Innovation-consumption Co-emergence Leads a Resilience Business

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Abstract : Dramatic advancement of the Internet has generated global simultaneous dependency on information technology (IT) which has, contrary to anticipation, resulted in the bi-polarization between IT advanced economies and IT growing economies. While the latter enjoy a virtuous cycle between advancement of IT and its productivity increase, IT advanced economies have fallen into a pit of a vicious cycle as further advancement of IT decreases its productivity. Consequently, countries in IT advanced economies suffer economic stagnation. Similar bi-polarization derived from be-yond anticipation issue can also be observed in business performance in high-technology firms. Aiming at elucidating the inside the black box of the foregoing growth engine resulting in bi-polarization, an empirical analysis utilizing a new approach integrating techno-metrics, psychophysiology and advanced monitoring techniques is demonstrated thereby insightful suggestion to the above engine is provided. Innovation-consumption co-evolution based on co-evolutionary acclimatization strategy is suggested to be essential for a resilient business while maintaining efficiency. A platform toward this resilient business model is proposed.

Key Words: Co-emergence, bi-polarization, resilience, anger of consumers, psychophisological measurement

1. Introduction

Dramatic advancement of the Internet beyond anticipation has generated global simultaneous dependency on IT (WEF, 2012; MIC, 2012; Shinozaki, 2012) which has, contrary to anticipation, resulted in the bi-polarization between IT advanced economies and IT growing economies (Fukuda et al., 2011). While the former economies enjoy a virtuous cycle between advancement of IT and its marginal productivity increase, the later economies have fallen in a pit of a vicious cycle between them. Similar bi-polarization derived from beyond anticipation issue can also be observed in business performance in hightechnology firms.

Only the way in overcoming this paradox can be found by constructing a co-emergence of institutional innovation between two economies (Chew et al., 2010) by improving functionality development (FD)^{*1} in IT growing economies by means of advanced IT initiated by IT advanced economies. This co-emergence beneficiates both economies by constructing co-evolutionary acclimatization trajectory common to both economies. This suggestion can be applied also to hightechnology firms in bi-polarization (Watanabe, 2009).

Given the increasing initiative in consumers in innovation game toward a post-excessive consumption society (McDonagh, 2008; Watanabe and Shin, 2009; Watanabe et al., 2011), this trajectory can be expected to be initiated by innovation and consumption co-emergence (Watanabe, Zhao and Nasuno, 2012).

To date, a number of studies have pointed out the significance of harnessing the vigor of emerging economies (e.g., Prahalad, 2004). However, these works attempted to find the solution within an individual system, and none have taken the perspective of a co-emergence of institutional innovation between the two types of economies with a recognition of current bi-polarization structure paying attention to consumers anger.

On the basis of an empirical analysis utilizing a new approach integrating techno-metrics, psychophysiology and advanced monitoring techniques, insightful suggestion to the above bipolarization structure is provided. Innovation-consumption coevolution based on co-evolutionary acclimatization strategy is suggested to be essential for a resilient business while maintaining efficiency. A platform toward this resilient business model is proposed.

Section 2 reviews beyond anticipation derived from IT advancement. Section 3 analyzes bi-polarization of IT driven economy. Section 4 observes growing anger of consumers. Sections 5 and 6 demonstrate the significance of innovationconsumption co-emergence based on co-evolutionary acclimatization. Section 7 provides a platform toward this coemergence. Section 8 briefly summarizes noteworthy findings, policy implications supportive to resilient business and also the points for future works.

2. Beyond Anticipation as a Consequence of the Dramatic Advancement of IT

Dramatic advancement of the Internet and subsequent mobile phones development have contributed significantly to enhance economic level in the world. Fig. 1 demonstrates trend in global simultaneous dependency on IT over the last decade between 2000 and 2010 as has been demonstrated in the dramatic improvement in the literate ratio of the world as illustrated in

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^{*1} Functionality development means ability to improve performance of production processes, goods and services by means of innovation (Watanabe et al., 2003).



