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Snarl-Up in Digitalization
How the uniqueness of ICT industries emerges with socially constraints

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Abstract

This paper gives the perspective that how and why the digitalization has been stacked in the marking time. Aiming of this paper is, to solve and clear the industrial structure and historical aspects of Information and Communication Technology (ICT) industries, and to investigate the scale and scope of newly-created industries/firms such as ICT industries by means of the perspective and the method of business history and quantitative approach. In the result, we could draw three implications; that is, (1) technological development for internet has the behavior of social construction of technology (SCOT), (2) and it efforts the goods traded within the ICT industries has a preference that highly motivated by social constraints, (3) hence, the depth and boundary of digitalization would be different in each firm, sector, industry, county and regions. And it suggests that the policy and principle of digitalization should be different under its own historical path and backgrounds.

Keywords: *Digitalization, two-sided markets, social construction of technology, cloud computing, national innovation system*

1. Introduction

As we lived in the city, we have settled down with various kind of digitalization; the kids are alright with iPod, business worker are tighten with his net book or PDA, the researcher his auxiliary forces by using the crowds of wisdom as named Google Scholar or Science Direct, thousands of un-named enmity put someone to death…, everything happened in a day in the life. On the other hand, within these 15 years, the firm tries to evolve itself to this “informational revolution”. Every office and his employees has his own PCs and making any transaction all around the world by means of the network. The rise and fall of buzz words are keeping on and who

could ever explain what “cloud computing” and “Web 2.0” is. Brings within huge wonders and criticisms, the prospect march are still going on… But keep in remember, the digitalization makes big firms such as Google, amazon.com, facebook, inc., and even the regeneration of China and India.

Within this paper, by using leading-edge technology and econometrical approach, and to investigate whether the perspective that the boundary, development and penetration of ICT firms are highly constrained by society constraints of technological development of utilization technology, organizational structure and its environment, and the structure of internet itself rather than by technological excellences.

2. ICT industry and its social constructivism

The categorization of ICT firms are encouraged by the term of “new economy” norms and their importance’s are enlightened such as (Friedman 2006, Carr 2008 *et al.*), but there are some criticisms by (Gordon 2000) and (Kurgman 1997), and the advantage of national innovation system in Japan as argued by (Okuno [Fujiwara] and Okazaki 1993) and (Aoki 1993) get weaker in 1990s as TFP rate by ICT firms is much lower than US[1]. And in historical approach, (Helpman 1998) classified as the innovation as General Purpose Technology. And (Mokyr 2002) states the appearance of internet in 1990s shows the existence of informational revolution, which is historically smoothed from industrial revolution and fruits us to lower the access cost to any knowledge.

And in the perspective of SCOT (Social Construction of Technology), we could state that within the process of technological development and its selection by the market, it is driven by the social group, perceived problem, possible solution and its artifacts as argued in (Pinch & Bijker 1987), (Hughes 1987) and (Latour 1987). By contraries, Technological Determinism which supported and reinforced by Marx, states that technological development and its excellence depends the path of technological selection and invention as argued (Hughes 1994) and (Misa 1994). As under the concept of hard constructivism, (Constant 1973) and (MacKenzie 1987) draws that within the development process of technology, its geological communities and its degree of integration calls the differences for accommodating with “presumptive anomaly” and artifact itself as the under the example of Turbojet and Missile. And outer of purely technological issue, we could observe the technology’s social constructivism in social technology such as in auditing (Power 1994) and accounting (Mirror 1991 and 1994 *et. al*).

[1] The national innovation system in United States is described in (Nelson and Rosenberg 1993)

In the technological aspect in internet, especially the movement of open source software is close to the characteristic mark of SCOT; (Lerner and Tirole 2002) investigates the economical rationality of open source software, and (Raymond 1999) states its development is rely on pioneering research attributes of engineer and close to “user-oriented innovation”, that is, distinguished user could make an influence to technological development and its repetition in mechanical component industry as (Rosenberg 1976) and (von Hippel 1988) argued. In the perspective of development process of technology for internet, it would have the preference of social constructivism and it results the uniqueness of its-generated industries and firms. Hence, in the next we should observe the history of internet.

3. Internet and its history

The story of internet has begun in 1969; ARPANET has started as distributed military network and it changed and divided to NSFNet for scholarly research in early 1980s. And in 1990, Sir Timothy John Berners-Lee developed World Wide Web, the main component of Internet, and every participants could use these technologies with free of charge. And in these early days, several firm tried to make an opportunity with building the network structure, as shown as the concurrent strength of Sun Microsystems and Cisco systems in this territory; they sell the basic equipment of the network, which enables to unite each computer every where in the world, but the network is still limited for some geeks and scholars.

