Highest or Lowest score
  - Spam group members rate the product/service high or low to change the sentiment on it.
- High deviation rating between spammers and others
  - Their rating to the product is different from other ordinary customers. The rate score deviation is large between the rate score of the group members and that of other customers.
- Low deviation among rating from spammers
  - To promote the product/service, all spam group members rate high. To demote the product/service of competitors, all member rate low. The rate score deviation is small among the fake reviewer group members.

67

Indicators for Group Spam Behavior: Content

- Content Similarity to the same product
  - To save time, spammers copy and revised reviews from their pervious reviews
  - The fake reviews posted by the fake review group members may be similar.
- Content Similarity to different product
  - Writing a new review is time consuming. Spammers may create new review based on reviews of previous product/service. Thus, the fake reviewed posted by spammers may be similar to the previous review to different product.

68

Indicators for Group Spam Behavior: Group Size

- Group size
  - The large the group size, the high possibility of the group members are spammers rather than ordinary customers of the same products by chance.
- Group size ratio
  - The members of spam groups compare to the total number of reviewers to a product is named as group size ratio.
  - The large of the group size ratio, the more impact of the spam group.

69

Indicators for Group Spam Behavior: Number of the Reviewed Product/Services

- Group spammers review products/service to earn money.
- The possibility is low that a random customer group happen to review many products together.
- Thus, numbers of the same reviewed products/service can be a indicator to judge whether a group of reviewers are spammers or not.

70

Social Network Analysis of Spammers

- Most product review website allow users to give responses to the review
  - Positive response support the product review and improve the trustworthy feeling to the review.
  - Fake reviewers may use other accounts to provide positive response to their reviews
- Mining social network of reviewers can help to finger out who are belong to a fake review group.

71

Preventing opinion spamming

Real Name

Real Consumption Experience

Filter out spamming

72

Require real name when posting review

- Most product review website request reviewers to register to post opinion or write reviews.
- Some websites asked users to provide they real name and verify their identity.
  - The identity verify requirement resists fake review spammers . Real name requirement make it more difficult to create accounts for fake reviewers.
  - However, it also reduce ordinary users' intention to post product review.

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- In addition, company may ask their employee to provide personal identity data to create accounts for fake reviews.
- Some websites (especially website to introducing new product) allow users to post anonymous response ,
  - Which make it easy to post fake reviews or fake responses

74

Require real consumption experience

- The verified purchase mechanism makes sure the reviewers have consumption experience.
  - The fake reviewers are usually write review without purchase.
  - The possibility is low for a review is fake if it is with verified purchase.

75

No Single Approach can Detect Spam Review Perfectly.

Some challenges exist in fake review detection

(Wang et al. 2012)

76

Challenges to Anti-opinion spam

- No ground truth of whether a review is written by a spammer or not.
  - Not enough cues to discriminate spam reviews from ordinary reviews.

77

Challenges to Anti-opinion spam

- Hard to capture spamming behavior.
  - Spammers may hind themselves by make their reviews look similar to the ordinary reviewers to mislead audiences.

78

Challenges to Anti-opinion spam

- Spammers can also be real customers sometimes
  - They can also write ordinary review as well as spam reviews. They write ordinary when they are real customers. However, they write spammers when they receive payment from companies. They may also write some ordinary review to fool detection rules of spam reviews.

79

Challenges to Anti-opinion spam

- Spammers can be just a fan to the product
- An user posted a lot of reviews on a specific product
  - This reviewer may be
    - Fake reviewer
    - Of just a fan of product
  - It is not easy to discriminate

80

Challenges to Anti-opinion spam

- The amount of spam reviews could be larger than that of ordinary reviews
  - Since spammers may create multiple identities to write spam. When a new product launch in the market, not so many customers have consumption experience. So, the product reviews may compose of many spam reviews and few ordinary review.
  - According to spiral of silence theory, ordinary reviewers will not write they comments if they found they are not in the mainstream.

81

Challenges to Anti-opinion spam

- Spamming fake reviews is unfair. However, in some situations, it is under the protection of "freedom of speech".

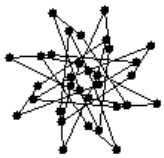
82

Thanks for kind attention

83

84

A Glance at Privacy Preservation



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Outline

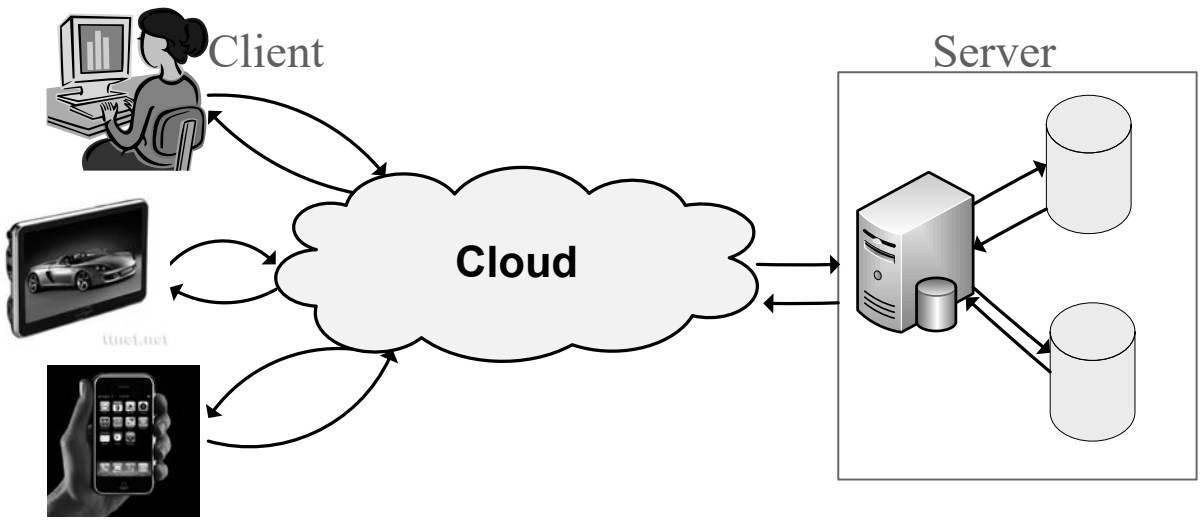
- The Scenario (6)
- Motivating Examples (13)
- Common Practices (3)
- Recent Studies (12)
  - Privacy-Preserving Data Publishing (*PPDP*)
  - Privacy-Preserving Network Publishing (*PPNP*)
  - Privacy-Preserving Data Mining (*PPDM*)
  - Location Privacy
  - Cloud Privacy
  - Mobile Privacy
- Some Challenges (5)

The Scenario – Objective (1/6)

- Privacy
  - The state of being private; the state of not being seen by others
  - *identities, medical records, political/religious /sexual preferences*, *location, sensitive context*, ...
- Database security
  - To prevent loss of privacy due to viewing/disclosing *unauthorized* data
- Privacy Preservation
  - To preserve privacy of *authorized/published* data

The Scenario (2/6)

- Querying public information is an activity of daily life. But privacy might be breached.