Fig. 1 Trend in Global Simultaneous Dependency on IT(Sources: White Paper on Japan's ICT (2012), Shinozaki (2012)).

1 SE Sweden 5.94	26 MT Mala 491	51 CN China 4.11	76 MX Mexico 3.82
2 SG Singapore 5.86	27 BH Bahrain 4.90	52 TR Turkey 4.07	77 TH Thailand 3.78
3 FI Finland 5.81	28 QA Qatar 4.81	53 MU Marins 4.06	78 MD Moldova 3.78
4 DK Denmark 5.70	29 MY Mahysia 4.80	54 BN Brunei Darussalam 4.04	79 E G Egypt 3.77
5 CH Switzer and 5.61	30 AE United Arab Emirates 4.77	55 KZ Kazakhstan 4.03	80 ID Indonesia 3.75
6 NL Nether lands 5.60	31 LT Lithuania 4.66	56 RU Russian Federation 4.02	81 CV Cape Verde 3.71
7 NO Norway 5.59	32 CY Cyprus 4.66	57 PA Panama 4.01	82 RW Rwanda 3.70
8 US United States 5.56	33 PT Portugal 4.63	58 CR Costa Rica 4.00	83 VN Vietnam 3.70
9 CA Canada 5 51	34 SA Saudi Arabia 4.62	59 GR Greece 3 99	84 BA Bernia and Herrogevina 3.45
10 UK United Kingdom 5.50	35 BB Barbados 4.61	60 TT Trinidad and Tobago 3.98	85 CS Serbia 3.64
11 TW Taiwan, China 5,48	36 PR Puerto Rico 4, 59	61 AZ Azerbaijan 3.95	86 PH Philippines 3.64
12 KR Korea, Rep. 5.47	37 SI Slovenia 4,58	62 KW Kuwait 3.95	87 D M Dominic an Republic 3.40
13 HK Hong Kong SAR 5.46	38 ES Spain 4.54	63 MIN Mongolia 3.95	88 GE Georgia 3.60
14 NZ New Zealand 536	39 CL Chile 4.44	64 SK Slovak Republic 3.94	89 BW Botswana 3.58
15IS Iceland 533	40 OM Oman 4.35	65 BR Brazil 3.92	90 GY Guyana 3.58
16 DE Germany 5.32	41 LV Latvia 4.35	66 MK Macedonia, FYR 3.91	91 MA Morocco 3.56
17 AU Australia 5 29	42 CZ Czech Republic 4.33	67 RO Romania 3.90	92 AR Argentina 3.52
18 JP Japan 5 25	43 HU Hungary 4 30	68 AL Albania 3.89	93 KE Kenya 3.51
19 AT Austria 5.25	44 UV Uruguay 4.28	69 IN India 3.89	94 AM Annenia 3.49
20 IL Israel 5 24	45 HR Croatia 4 22	70 BG Bulgaria 3.89	95 LB Lebanon 3.49
21 LU Luxembourg 5 22	46 ME Montene gro 4.22	71 LK Sri Lanka 3.88	96 EC Ecuador 3.46
22 BE Belginn 5.13	47 JO Jordan 4.17	72 ZA South Africa 3.87	97 GH Chana 3.44
23 FR France 5.12	48 IT halv 4.17	73 CO Colombia 3.87	98 GT Guatemala 3.43
24 EE Estonia 5.09	49 PL Poland 4.16	74 JM Jamaica 3.86	99 HN Honduras 3.43
25IE he hand 5.02	50 TN Tunisia 4.12	75 UA Ukraine 3.85	100 SN Senegal 3.42

Table 1 Networked Readiness Index in 100 Nations (2011)

^e Color of the country indicates N: Eurasian, N: Oceania, N: America, N: Africa Source: The Global Information Technology Report 2012 (World Economic Forum, 2012).

the left hand side of the Figure (MIC, 2012). Such an IT advancement has led to a dramatic decrease in digital divide in the world as illustrated in the right hand side of the Figure (Shinozaki, 2012). This decrease demonstrates global simultaneous dependency on IT.