The things changed in 1995; (1.) NSFNet has turned to be public, become to private sector, (2.) Microsoft Windows 95, the first “people-oriented” operating system, has been released; it means that Personal Computer (PC) has finally means itself, PC has become set to every living room all over the world, and each individual has a capability to make Document, Presentation, Arts and even Music by themselves; the truly meanings of informational revolution as (Mokyr 2002) argued. But, each PCs has stood alone, the connectivity to other computer is limited only as known as PC communication service; AOL in United States, Nifty-Serve in Japan. And around 2000, the first information technology bubble ever, the network has become higher and higher, the decade of broadband has begun; people could use internet with high-speed connections and they could finally transfer their own creations which made at PCs not only texts and graphics, but also movie and music, as we could observe it the appearance and huge user growth with Napster in early 2000s and YouTube in late 2000s.

From 1995 to 2005, the first ten years of publically opened internet, we shall be recognized this decade as “the beginning of the synthetic market”, the coordination and interaction between cooperates and markets make the internet widely and broadly,

changing the definition and boundaries itself continuously, stenciled each participants what “goods” and “bads” in this “market”, and finally it became the one of general purpose technology (GPTs), as (Helpman 1998) argued.

And now, as following the history of internet above, we could observe and learn what the characteristic mark of internet, which is consisted from three points; (1.) diverseness, fault-tolerant and depressiveness of the network. Every participant could join the network if they have some server and IP address, and some connectivity to the network. (2.) Mutual management team, as what ICANN and APNIC shows. They handle the internet under their own democratic rules; try to eliminate the enforcement by any government of developed countries and even United Nations, and (3.) The network has a preference as “public goods”. For example, Root DNS Server, which is actually “root” of internet DNS service, has been managed by several institutions or firms but they are no any purpose for profits and/or revenue for this service. And most of services in the internet are based on standardization software like apache (as Web server), sendmail (as Mail Server) and bind (as DNS server). They’ve distributed as open source software under GPL license. Most of IT-related businesses are motivated by these prerequisites.

4. Hosting Industry and its quantitative analysis

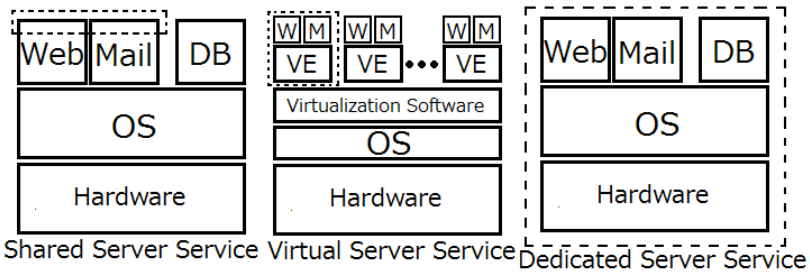
As showing in previous chapters, ICT firms are highly constrained with *ex ante* conditions which include social behavior; the development system of open source software, the system and governance, national policies and the market uniqueness itself. And in parallel to previous qualitative approach, by using the panel data of typical ICT firms, hosting industry in Japan, which generally known in competitive market, to investigate the market is highly depend on the causality within the market factor and has the “two-sided market” effect, and the technological development is as far as limited and inherited from closer segment within these quantitative approaches.

Under the definition by (Wainewright 2002), Hosting is the service which generated in the first era of preeminence of the market of internet in the middle 1990s, which supplying psychical server/network facilities which connected to the network, and facilitates its technical supports in which highly constrained to emergency correspondence. And consider about the purpose of internet itself, every market is opened for everywhere which resides in foreign companies. Under the analysis by Netcraft, Inc.[2], in the beginning of 2009, 185,167,897 sites are existed in the network and one third of sites are still active. That shows the demands for hosting service is the common issue and if considering about any costs and price, even its connectivity

[2] Source: NetCraft, http://news.netcraft.com/

of internet, the economically rational selection might be to use hosting company in United States because of (1) market size: now 25, 756 firms [50% share for hosting companies in 01/2009] are active and has competitive market, (2) network and facilitating cost (especially for IDC) is quite low[3]. But in fact, due to the reason (1) language barrier for supporting/marketing/business activities, (2) network connectivity and reliability of connection speed between the countries or regions; hence the local hosting player could be existed and kept his own activities.

Normally, as shows in Graph1, concurrent hosting provider provides (1.) shared hosting service, (2.) virtual server service, (3.) dedicated server service. In shared hosting service, provider splits up one physical server for thousands of customer by means of "virtual domain" functionality under the several open source software, such as apache (Web Server), qmail (Mail Server). By contrast, dedicated server service serves whole one physical server for only one customer, hence the customer could use whole server resource. That is why; normally small SMBs/individuals used low-price/low-capability shared hosting service and middle/big firms used high-price/high-capability dedicated hosting service especially in 1990s and the beginning of 2000s. And around 2003, Virtual Server Service is induced; the service aims to (1) provide nearly-equal functionality as well as dedicated server service in low-price range by means of virtualization software as known as its product name, such as VMware, Xen, Virtuozzo Containers, (2) increase the variety of service for each hosting provider easily; the supplier could set up by means the method of QoS (quality of service) parameter as the source of added value.