The Scenario (3/6)

What is privacy risk to social-networking users?

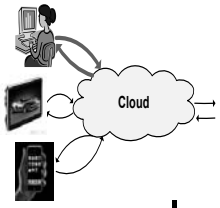
The information you share explicitly, e.g., name, age, gender, phone, address, employer, etc. can lead to identity theft.

The Scenario (4/6)

What is privacy risk to social-networking users?

The information you did not share explicitly can also be derived from your public profile, friendship connections or even micro-targeted advertising systems.

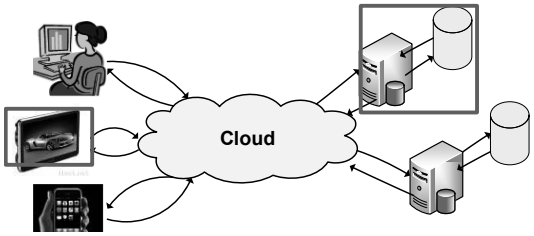
The Scenario - Attacks from client side (un-trusted clients) (5/6)



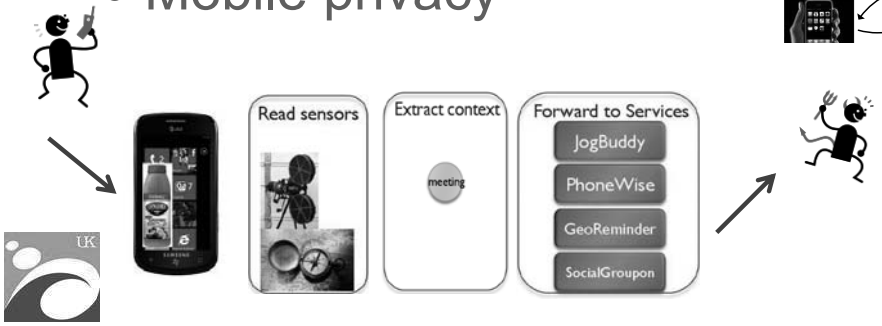
- Retrieve information, analyze, re-identify personal information, then attack,
  - Relational data privacy - *PPDP*
  - Set data (transaction data) privacy - *PPDP*
  - Graph data (social network data) privacy – *PPNP, PPSN*
  - Edge weight privacy – *PPNP, PPSN*
  - Association rule privacy – *PPDM*

The Scenario - Attacks from server side (un-trusted servers) (6/6)

- Location-based service privacy
  - Based on client's queries, identify personal information (location, identity), then attack,
- Cloud privacy

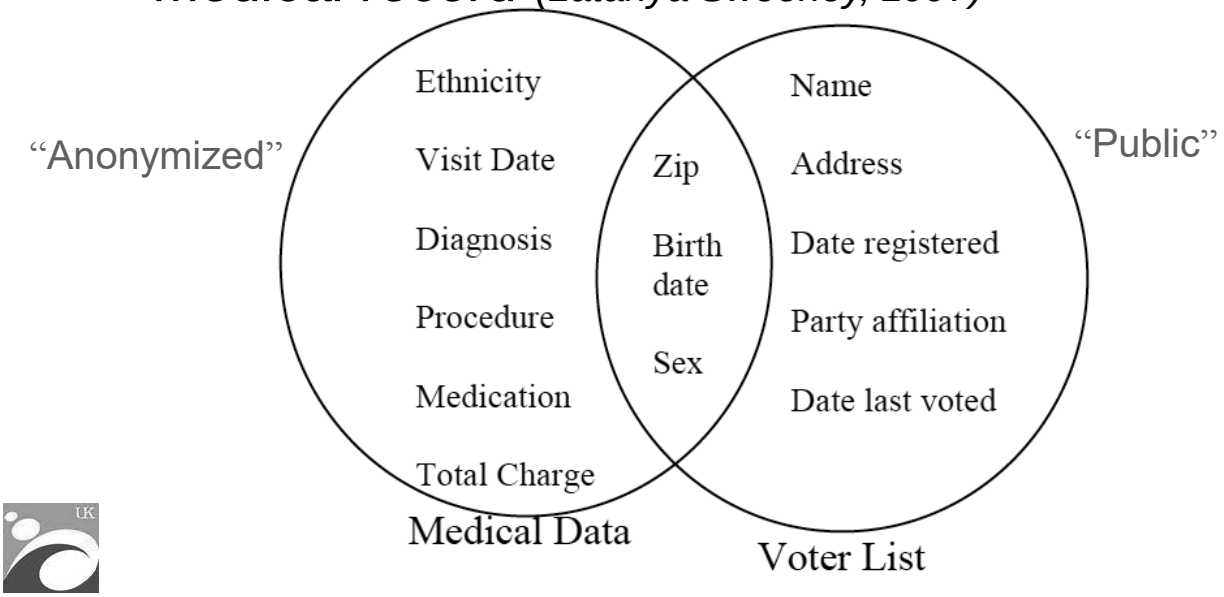


- Mobile privacy



Motivating Examples - Privacy Preserving Data Publishing (1/13)

- *Motivating examples – Group Insurance Commission: they found MA governor's medical record (Latanya Sweeney, 1997)*



Motivating Examples - Privacy Preserving Data Publishing (2/13)

- *Motivating examples – Group Insurance Commission*

Hospital Patient Data (Name, ID are hidden)

DOB	Sex	Zipcode	Disease
1/21/76	Male	53715	Heart Disease
4/13/86	Female	53715	Hepatitis
2/28/76	Male	53703	Brochitis
1/21/76	Male	53703	Broken Arm
4/13/86	Female	53706	Flu
2/28/76	Female	53706	Hang Nail

Vote Registration Data (public info)

Name	DOB	Sex	Zipcode
Andre	1/21/76	Male	53715
Beth	1/10/81	Female	55410
Carol	10/1/44	Female	90210
Dan	2/21/84	Male	02174
Ellen	4/19/72	Female	02237

- Andre has heart disease!