The level of worldwide advancement of IT can be traced by the Network Readiness Index (NRI) measured by the World Economic Forum (WEF, 2012). NRI measures worldwide advancement of IT by computing following four dimensions:

- (i) Environment (Political and regulatory environment, business and innovation environment),
- (ii) Readiness (Infrastructure, digital content, and affordability),
- (iii) Usage (Individual usage, business usage and government usage), and
- (iv) Impact (Economic impact and social impact).

Table 1 tabulates the ranking of NRI in 100 nations in 2011. Looking at the Table we note that Sweden demonstrates the highest score followed by Singapore, Finland, Denmark, Switzerland, Netherlands, Norway, United States, Canada and UK. Japan ranks 18 while other G7 nations as Germany, France and Italy rank 16, 23 and 48, respectively. Newly industrialized Asian tigers as Taiwan, Korea and Hong Kong rank 11, 12 and 13, respectively. Contrary to such higher rankings in Nordic countries, Singapore and majorities of G7 nations and Asian tiger, rankings in BRIC as Brasil, Russia, India and China remain lower ranking as 65, 56, 69 and 51, respectively.

Foregoing observations suggest that economic development level in 100 nations tabulated in Table 1 can be depicted by a function of NRI as follows:

$$\frac{V}{P} = F(NRI) \tag{1}$$

where V/P: GDP per capita at fixed prices.

Taylor expansion to the first term:

$$\ln \frac{V}{P} = a + b \ln NRI \tag{2}$$



Fig. 2 IT Driven Economic Development Trajectory in 100 Nations (2011).



Fig. 3 Stagnation in Economic Growth in IT advanced Economies (2006-2010).

where a and b: coefficients.

Empirical analysis taking 100 nations in 2011 demonstrates as follows:

$$\ln \frac{V}{P} = 3.47 + 4.25 \ln NRI + 1.03D_1 - 1.12D_2 \tag{3}$$

where *t* value of each term are 10.62, 19.47, 9.31 and -9.29 respectively, and the value of $adj.R^2$ equal to 0.876. D_1 and D_2 are dummy variables as D_1 : 8 nations with extreme lower level of *NRI* than *V*/*P* (Qatar, Luxemburg, Kuwait, Brunei, UAE, Norway, Italy and Greece) = 1, other nations = 0; D_2 : 8 nations with extreme higher level of *NRI* than *V*/*P* (Sweden, Israel, New Zealand, Finland, Jordan, Korea, Estonia and Malaysia) =1, other nations = 0.

This analysis demonstrates that economic development level in the current world is governed largely by the advancement of IT and suggests that economic development trajectories in these nations can largely be attributed to the level of IT.

Prompted by these observations, Fig. 2 demonstrates economic development trajectory in 100 nations taking logistic growth function initiated by NRI (Network Readiness Index).

Fig. 2 demonstrates that economic development trajectory in 100 nations fit better to IT driven logistic growth function as follows:

$$Y = \frac{V}{P} = \frac{N}{1 + e^{-aNRI + b}} + cD_1 + dD_2$$
(4)

where *N*: carrying capacity; D_1 and D_2 : dummy variables corresponding to the preceding analysis; and *a*, *b*, *c* and *d*: coefficients.

3. Bi-polarization of IT-driven Economy

Similar to the preceding analysis, empirical analysis taking 100 nations in 2011 demonstrates as follows:

N	а	b	с	d
5723	9 1.68	-7.90	46434	-12913
(9.62) (7.58)	(-9.80)	(14.54)	(-5.25)

 $adj.R^2 = 0.885$

While such a dramatic advancement in IT provides strong anticipation in significant economic growth in IT advanced economies, contrary to such anticipation, their economic growth engine has disappeared except Singapore as demonstrated in Fig. 3.

This against anticipation happening can be attributed not to Lehman shock in 2008 neither to Euro crisis as generally anticipated, but to beyond anticipation source as demonstrate in the following Section.