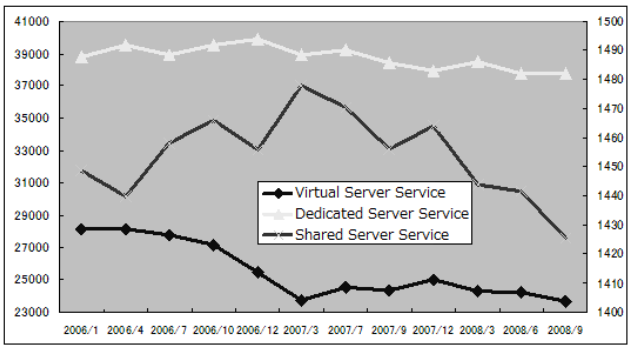
Graph 1. The Structure of Hosting Service

And Graph 2 shows the movement of average price for each hosting service from 07/2006 to 09/2008. We could observe that (1.) the price is quite different between Virtual/Dedicated Server Service and Shared Server Service, (2) price declination in every service segment, but its decreasing rate is immediately low.

To investigate Japanese hosting industry and its performance and uniqueness, I

[3] Source: Webhosting.info, http://www.webhosting.info/

performed GMM analysis. The data source[4] has been collecting the information of product which supplied by Japanese hosting providers for every quarter.



Graph 2. Average Price for each hosting service (from 07/2006 to 09/2008)[5]

In equation, we could state that;

$$price_{it} = \alpha_1 HDD_{it} + \alpha_2 DOMAIN_{it} + \alpha_3 TRIAL_{it} + \alpha_4 CATALOG_{it} + \alpha_5 WebSupplier_{it} + \alpha_6 TURNOVER_{it} \quad \textbf{(1)}$$

such that,

$$TRIAL_{it} = \begin{cases} 1 = firm_i \text{ sets up trial service at period } t \\ 0 = firm_i \text{ does not sets up trial service at period } t \end{cases} \quad \textbf{(2)}$$

$$TURNOVER_{it} = \frac{\#\, of\ exit_t \quad +\#\, of\ entry_t}{\#\, ofcompanies_t} \quad \textbf{(3)}\ ^{6}$$

In above equation, *i* denote the service supplied by firm, and *t* denote the period of time. Under the theorem of hedonic functionality such as (Pakes 2003), *price* set as the explained variable for investigate how the price declination occurred by the influence of technological, management or market factor. (1.) Technological factor has been consists by *HDD* and *DOMAIN*, the first one indicates the capability of disk space for each hosting service, the latter one substitutes the capability of its hosting service. (2.) Management Factor are *TRIAL* and *CATALOG*; the trial service might have an impact to price and the added-value of hosting service itself and could be controlled individually by the firm[7], and *CATALOG* denotes the variety of service

[4] Source: "Comprehensive Hosting Server Guide", No.1-15, Impress R&D.
[5] Vertical axis in left side shows Virtual Server Service and Dedicated Server Service, in right side shows Shared Hosting Service in Yen.
[6] The Variable TURNOVER is under the definition of (Bartelsman, Eric,Haltiwanger and Scarpetta 2004).
[7] (Gallaugher and Wang 2002) shows that trial service for commercial use web server has positive impact to the price under the hedonic approach.

which supplied by hosting provider. These indicators might show up the influence of management decision by the firm and controllability of goods. (3.) Market factor are *Websupplier* and *TURNOVER*. The number of web contents supplier would have a positive impact for hosting market, and the higher rate of *TURNOVER* might shows the importance of firm dynamics, that is, frequent market enter and/or exit calls re-allocation of goods within/without the market and positive impact to innovation and productivity, as (Baldwin 1995) and (Sharpe and Currie 2008) argued.

In the result, as shown in the last page, *HDD* has a positive impact in every service segment, but *DOMAIN* denotes negative impact in virtual/dedicated hosting service, it means technological superiority does not matter in hosting industry. *TRIAL* has negative impact for every segment, and *CATALOG* too except virtual hosting service. That shows management choice led by the firm is to draw the price declination and the indifference of goods among the industry; the commodity. Meanwhile, both market factors has positive impact to price, it indicates the market size of Web Contents has a “two-sided market” effect with hosting industry. And high turn-over rate of market and its positive impact to market price shows, the market itself are mostly motivated by socially constraints; user-oriented technological development, complementary interaction among the network, knowledge-intensively of goods.

