
Korean Personal Informatization Indices (KPII) and its Policy Implications

KOREA AGENCY FOR DIGITAL OPPORTUNITY & PROMOTION

Professor Heungsuk Choi
Department of Public Administration
Korea University

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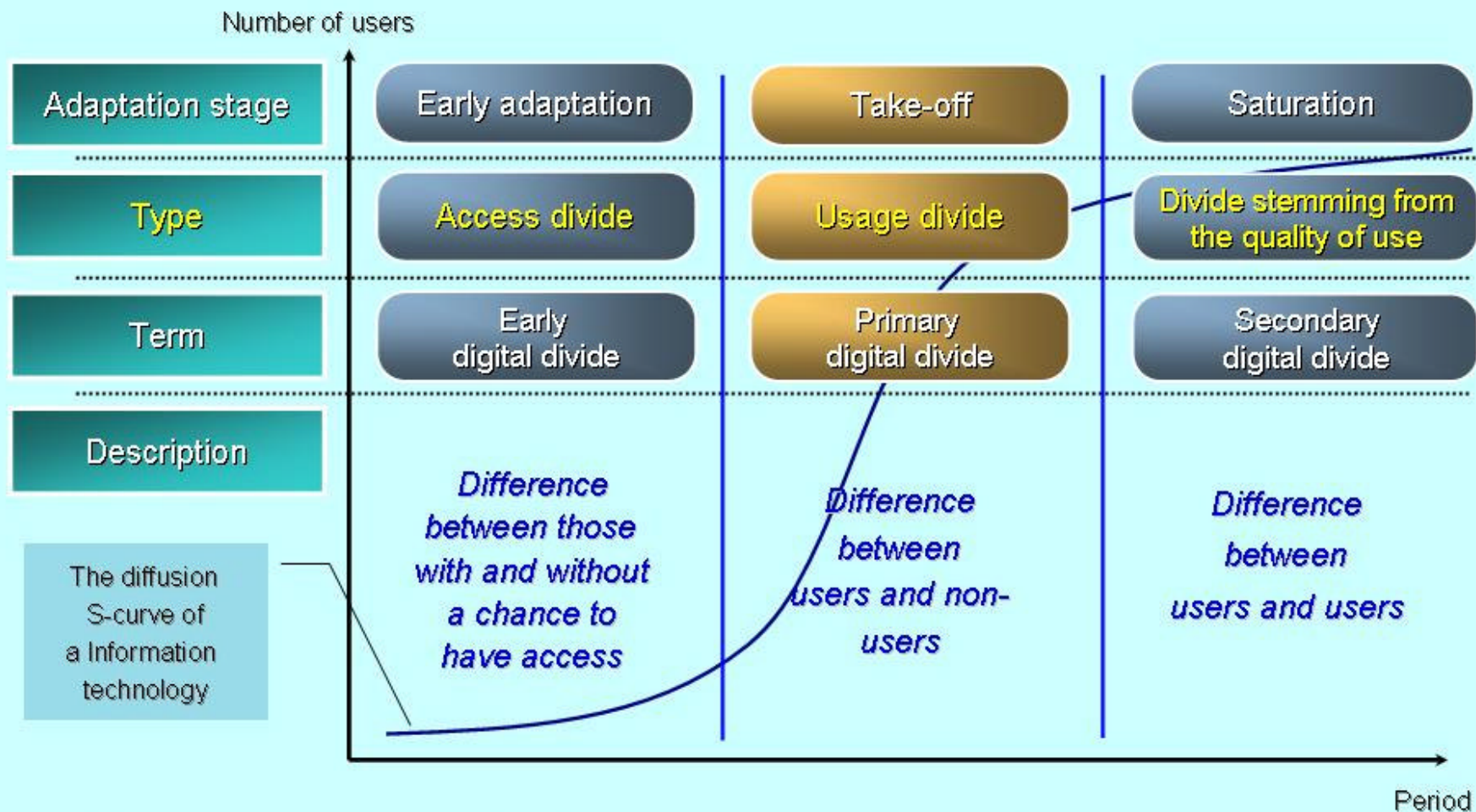
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. Characteristics of Digital Divide

The explanation frame of the digital divide



□ Source : Szilard Molnar, "The explanation frame of the digital divide", Information Society, 2002