Since logistic growth trajectory can be developed to a bipolarization trajectory as follows (Tokumasu and Watanabe, 2008), foregoing analysis suggests that IT driven economic development trajectory in 100 nations splits to bi-polarization as demonstrated in Fig. 4.

$$\frac{dY}{dt} = aY(1 - \frac{Y}{N}) = \frac{aN}{1 + e^{-at-b}}(1 - \frac{1}{1 + e^{-at-b}})$$
$$= \frac{aN}{1 + e^{-at-b}} \times \frac{e^{-at-b}}{1 + e^{-at-b}}$$
$$= \frac{aN}{2 + e^{-at-b} + 1/(e^{-at-b})}$$
(5)

IT advanced economies (vicious cycle between IT advancement and its marginal productivity increase



Fig. 4 Bi-polarization of IT Driven Economic Development Trajectory in 100 Nations (2011).

Fig. 5 Bi-polarization of Leading High-technology Firms in Japan (2011).

$$\frac{aN}{dY/dt} = 2 + e^{-at-b} + \frac{1}{e^{-at-b}}$$
(6)

$$y = (1+x) + (1+\frac{1}{x})$$
(7)

where

$$y \equiv \frac{aN}{dY/dt}, x \equiv e^{-at-b}$$

Looking at Fig. 4 we note that IT driven economic development trajectory in 100 nations has split to two economies. While IT growing 70 nations (nations with NRI ranking 31 to 100 in Table 1) have been enjoying a virtuous cycle between IT advancement and its marginal productivity increase, IT advanced 30 nations (NRI ranking 1 to 30) have fallen into a pit of a vicious cycle as IT advancement decreases its marginal productivity.

Similar bi-polarization can be observed also in the competition market in high-technology firms. Fig. compares 5 income of Japan's leading high-technology net firms in 2011 which demonstrates а conspicuous bi-polarization between firms maintaining profits and those suffering serious deficits. Contrary to profits in automobile firms as Nissan, Toyota and Honda, majority of electric machinery firms as Panasonic, Sony and Sharp suffered significant deficits. Under such circumstances Canon maintains conspicuous profits. Hitachi's profits can be attributed to shifting to social infrastructure field not to indigenous electric machinery innovation efforts.

Significant deficits in world leading electric machinery firms as Panasonic, Sony and Sharp can be attributed to overlooking new beyond anticipation stream as (i) dramatic advancement of the Internet, (ii) digitalization of manufacturing, (iii) new stream of emerging economies, and subsequent (iv) growing anger of consumers.

4. Growing Anger of Consumer

As reviewed in the preceding Section, sources resulting in bipolarization in leading high-technology firms can be beyond anticipation issues as (i) dramatic advancement of the Internet beyond anticipation, (ii) digitalization of manufacturing, and (iii) new stream of emerging economies. All leads to

Fig. 6 growing anger of Consumers.

(iv) growing anger of consumers as illustrated in Fig. 6. As postulated by Nobel laurite in Economics, Modigliani, people never forget utmost gratification of consumption ever experienced that has memorized in the brain and affects consumers preference in consumption (Modigliasni, 1965). As a consequence of historical change in nations experiences, in line with the general shift in commodity oriented society to service and information oriented society, it is generally postulated that consumers preference has been steadily shifting from economic functionality driven preference to supra-functionality beyond economic value driven preference (McDonagh, 2008; JCO, 2012). Here, supra-functionality beyond economic value encompasses social, cultural and emotional values. Such a shift can be observed clearly by Public Opinion Survey Concerning People's Lifestyles, conducted annually by Japan's Cabinet Office (JCO). Under such circumstances consumers desires have been shifting (i) from economic value to supra-functionality beyond economic value, (ii) from claimers to creators, and (iii) to eco-contribution by own option. Consequently, consumers complaints to producers and also to themselves as being remained consumers have been growing. In parallel with such growth, consumers wish to manufacture by own hand what they anticipate has dramatically increased. Under such circumstances, dramatic advancement of the Internet has enabled consumer accumulate more knowledge than producers. Their consumption mode has changed to AISCEAS: Attention >> Interest \gg Search \gg Comparison \gg Examination \gg Action \gg Share. Maker movement enabled by digitalization of manufacturing, advancement of 3D printers and laser cutter has accelerated the foregoing change in consumers preference and subsequent consuming style and behavior. New stream of emerging economies also impacting on consumers growing anger by realizing them the beauty of frugality and also suppliers simultaneous start up in new sales.