Motivating Examples - Privacy Preserving Data Publishing (3/13)

- *Motivating examples – A Face Is Exposed for AOL Searcher No. 4417749*
  - *Buried in a list of 20 million Web search queries collected by AOL and recently released on the Internet is user No. 4417749. The number was assigned by the company to protect the searcher's anonymity, but it was not much of a shield. – New York Times, August 9, 2006.*

Thelma Arnold's identity was betrayed by AOL records of her Web searches, like ones for her dog, Dudley, who clearly has a problem.

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Motivating Examples - Privacy Preserving Data Publishing (4/13)

- *Motivating examples – American On Line*
  - ~650k users, *3 months period, ~20 million queries released*
  - *No name, no SSN, no driver license #, no credit card #*
  - *The user, ID 4417749, was found to be Thelma Arnold, a 62 year old woman living in Georgia.*
  - *Lost of privacy to users, damage to AOL, significant damage to academics who depend on such data.*

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Motivating Examples - Privacy Preserving Data Publishing (5/13)

- *Motivating examples – Netflix Prize*
  - In October of 2006, Netflix announced the $1-million Netflix Prize for improving their movie recommendation system.
  - Netflix publicly released a dataset containing 100 million movie ratings of 18,000 movies, created by 500, 000 Netflix subscribers over a period of 6 years.
  - Anonymization - replacing usernames with random identifiers.
  - Shown that 84% of the subscribers could be uniquely identified by an attacker who knew 6 out of 8 movies that the subscriber had rated outside of the top 500.

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Motivating Examples - Privacy Preserving Data Publishing (6/13)

- *Motivating examples – Target*
  - *Nice customer service!*
  - New York Times, Feb 12, 2012. Target has figured out how to data-mine its way into your womb, to figure out whether you have a baby on the way long before you need to start buying diapers. (*pregnancy prediction score*)
  - Take a fictional Target shopper named Jenny Ward, who is 23, lives in Atlanta and in March bought cocoa-butter lotion, a purse large enough to double as a diaper bag, zinc and magnesium supplements and a bright blue rug. There's, say, an 87 percent chance that she's pregnant and that her delivery date is sometime in late August.

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Motivating Examples - Online Social Networking (7/13)

Motivating Examples - Online Social Networking (8/13)

facebook

- **Over 1.19 billion active users and 727 million daily active users (Sept, 2013)**
  - **Used by one out of 7 people on earth**
  - **Average user has 190 friends**
- **End of 2012**

	Rank	Active User	Population Penetration
USA	1	166 million	52.9%
India	2	62 million	5.2%
Brazil	3	58 million	30.2%
Indonesia	4	51 million	20.55%
Japan	17	17 million	13.5%
Taiwan	20	13 million	56.99%
Austria	53	2.9 million	35.47%

Motivating Examples - Privacy in Social Networking (9/13)

- (March 2013 – **"You are what you like"**) Researchers from Cambridge University were able to accurately infer a Facebook user's **race, IQ, sexuality, substance use, personality or political views** using only a record of the subjects and items they had "**liked**" on Facebook (from 58,000 U.S. Facebook users).
- able to **predict whether men were homosexual with 88% accuracy** by their likes of Facebook pages such as "Human Rights Campaign" and "Wicked the Musical"
- **75% accuracy rate for predicting drug use** among Facebook users, analyzing only public "like" updates

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Motivating Examples - Privacy in Social Networking (10/13)

- African Americans and Caucasian Americans were correctly classified in 95 percent of cases, and
- Males and females were correctly classified in 93 percent of cases
- Christians and Muslims were correctly identified in 82 percent of cases, as were
- Democrats and Republicans with 85 percent accuracy.

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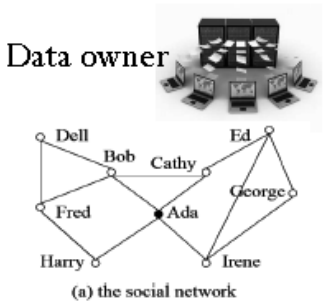
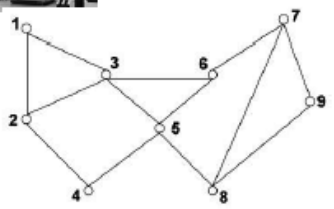
Motivating Examples - Privacy Preserving Network Publishing (11/13)



(a) the social network

release

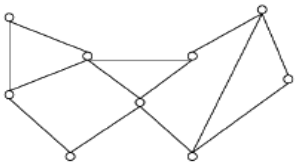
Data miner



name	sex	age	disease	salary
Ada	F	18	cancer	25k
Bob	M	25	heart	110k
Cathy	F	20	cancer	70k
Dell	M	65	flu	65k
Ed	M	60	cancer	300k
Fred	M	24	flu	20k
George	M	22	cancer	45k
Harry	M	40	flu	95k
Irene	F	45	heart	70k

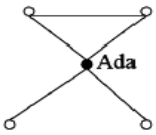
id	Sex	age	disease	salary
5	F	Y	cancer	25k
3	M	Y	heart	110k
6	F	Y	cancer	70k
1	M	O	flu	65k
7	M	O	cancer	300k
2	M	Y	flu	20k
9	M	Y	cancer	45k
4	M	M	flu	95k
8	F	M	heart	70k

Motivating Examples - Privacy Preserving Network Publishing (12/13)