. Background of KPII development

- **Digital divide has often been measured with simple indicators such as the rate of individuals that use internet, PC ownership rate of household and so on.**
- **However, these simple measurement indicators fall short of reflecting multi-dimensionality of digital divide.**
- **So to speak, digital divide takes place not only in the arena of access to IT instruments, but also in the arenas of ability to use IT instruments and the ways how IT instruments are used.**
- **As informatization in a nation progresses, the digital divide in the latter arenas frequently have more serious implications.**

- Any appropriate policy to reduce digital divide should be based on correct diagnosis of the current state and trend of digital divide.
- In order to come up such diagnosis, it is in turn essential to have composite indicator that cover important multi-dimensions of digital divide.
- The multi-dimensions of digital divide means Access divide, Usage divide and Divide stemming from the quality of use.
- Indeed, cross sectional and longitudinal analysis of digital divide index is the most essential for policy establishment and evaluation concerning digital divide.



KADO and Korea University developed KPII which can measure the levels and characteristics of digital divide in the arena of access, capacity and quantitative / qualitative utilization.

. Basic Considerations in Developing KPII

1

Digital divide is defined as the gap in the extent to which each individual is informatized.

2

Digital divide is measured in terms of not only access to IT, but also usage of IT.

3

The indices and survey instruments must be validated through a pilot test.

4

The indices and survey instruments should better be flexible and adjustable enough to accommodate cross sectional and longitudinal comparisons.

. Structure of KPIL

- Digital divide is measured as the gap in
‘Korea Personal Informatization Indices’ (KPIL)
- KPIL consists of Personal Access Index(PAI),
Personal Capacity Index(PCI), and Personal Usage Index(PUI).
Personal Informatization Indices(PIL) as a composite measure for
digital divide is a weighted sum of PAI, PCI and PUI.

Korea Personal Informatization Index = f {access, capacity, usage}

- PAI measures the degree to which each person has an access to information technology. PAI could be expressed as following in a functional form.

**PAI = f {ease of access to computer and internet when needed,
capacity of computer, speed of internet connection, variety
of IT owned}**

- **PCI reflects a person's preparedness for information society in terms of his or her ability to use IT. PCI consists of the ability to use computers and the ability to use internet.**
- **Individuals may differ in terms of the kinds of software and internet applications they need to use. Considering these different individual needs, computer software and internet applications have been categorized in accordance with their difficulties to learn.**
- **The highest score in each software and applications category is used in calculating PCI.**

$$\text{PCI} = f \{ \text{ability to use computer, ability to use internet} \}$$

- **PUI deals with the usage of computers and internet in terms of both quantity and quality. PUI could be denoted as following.**

$PUI = f \{ \text{quantity of use, quality of use} \}$

Where,

**quantity of use = f {hours of computer use, hours of internet use,
(PQnUI) number of internet site membership}**

**quality of use = f {perceived usefulness of the use of computers,
(PQuUI) degree of using 'desirable' software and contents}**

- **'Desirable' software and contents are pre-selected for each of the social groups, which are students under K-12, undergraduate and graduate students, household wives and blue color workers, and white color workers.**

The weights for the indicators are as following :

- Weighted sums are used to calculate each index. Questions were asked to 19 experts - 17 university professors and 2 researchers - in a form of Delphi survey to come up with weights for the indicators.

$$\text{❖ KPII} = 0.2 * \text{PAI} + 0.3 * \text{PCI} + 0.5 * \text{PUI}$$

$$\begin{aligned} \text{❖ PAI} = & 0.6 * \text{ease of access to computer and Internet when needed} \\ & + 0.3 * \text{capacity of computers \& internet connection} + 0.1 * \\ & \text{The extent of owning various IT instrument} \end{aligned}$$

❖ $PCI = 0.5 * \text{ability to use computer} + 0.5 * \text{ability to use Internet}$