5. Co-emergence of Institutional Innovation

The foregoing bi-polarization necessitates co-emergence of institutional innovation between two types of economies in such a way as advanced IT enabled by IT advanced economies improves functionality development (FD) in IT growing economies which increases marginal productivity of IT in these economies leading to their economic growth enabling IT advanced economies harness the vigor of IT growing economies as illustrated in Fig. 7 Y = F(X, I), Y = V/P (GDP per capita), X: labor and capital, and I: level of IT by NRI

This is also the same in high-technology firms technopreneurial strategy in the face of growing anger of consumers. Co-emergence of institutional innovation between ribal firms and/or consumers in a way to harness the vigor of partners has become indispensable.

Such a trajectory leading co-emergence of institutional innovation between two types of economies can be called "coevolutionary acclimatization trajectory" as both economies can maintain respective sustainable growth by constructing a virtuous cycle between them through mutual inspiration and acclimatization of comparative advantages of the partner.

In order to examine the significance of such a co-evolutionary acclimatization trajectory for co-emergence of institutional innovation between two economies under the current bipolarization structure, Fig. 8 compares trend in global change in growth engine over the last half century taking 10 leading nations in current IT advanced economies and BRIC (Brazil, Russia, India and China) which belong to current IT growing economies. Growth engine is examined by analyzing key driving mechanism enabling a conspicuous development in each historical era.

Looking at the Figure we note that over the first 3 decades (1961-1990) Japan (together with Singapore) demonstrated a conspicuous economic growth based on "growth oriented trajectory" that harnesses own vigor for further innovation for sustainable growth (Watanabe et al., 2006; Chen and Watanabe, 2007). During this period Japan initiated growth engine was appraised as a source of "Japan as No. 1" and also "Japan's high-technology miracle."

This notable growth engine, however, faded out in the 1990s as paradigm shifted from an industrial society to an information society and subsequent mature economy (Watanabe, 2009). Contrary to Japan's decline, USA demonstrated contrasting growth by utilizing the advantage of digital economy (Kondo et al., 2007). This can be attributed to "functionality development initiated trajectory" that induces growth engine by creating new functionality rather by quantitative increase in economy (Watanabe and Shin, 2009).

This growth engine also faded out in this century, particularly in the later half of the 1st decade of this century. Economic growth in almost all of leading countries in IT advanced economies except Singapore has stagnated during this period. Contrary to such stagnation in IT advanced economies (also ex-

Fig. 7 Basic Concept of Co-emergence of Institutional Innovation between IT Advanced Economies and IT Growing Economies.

Fig. 8 Global Change in Growth Engine.

cept Singapore), conspicuous growth has been observed in not a few countries in IT growing economies, particularly in China and India. This contrast corresponds to a contrast of a virtuous cycle in IT growing economies and a vicious cycle in IT advanced economies with respect to advancement of IT and its marginal productivity increase as demonstrated in Fig. 4.

Foregoing observations remind us the limit of "growth oriented trajectory" and also "functionality development initiated trajectory" that functioned effectively in current IT advanced economies in the last century. Consequently, these observations resulted in revealing the limit of individual strength and leading us to realize the significance of co-evolutionary acclimatization trajectory for co-emergence of institutional innovation between IT growing economies and IT advanced economies under the current bi-polarization structure between them.