(b) the network with anonymous nodes

attack



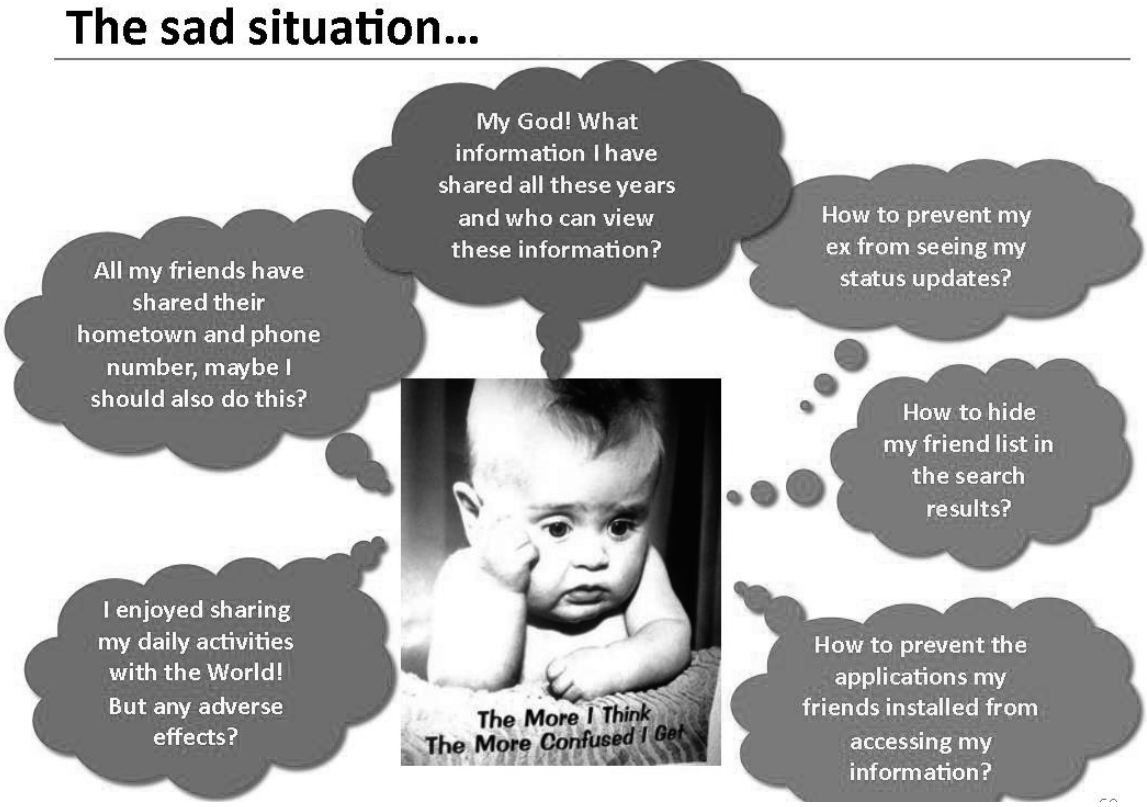
Attacker

Ada's sensitive information is disclosed.

id	Sex	age	disease	salary
5	F	Y	cancer	25k
3	M	Y	heart	110k
6	F	Y	cancer	70k
1	M	O	flu	65k
7	M	O	cancer	300k
2	M	Y	flu	20k
9	M	Y	cancer	45k
4	M	M	flu	95k
8	F	M	heart	70k

Privacy breaches
- Identity disclosure
- Link disclosure
- Attribute disclosure

Motivating Examples - Privacy Preserving Network Publishing (13/13)



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Common Practices (1/3)

- Limiting access
  - Control access to the data
  - Used by secure DBMS community
- "Fuzz" the data
  - Forcing aggregation into daily records instead of individual transactions or slightly altering data values
  - Used by the US Census Bureau

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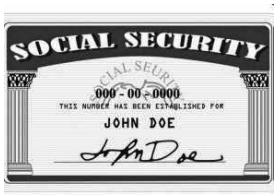
Common Practices (2/3)



- Eliminate unnecessary groupings
  - The first 3 digits of SSNs are assigned by office sequentially
  - Clustering high-order bits of a "unique identifier" is likely to group similar data elements
  - Unique identifiers are assigned randomly
- Augment the data
  - Populate the phone book with extra, fictitious people in non-obvious ways
  - Return correct info when asking an individual, but return incorrect info when asking all individuals in a department

Common Practices (3/3)

- Audit
  - Detect misuse by legitimate users
  - Administrative or criminal disciplinary action may be initiated

Recent Studies – partial list (12)

- Privacy-Preserving Data Publishing (2)
  - K-anonymity
- Utility-based Privacy-Preserving (3)
- Differential Privacy (2)
- Location Privacy (1)
- Cloud Privacy (1)
- Mobile Privacy (3)

Privacy Preserving Data Publishing (1/2)

- *K-Anonymity for linking attacks*

QI

SA

Hospital Patient Data (Name, ID are hidden)

DOB	Sex	Zipcode	Disease
1/21/76	Male	53715	Heart Disease
4/13/86	Female	53715	Hepatitis
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Vote Registration Data (public info)

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Carol	10/1/44	Female	90210
Dan	2/21/84	Male	02174
Ellen	4/19/72	Female	02237

- Andre has heart disease!

Privacy Preserving Data Publishing (2/2)

- *K-Anonymity for linking attacks*

Age	Race	Gender	Zip Code	Diseases
47	White	Male	21004	Common Cold
35	White	Female	21004	Flu
27	Hispanic	Female	92010	Flu
27	White	Female	92010	Hypertension

QI

SA

Age	Race	Gender	Zip Code	Diseases
*	White	*	21004	Common Cold
*	White	*	21004	Flu
27	*	Female	92010	Flu
27	*	Female	92010	Hypertension

- An example of 2-Anonymity (one-to-many approach)
- K records with same QI, but different SA values

Utility-based Privacy-Preserving (1/3)

- Original data

tId	*Age*	*Education*	*Zip Code*	*Annual Income*	*Target Customer*
t1	24	Bachelor	53711	40*k*	Y
t2	25	Bachelor	53712	50*k*	Y
t3	30	Master	53713	50*k*	N
t4	30	Master	53714	80*k*	N
t5	32	Master	53715	50*k*	N
t6	32	Doctorate	53716	100*k*	N

Utility-based Privacy-Preserving (2/3)