❖ $PUI = 0.4 * \text{quantity of use} + 0.6 * \text{quality of use}$

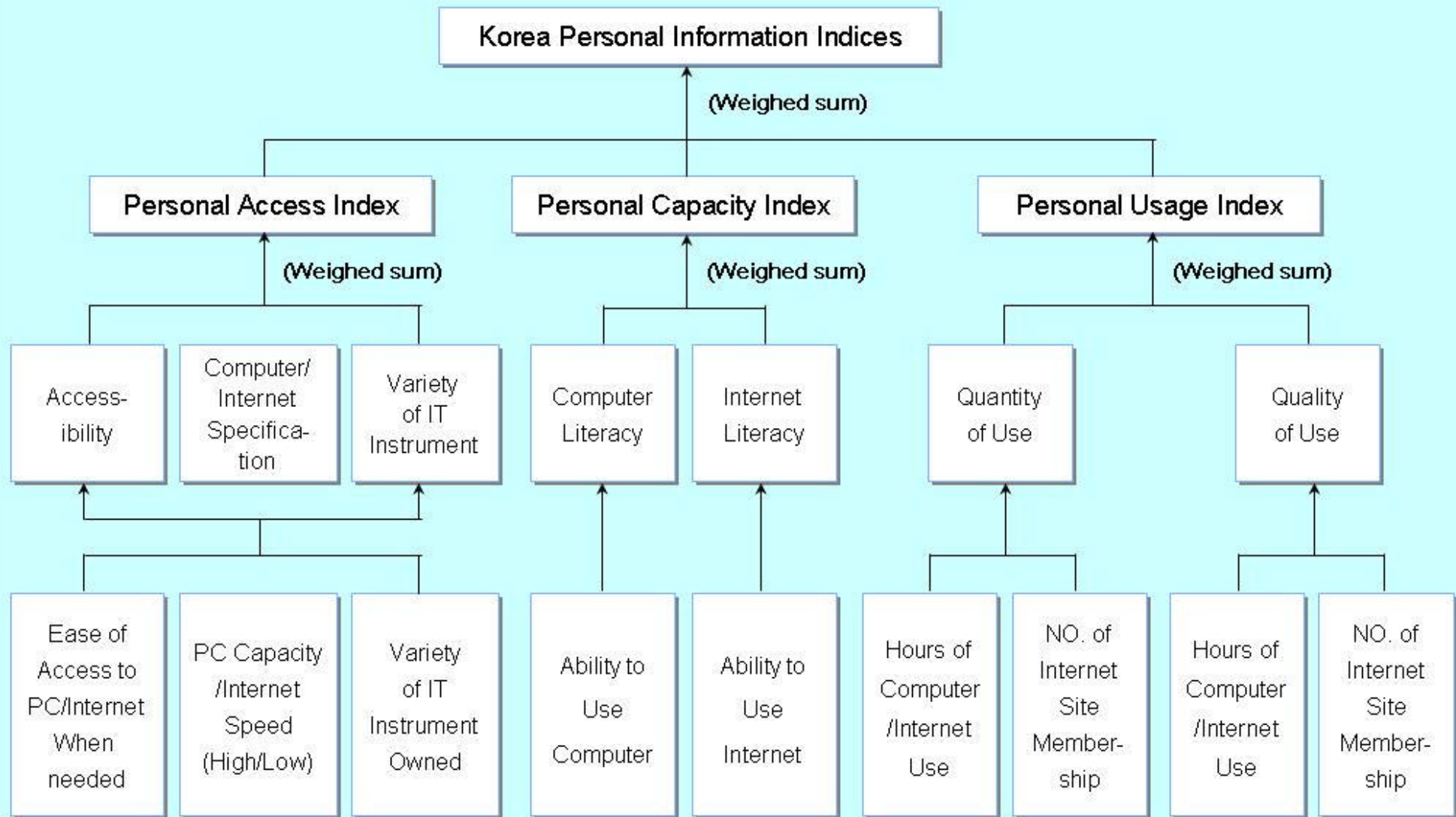
Where,

✓ $\text{quantity of use} = 0.7 * \text{hours of computer \& internet use} +$
 $(PQnUI) \quad 0.3 * \text{number of Internet site membership}$

✓ $\text{quality of use} = 0.6 * \text{perceived usefulness of the use of}$
 $(PQuUI) \text{ computers} + 0.4 * \text{degree of using 'desirable'}$
 $\text{software and contents}$

● The total score for each index has been adjusted to 100.

The following figure depicts the structure of KPII



. The result of Pre-analysis using the existing data

Following is the result of pre-analysis using the existing data of survey which was performed in 2002 to 2003, in order to examine validity and reliability on measurement structure of PII.

✂ We used data of “survey on the status of national information life in 2002” and “survey on the status of digital divide on The Information Poor in 2003.”