5. Conclusion

From the beginning of Industrial Revolution, as (Schumpeter 1944) states, we humankind repeat the economical development process, that is (1.) invent new technology and its expansion calls the expansion of economy and business activity, (2.) economical growth and increasing of assets, (3.) the creation, transaction of market and satisfying it own equilibrium, (4.) sophisticating, urgency of buffering on technology as (Langnois 2002) argued, (5.) creative destruction by innovation.

And now, it has widely been believed that internet as the forefront of digitalization and the key of economic growth in highly-constrained 21st century era such as environmental affair and population problem. But in fact, the benefit of digitalization is toughly limited to several companies, or countries.

Within this paper, I ensure that how “Snarl-Up in Digitalization” is emerged, that is (1.) the technology of internet is not main factor of digitalization and the innovation led by internet, because, (2.) its scope and boundaries are highly determined by social constraints and its path-dependency of technological development, even enforcing to its industrial organizational structure, hence (3.) as the national innovation system, the comprehensive master plan for digitalization should be differed in every countries under the prior condition of society, industry and

the capability for knowledge-intensive industries. As we could proof these path-dependency, the industry named hosting has no economical rationality and could be replaced by cloud computing are still existed and motivated by social constraints; most of well-influenced ICT firms are established in United States as not only by incredulous “winner-takes-all” or “de-facto standard” thesis, but the realm and complementarily of socially-facilitated investment, venture-capital and higher education system; the invasion by India in ICT sector was led by ex-import-substitution growth model as the engineer rush to learn Linux, which is the mainframe of internet.

That is why the depth and effectiveness of digitalization would be different, and most of firms/regions are still in “*superphyla*” state. As the importance and adhibition should be differed in each complicated service sector, I focus on hosting, the industry which has the characteristics of ICT industry, further research is needed to assess the degree of applicability of this research findings.

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ined Variance: PRICE

atory le	(A.) Total Service Segment (1.) normal	 (2.) semi-log.	 (3.) log-log.	(B.) Shared Server Service (1.) normal	 (2.) semi-log.	 (3.) log-log.	(C.) Virtual Server Service (1.) normal	 (2.) semi-log.	 (3.) log-log.	(D.) Dedicated Server Service (1.) normal	 (2.) semi-log.	 (3. log
	129.35***	5663.65***	0.45***	28.39**	-7.68	0.06**	558.27***	9057.51***	0.32***	22.45***	4603.97***	0.
	(16.92)	(226.32)	(0.01)	(14.35)	(33.02)	(0.03)	(187.70)	(2284.02)	(0.03)	(9.13)	(1167.65)	
AIN	4677.56***	-1563.72	0.05	110.94*	27.48	-0.01	-10089.61**	-7583.33**	-0.38***	-4494.70***	-4109.89***	-0.
	(753.23)	(973.29)	(0.05)	(67.41)	(72.23)	(0.08)	(3045.64)	(3556.97)	(0.08)	(1246.94)	(1221.42)	
L	-12921.66***	-6117.00***	-0.84***	-243.34**	-341.87***	-0.35***	-12861.17***	-16625.82***	-0.49***	-5467.70**	-7543.40***	-0.
	(1270.94)	(973.54)	(0.08)	(102.18)	(98.11)	(0.10)	(3305.99)	(3389.65)	(0.16)	(2379.70)	(2112.61)	
LOG	227.92	-761.8176	0.09**	-43.68	-179.63**	-0.12	514.08	4017.98**	0.25***	-793.92***	-4049.37***	-(
	(223.99)	(784.88)	(0.04)	(30.53)	(85.25)	(0.08)	(367.60)	(1683.67)	(0.06)	(224.17)	(1186.04)	
er	19.40***	1871.66***	1.24***	2.48***	265.24***	1.14***	53.56***	1059.98	1.38***	87.87***	4766.01***	1.
	(2.75)	(200.40)	(0.01)	(0.20)	(16.29)	(0.01)	(15.38)	(1214.59)	(0.05)	(5.07)	(869.30)	
ver	265.79***	1852.92***	0.30***	-5.45	39.99**	0.19***	347.13***	2806.84	0.36***	762.68***	702.20***	0.
	(44.86)	(329.27)	(0.02)	(3.68)	(19.80)	(0.02)	(103.85)	(1830.62)	(0.08)	(61.14)	(244.39)	
	6679	6679	6679	2599	2599	2599	1336	1336	1336	2887	2887	

*** denotes that insignificant in one percent, ** denotes that insignificant in 5 percent, * denotes that insignificant in 10 percent. And the value shows in parentheses denotes standard error.

del, the seasonal dummy is included but not display in this table. And, instrumental variable is each explanatory value in 1st period before. In (A) Total Service Segment, the variable for

n dummy is included and its value is insignificant. Semi-log denotes that explanatory value is in logarithmic processing, and Log-log denotes explanatory and explained variable is in loga

ing