6. Innovation-Consumption Co-emergence

6.1 General Scheme

Preceding analysis identifies the significance of the improvement of functionality development in IT growing economies for global sustainability by constructing a co-evolutionary acclimatization trajectory worldwide under the current bi-polarization structure. This is also the same for sustainable technopreneurial strategy in the bi-polarization structure as a consequence of the success and failure in overcoming or overlooking new beyond anticipation stream.

Given the increasing initiative in consumers in innovation game toward a post-excessive consumption society (McDonagh, 2008; Watanabe and Shin, 2009, Watanabe et al., 2011), dynamism for this improvement can be revealed by analyzing the leading role of functionality development in advancing utility function that induces sustainable growth significantly. The role of IT support to IT growing economies by IT advanced economies can be identified in this context of the analysis.

Prompted by such perspective, Fig. 9 outlines IT driven innovation-consumption co-emergence dynamism. It is generally postulated that consumers preference has been steadily shifting from economic functionality driven preference (Y) to supra-functionality beyond economic value driven preference (Q) (McDonagh, 2008; JCO, 2012). Here supra-functionality beyond economic value encompasses social, cultural and emotional values. AS mentioned earlier, such a shift can be observed clearly by Public Opinion Survey Concerning People's Lifestyles', conducted annually by Japan's Cabinet Office (JCO) as illustrated in the upper right of the Figure.

With such understanding, utility function that represents gratification of consumption essential for economic growth can be depicted by a function of Y and Q composing of (i) marginal consumption to utility, (ii) consumption, (iii) income elasticity to consumption, (iv) IT elasticity to consumption, and (v) Q elasticity to IT as depicted in the lower part of Fig. 9.

While increasing trend in Q has been inducing IT dependency (Q elasticity to IT effect), advancement of IT cannot be managed by IT growing economies. Such constraints can be expected to be removed by IT support by IT advanced economies leading to dramatic increase in IT induced consump-

Fig. 9 IT Driven Innovation-Consumption Co-emergence Dynamism.

Fig. 10 Dynamism Inducing Innovation-Consumption Co-emergence.

tion (IT elasticity to consumption effect) and enhances utility level which in turn further induces consumption (income elasticity to consumption effect) leading to IT driven innovationconsumption co-emergence under the condition of IT support by IT advanced economies.

Such co-emergence in IT growing economies beneficiates IT advanced economies by providing increasing opportunity in harnessing the vigor of IT growing economies essential for countries in IT advanced economies for their sustainable growth in a stagnating economic environment while IT option results in accelerating stagnation by decreasing its marginal productivity.

Given such IT driven co-emergence of institutional innovation between tow economies enabled by constructing a coevolutionary acclimatization trajectory, Fig. 10 illustrate such dynamism.

Advancement of IT initiated by IT advanced economies (IAE) stimulates increasing preference of supra-functionality beyond economic value (Q) in IT growing economies (IGE). This preference is accelerated by such noteworthy stream as dramatic advancement of the Internet, digitalization of manufacturing process, and maker movement. Stimulated Q in IGE induces its further IT dependency inducing its consumption. While this inducement provide opportunity for IAE to harness the vigor of IGE enabling further advancement of IT, this inducement also increases economic growth in IGE leading to further increase in its consumption demand inducing further Q elasticity to IT leading to constructing a dual innovation-consumption co-emergence cross over two economies.

6.2 Singapore NEWater Endeavor

Such a dual innovation-consumption co-emergence can be observed in Singapore's development trajectory as demonstrated in its NEWater (recycled water) development dynamism as illustrated in Fig. 11. Securing water is crucial survival strategy for Singapore (Chew et al., 2010). In order to accomplish this survival strategy, Singapore endeavored to explore technology driven water starting from importing advanced membrane technology from USA and Japan (Phase 1). Then it endeavored to transit from learning to indigenous technology development (Phase 2). It further endeavored to accelerate exporting developed indigenous technology (Phase 3) and co-evolutionary acclimatization of global best practices through exporting activities (Phase 4).