The Index score by social strata

	PAI	PCI	PQnUI	PQuUI	KPII
All nation (N = 3,010)	65.9	47.7	59.7	24.1	49.4
Low-income People (N = 1,000)	38.6	24.7	37.7	15.2	29.0
People with disabilities (N = 1,002)	38.9	16.8	25.9	10.2	22.9
Aged over 50 (N = 1,000)	31.9	9.4	13.1	4.9	14.8

The result of Pre-analysis using the existing data

The Index score by vocation

	PAI	PCI	PQnUI	PQuUI	KPII
White collars (N = 409)	81.0	71.8	84.9	45.1	70.7
Service/sales (N = 570)	63.1	44.9	53.2	23.2	46.1
Farmers (N = 122)	31.2	9.8	15.2	3.6	15.0
Blue collars (N = 467)	54.0	35.0	41.6	16.0	36.7
Elementary school students (N = 384)	81.3	55.5	85.3	23.0	61.3
Middle and high school, University Students (N = 303)	86.7	75.2	91.7	34.6	72.0
Household wives (N = 468)	50.2	24.3	30.6	9.9	28.8

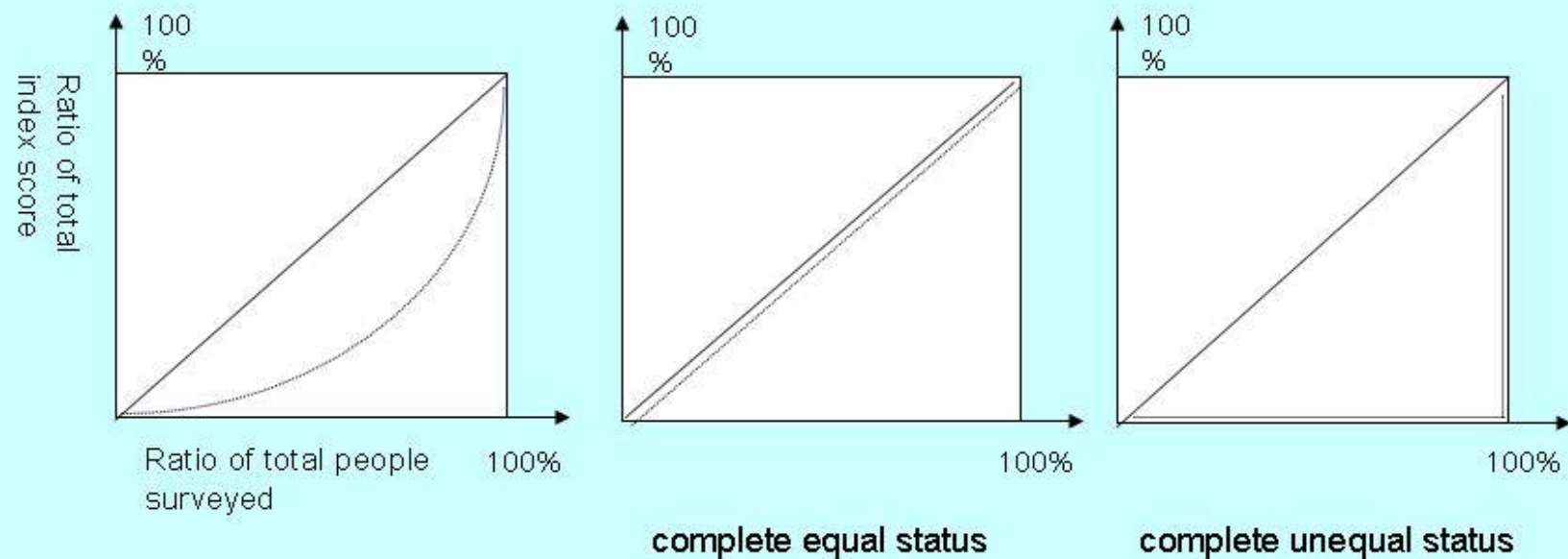
. The calculation of Digital Gini Ratio Using KPII

The Concept of Digital Gini Ratio (Information Inequality Ratio)