- Two possible anonymization

gId	*tId*	*Age*	*Education*	*Zip Code*	*Annual Income*	*Target Customer*
g1	t1	[24-25]	Bachelor	[53711-53712]	40*k*	Y
g1	t2	[24-25]	Bachelor	[53711-53712]	50*k*	Y
g2	t3	30	Master	[53713-53714]	50*k*	N
g2	t4	30	Master	[53713-53714]	80*k*	N
g3	t5	32	GradSchool	[53715-53716]	50*k*	N
g3	t6	32	GradSchool	[53715-53716]	100*k*	N

gId	*tId*	*Age*	*Education*	*Zip Code*	*Annual Income*	*Target Customer*
g1	t1	[24-30]	ANY	[53711-53714]	40*k*	Y
g2	t2	[25-32]	ANY	[53712-53716]	50*k*	Y
g3	t3	[30-32]	Master	[53713-53715]	50*k*	N
g1	t4	[24-30]	ANY	[53711-53714]	80*k*	N
g3	t5	[30-32]	Master	[53713-53715]	50*k*	N
g2	t6	[25-32]	ANY	[53712-53716]	100*k*	N

Utility-based Privacy-Preserving (3/3)

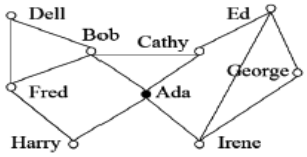
- Q1:"How many customers under age 29 are there in the data set?"
- Q2: "Is an individual with age=25, education= Bachelor, Zip Code = 53712 a target customer?"

- First technique, answers: "2"; "Y"
- Second technique, answers: [0, 4]; 50% "Y", 50% "N"

- ***High Privacy, High Utility***

Differential Privacy (1/2)

Data owner 



(a) the social network

Data miner

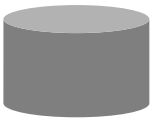
Query f

Query result + noise

name	sex	age	disease	salary
Ada	F	18	cancer	25k
Bob	M	25	heart	110k
Cathy	F	20	cancer	70k
Dell	M	65	flu	65k
Ed	M	60	cancer	300k
Fred	M	24	flu	20k
George	M	22	cancer	45k
Harry	M	40	flu	95k
Irene	F	45	heart	70k

Adversary can only obtain query results, Not the data itself!

Receive approximate answers , but cannot be sure of the true element.



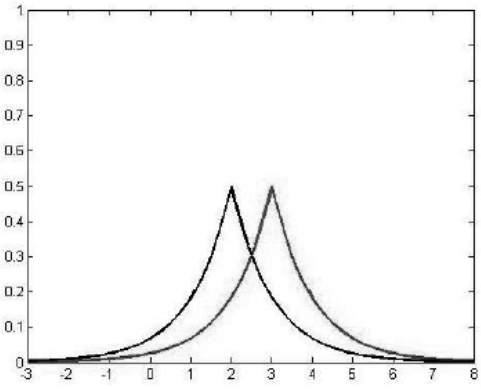
Differential Privacy (2/2)

name	disease
Ada	cancer
Bob	heart
Cathy	cancer
Dell	flu
Ed	cancer
Fred	flu

K ⟸ f count(#cancer)

⟹ f(x) + noise

3 + noise



name	disease
Ada	cancer
Bob	heart
Cathy	cancer
Dell	flu
Ed	cancer
Fred	flu

K ⟸ f count(#cancer

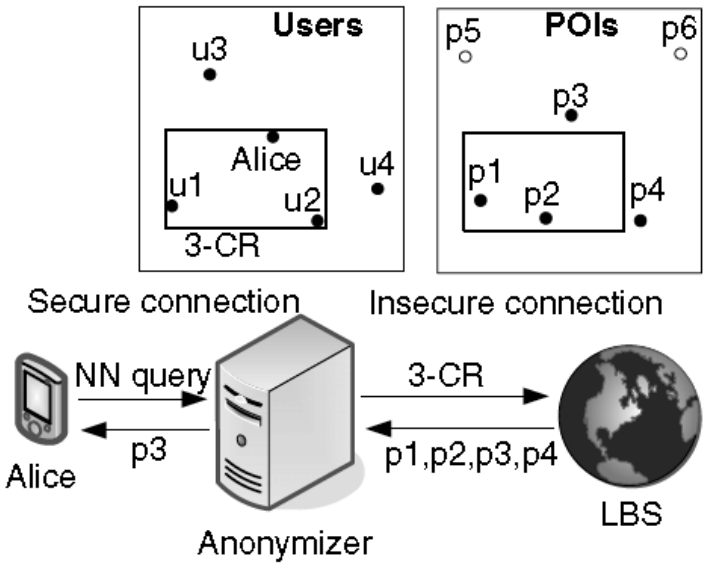
⟹ f(x') + noise

2 + noise

Two databases (x, x') differ in only one row.

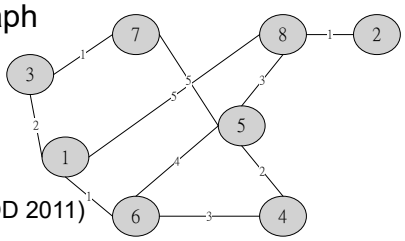
Location Privacy (1/1)

- Location Privacy (Papadopoulos VLDB'10)
  - To find the NN (POI p3) of Alice, without exposing true location of Alice to LBS
  - Location obfuscation
    - Send additional set of "dummy" queries, in addition to actual query