Based on such a stepwise endeavor Singapore succeeded to depending 40% of water on technology driven water (30% on NEWater and 10% on desalination). It attempts to increase such dependency double by 2061 (50% on NEWater and 30% on desalination).

Through the course of accomplishing such survival strategy Singapore has created dual innovation-consumption coemergence structure which can be considered the source enabling it exceptional sustainable growth despite bi-polarization structure resulting in stagnating sustainable growth in IT advanced economies as reviewed in Figs. 3 and 8.

6.3 Canon's Co-evolutionary Acclimatization

As compared in Fig. 5, notwithstanding new beyond anticipation stream as dramatic advancement of the Internet, digital-

Fig. 11 NEWater Development Dynamism in Singapore

ization of manufacturing, new stream of emerging economies, and growing anger of consumers that impacted its rival firms as Panasonic, Sony and Sharp resulting in suffering them significant deficits, Canon has maintained sufficient profits. This can be attributed to its unique business model based on coevolutionary acclimatization strategy.

Canon's identical business model starts from its technological diversification strategy as illustrated in Fig. 12 (Watanabe, Lei and Ouchi, 2009).

Starting from camera, Canon endeavored technological diversification strategy inducing intra technology learning such as coping machine, printers and digital camera.

Another noteworthy strategy is coopetition: cooperation and competition strategy. While Canon succeeded to develop market leading printers, it terminated PCs production in 1998 and provides opportunity to utilize attractive printers essential for the advancement of PCs to rival firms as NEC, Fujitsu, Sony and Toshiba. Through such cooperation and competition: coopetition strategy by means of attractive printers, crystal of intra technology learning, Canon has been able to obtain external learning, crystal of PCs technology developed by rival firms thereby constructed a virtuous cycle between its printers and rival firms PCs as illustrated in Fig. 13.

In addition to such a virtuous cycle, Canon endeavored to harness the vigor of mobile phones development in consumers market. While Canon has never involved in mobile phones handset development, it can harness the vigor in the market activated by its attractive digital camera. In response to activated demand in the market rival firms (majority of them are PCs producers and users of Canon's printers) endeavors development of advanced handsets which can be learned by Canon through coopetition between printers and PCs. Fig. 14 demonstrates this dynamism in co-emerging innovation and consumption through "in-vitro fertilization."

On the basis of the foregoing stepwise endeavor as individual

technology, intra-technology learning, coopetition and in-vitro fertilization, Canon established unique business model in coemerging innovation and consumption as demonstrated in Fig. 15. This is similar to Singapore's innovation-consumption coemergence structure and can be considered the source of its resilience against beyond anticipation issues as demonstrated in Fig. 5.

7. Commodification of Experiences

Foregoing analyses demonstrate the significance of innovationconsumption co-emergence based on co-evolutionary acclimatization in overcoming beyond anticipation issues by incorporating efficiency and resilience.

As reviewed in Fig. 6 while consumers anger has been increasing, it remains intangible. Therefore, the point of innovation-consumption co-emergence depends on how to conceptualize "voiceless voice" of consumers anger.

Given that innovation-consumption co-emergence is triggered by resonance between signals emitted by both innovative goods/services and consumer, and resonance is induced by learning both be consumer and innovative goods/services (Watanabe, 2009) as illustrated in Fig. 16, comodification of learning experiences would be essential for innovationconsumption co-emergence.

As postulated by Maslow (1954) and Modigliani (1965), such learning experiences as utmost gratification of consumption ever experienced has memorized in the brain. Consumers confronting innovative goods and services collate with utmost gratification of consumption ever experienced and search existing learning record in the brain which inevitably elevates brain temperature. However, in order to maintain homeostasis, such energy elevating brain temperature should be released from the face which leads to elevate face temperature as illustrated in Fig. 17.

Prompted by this hypothesis, pilot experiments in elucidat-

Fig. 12 Canon's Technological Diversification Strategy.

Fig. 13 Virtuous Cycle between Canon Printers and PCs.