- **Gini ratio, which is used in economics as the summary measurement of unequal income distribution, can be used for calculating Digital Gini Ratio which are the summary measurement of national digital divide.**
- **Digital Gini Ratio are the summary measurement which enable to measure the degree of unequal distribution of information on the basis of the whole nation.**
- **Digital Gini Ratio are the indicator which measures the degree of unequal status of access, capacity, quantitative and qualitative utilization as well as the degree of unequal status covering those four arenas.**
- ✂ **In economics, in order to resolve the unequal distribution of national incomes, various methods were developed such as Lorenz Curve, Gini Ratio, Kuznets Measure, Atkins Measures. One of the most used methods is Gini ratio.**

- **The Gini Ratio is located from 0 to 1. The Gini Ratio is '0' in an absolute Even distribution, and '1' in an absolutely unequal distribution. Digital Gini Ratio has the identical interpretation criteria with Gini Ratio.**
- **In general, a distribution is regarded unequal when the Gini ratio becomes larger than 0.3. It is regarded quite unequal when the Gini ratio is larger than 0.4.**
- **Digital Gini Ratio has the identical interpretation criteria with Gini Ratio.**

< Interpretation Criteria of Digital Gini Ratio >



- **Gini Ratio has the curve drawn by the horizontal and vertical axes. The first one indicates people in the order of income from low to high while the latter expresses their incomes. The fundamental hypothesis of Gini Ratio is that the vertical axis must be the figure which is income.**
- **Gini Ratio has the curve drawn by the horizontal and vertical axes. The first one indicates people in the order of income from low to high while the latter expresses their incomes. The fundamental hypothesis of Gini Ratio is that the vertical axis must be the figure which is income.**
- **The Method calculating Gini Ratio can be applied to calculating Digital Gini Ratio since PAI, PCI, PUI and KPUI are the figure just like income.**

The method of calculating Digital Gini Ratio

- The method of calculating Digital Gini Ratio for measuring the degree information inequality is as following.
First of all, the horizontal axis shows the number of people surveyed, and the vertical axis is the sum total of index score of all the people surveyed.
- In order to calculate Digital Gini Ratio, one should measure the area (a) of triangle and the area (b) under the curve. When two areas are calculated, The Gini Ratio can be calculated by the formula;

$$(a-b) / a$$

- When the formula is looked into more specifically, it is as following.
(【Picture 1】) First of all, the horizontal axe shows the number of total population or the people surveyed while the vertical axe expresses the accumulated score of individual index. (below function ① and ②)
In this function, ' I ' means score of individual index and ' I_i ' means *ith* less informatized person's index score.

The horizontal axe : n ----- ①

The vertical axe : $\sum_{i=1}^n I_i$ ---- ②

- Given that the area of the triangle is the half of that of the square, Calculating the area of the triangle is as following:

$$\frac{\sum_{i=1}^n I_i}{2} * n \text{ ----- } \textcircled{3}$$

- On the curve, score which is accumulated to the i th-lower index as shown is as following.

$$\sum_{j=1}^i I_j \text{ ----- } \textcircled{4}$$

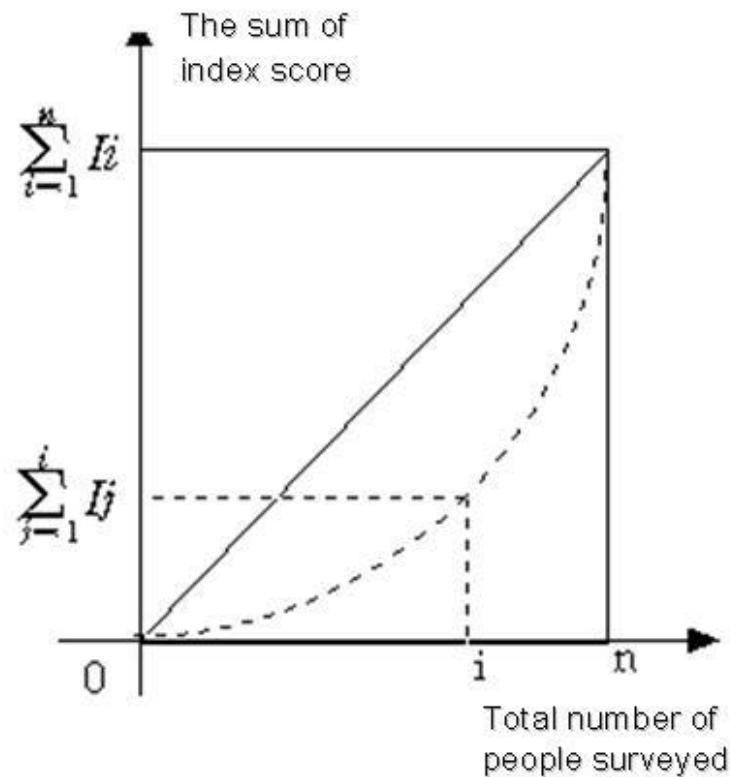
- The area below the curve, when using the Interpolation, can be calculated by adding up the formulas ④ from 1 to n.