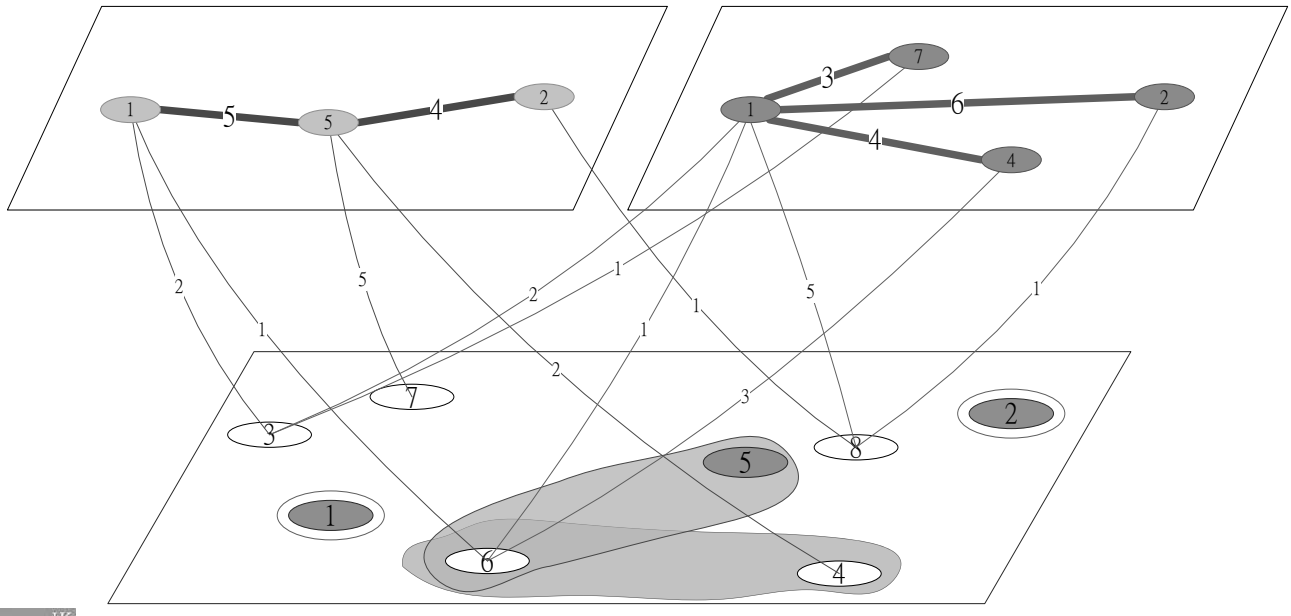


Cloud Privacy (1/1)

Original graph



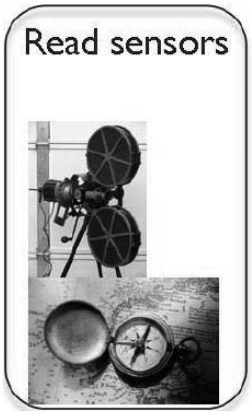
- Shortest distance in the cloud (SIGMOD 2011)
  - *Protect 1-neighborhood-d-radius* privacy

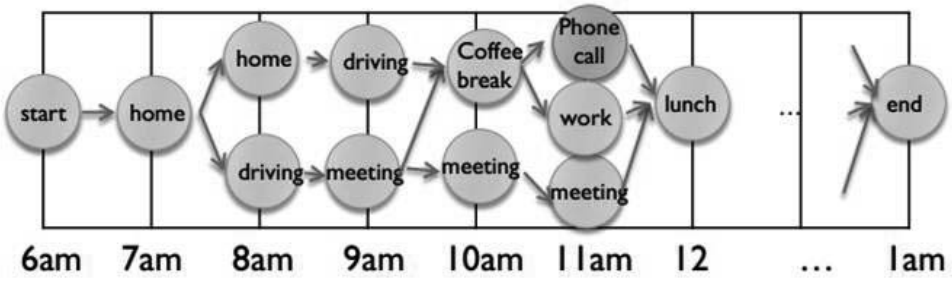


Link graph and outsources graphs

Mobile Privacy (1/3)

- Protecting privacy against adversaries



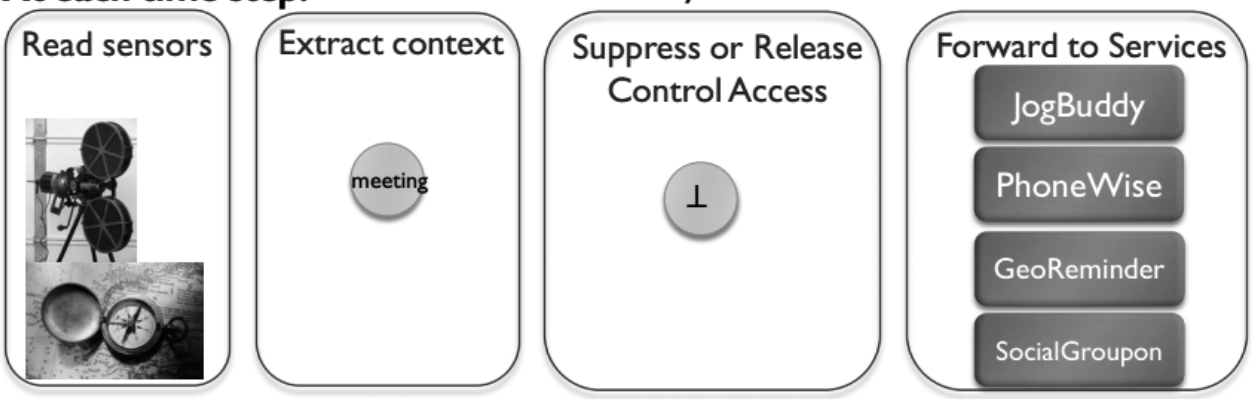


Mobile Privacy (2/3)

MaskIt

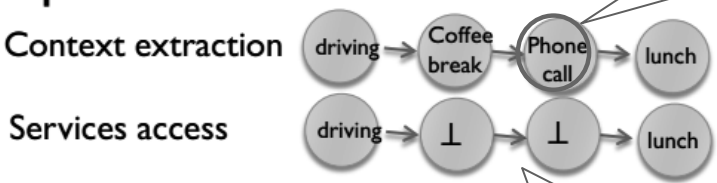
At each time step:

Privacy Check:



Example stream over time:

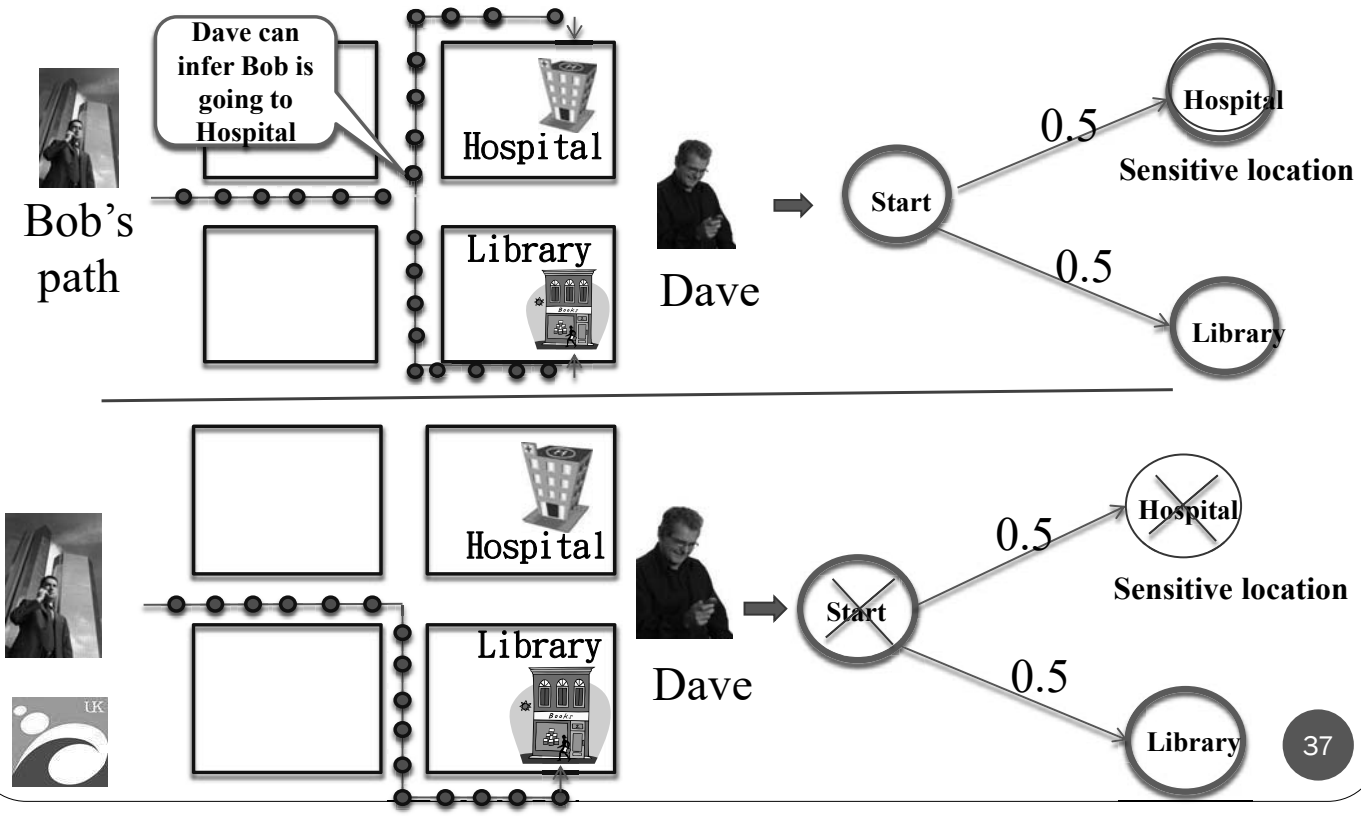
Sensitive context



Privacy Check suppressed both context

Mobile Privacy (3/3)

- Denial-of-request inference attacks



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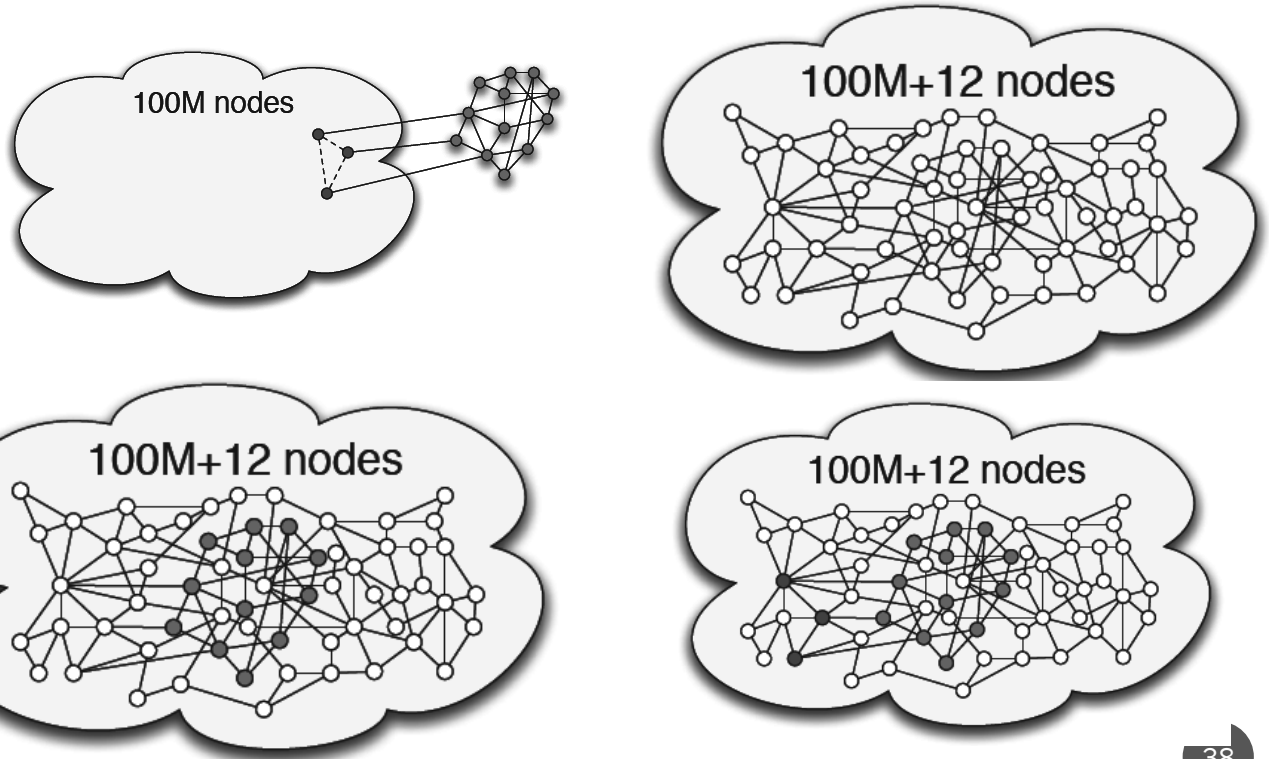
Some Challenges (1/3) Attacking an Anonymized Network