Fig. 14 Dynamism in Co-emerging Innovation and Consumption ? In-vitro Fertilization.

ing the inside the black box of innovation-consumption coemergence were attempted both in Tokyo (Feb. 2011) and Jyvaskyla, Finland (Mar. 2012). By utilizing advanced thermography: novel psychophisiological measuring technique enables observation in the objective circumstances without providing any cautions to examiners, relationship between innovative goods/ services and consumers facial temperature elevation was monitored at the leading supermarkets in two countries as demonstrated in Figs. 18-20.

Typical results of the experiments are demonstrated in Figs. 21 (Tokyo) and 22 (Jyvaskyla). Both support the hypothetical view and demonstrate elevation of consumers facial temperature as they satisfied innovative goods/services provided.

On the basis of these pilot experiences, Fig. 23 proposes a

platform for commodification of learning experiences that contributes to activating innovation-consumption co-emergence.

8. Conclusion

In light of the bi-polarization between IT advanced economies and IT growing economies and also resilience in hightechnology firms, this paper attempted to explore the way for co-emergence between different dimensional institutional system.

An empirical analysis focusing on the development trajectories and their growth engine in 100 nations in the world and also an examination of the institutional sources enabling sustainable growth in particular country and firm in success were conducted. In addition, new approach integrating techno-metrics,

Fig. 15 Canon's Business Model in Co-emerging Innovation and Consumption.

Fig. 16 Dynamism in Co-emerging Innovation and Consumption.

Fig. 17 Scheme of Facial Temperature Feedback Hypothesis.

psychophysiology and advanced monitoring techniques was attempted for the identification of successful platform. Noteworthy findings obtained include:

- While dramatic advancement of the Internet has enabled global simultaneous dependency on IT, it has resulted in a bi-polarization between IT advanced economies and IT growing economies.
- While the later economies enjoy a virtuous cycle between IT advancement and its marginal productivity increase, the former economies have fallen in a pit of a vicious cycle between them. Similar bi-polarization structure has been observed also in the competitive market in high-technology firms.
- This necessitates a co-emergence of institutional innovation between the two types of economies to ensure their sustainability.
- This co-emergence can be accomplished by a coevolutionary acclimatization trajectory between two economies.
- Given the increasing initiative of consumers in innovation and global stagnation of consumption, co-emergence of innovation and consumption will play a decisive role in navigating this trajectory.
- This co-emergence is triggered by resonance between innovative goods/services and consumers which are induced by learning experiences.

Analyze the recorded data by the exclusive software "FLIR Research IR" (able to identify a pin-point temperature)

Fig. 18 Thermography for Monitoring Facial Temperatures.

Shelf on which PC is stalled (15 February)

ermography (15 February) Angle of the thermography (21 February) (21 February)

Fig. 19 Pilot Experiment at a Japanese Leading Supermarket in Tokyo (February 2011).

Fig. 20 Pilot Experiment at a Finish Leading Supermarket in Jyvaskyla (March 2012).

 Advanced psychophisiological measuring approach provides constructive insight in elucidating this dynamism.

These findings provide following constructive suggestion supportive to constructing a resilient business while maintaining efficiency:

- Both economies should realize the limit to individual strength and significance of fusion with global best practices.
- Both economies should make every effort in constructing a co-evolutionary acclimatization trajectory.
- These can be applicable also to high-technology firms in bi-polarization.

- Such trajectory can be anticipated to be accelerated by stimulating innovation- consumption co-emergence.
- Commodification of lerning experiences contributes to constructing this co-emergence.

Further work should endeavor to examine noteworthy success in such a co-emergency given the hierarchy structure of institutional systems consisting of national, industry, sector, firm and individuals.

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5. Metabolie Control System (devate temperature), 545. Sympaticite rei vous System (deseend temperature)

Fig. 21 Standard Pattern of Facial Temperature Change in Purchased (Tokyo).

Fig. 22 Standardized Pattern of Facial Temperature Change in Purchased (Jyvaskyla).

Fig. 23 Platform for Commodification of Experiences.

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