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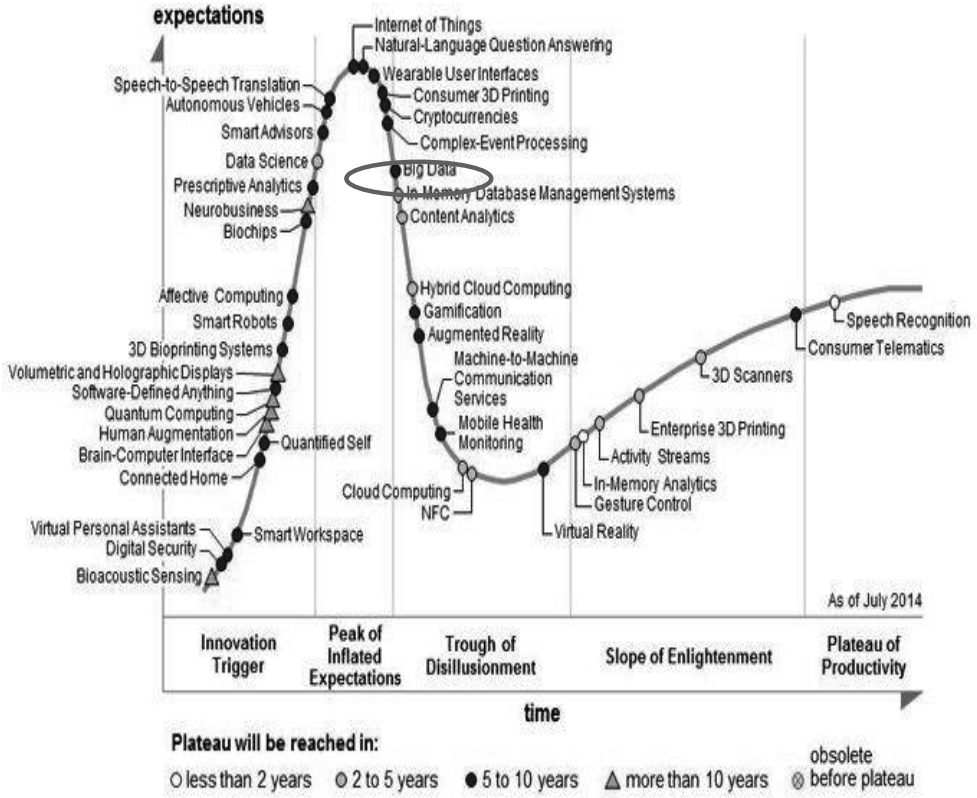
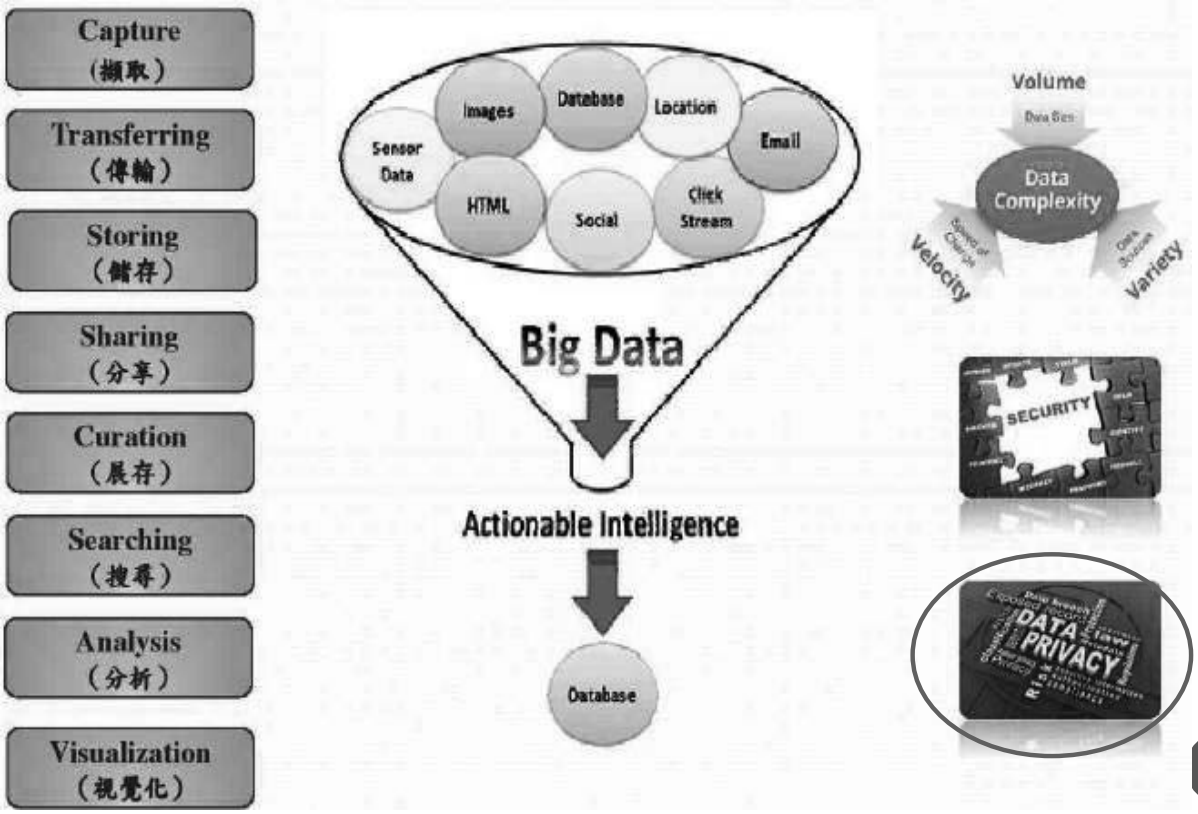
Some Challenges (2/3)
Hype Cycle for Emerging Technologies(Gartner, 2014)



Some Challenges (3/3)
Challenges for Big Data



Tutorials

- *Privacy in data system, Rakesh Agrawal, PODS03*
- *Privacy preserving data mining, Chris Clifton, PKDD02, KDD03*
- *Models and methods for privacy preserving data publishing and analysis,* Johannes Gehrke, ICDM05, ICDE06, KDD06
- *Cryptographic techniques in privacy preserving data mining, Helger Lipmaa ,* PKDD06
- *Randomization based privacy preserving data mining, Xintao Wu, PKDD06*
- *Privacy in data publishing, Johannes Gehrke & Ashwin Machanavajjhala, S&P09*
- *Anonymized data: generation, models, usage, Graham Cormode & Divesh Srivastava, SIGMOD09*
- *A tutorial of privacy-preservation of graphs and social networks, Xintao Wu, Xiaowei Ying, PAKDD 2011*
- *Privacy-aware data management in information networks, Michael Hay, Kun Liu, Gerome Miklau, Jian Pei, Evimaria Terzi, SIGMOD 2011*