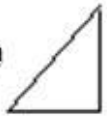
$$\sum_{i=1}^n \textcircled{4} = \sum_{i=1}^n \sum_{j=1}^i I_j \text{ ----- } \textcircled{5}$$


- When both areas of ③ and ⑤ are calculated, Gini Ratio is measured by the following formula.

$$\frac{\textcircled{3} - \textcircled{5}}{\textcircled{3}} = \frac{\frac{\sum_{i=1}^n I_i}{2} * n - \sum_{i=1}^n \sum_{j=1}^i I_j}{\frac{\sum_{i=1}^n I_i}{2} * n}$$

【Picture 1】 The method of calculating Digital Gini Ratio



Area (a)  : $\frac{\sum_{i=1}^n I_i}{2} * n$ --- ③

Area (b)  : $\sum_{i=1}^n \sum_{j=1}^i I_j$ --- ⑤

Digital Gini Ratio : $\frac{③ - ⑤}{③}$

The calculation result of Digital Gini Ratio using the existing data

The Digital Gini Ratio was calculated by using the PAI, PCI, PQnUI and PQuUI. The PAI, PCI, PQnUI and PQuUI were calculated by using the existing data of survey which was performed in 2002 to 2003.

※ We used data of “survey on the status of national information life in 2002” and “survey on the status of digital divide on The Information Poor in 2003.”

Divison	Access	Capacity	Quantitative Usage	Qualitative Usage
Digital Gini Ratio	0.413	0.548	0.527	0.606

VII. National Survey of Digital Divide

Protocols of the national survey of digital divide

- o **Started in 2004 and held every year**
- o **Sample: general citizen + 4 categories of the disadvantaged (16,700)**
 - **General citizen 1,500,**
 - **Handicapped, low-income (beneficiary of basic social security), elderly(>50), and rural citizens: 3,800 x 4**
- o **Survey areas: all of the 16 provinces in S. Korea including Jeju**
- o **Survey method: interview**
- o **Sampling method: multistage proportional stratified random sampling**
- o **Date collection period: September-December, 2009 (for example, in 2009)**

VII. National Survey of Digital Divide

Result of the national survey of digital divide

classification	2004		2005		2006		2007		2008		2009	
	DI	Difference	DI	Difference	DI	Difference	DI	Difference	DI	Difference	DI	Difference
Access	36.3	63.7	29.0	71.0	19.8	80.2	13.5	86.5	10.3	89.7	9.0	91.0
Capacity	72.5	27.5	65.8	35.2	57.1	42.9	55.5	44.5	54.3	45.7	51.1	48.9
Use	66.9	33.1	59.0	41.0	50.8	49.2	48.6	51.4	46.9	53.1	45.2	54.8
Quantity of use	65.8	34.2	57.8	42.2	49.7	50.3	47.2	52.8	45.6	54.4	44.3	55.7
Quality of use	70.4	29.6	62.3	37.7	53.6	46.4	52.0	48.0	49.9	50.1	47.7	52.3
Overall	55.0	45.0	46.7	53.3	38.0	62.0	34.1	65.9	32.0	68.0	30.3	69.7

*divide between general population and the disadvantaged (elderly, handicapped, low-income, rural)

VII. National Survey of Digital Divide

Result of the national survey of digital divide : Gini coefficient

	handicapped	elderly	low income	Rural
2004	.485	.522	.559	.583
2005	.414	.469	.462	.575
2006	.376	.376	.409	.465
2007	.365	.348	.369	.415
2008	.330	.331	.334	.394

VIII. Programs to Reduce Digital Divide – Infrastructure

● Improved access to internet and distribution of used PC

- establishment of 1,046 information access centers ('00~'05년)
- distribution of 194,771 used PCs ('97~'08)

● Content & auxiliary IT devices for the disadvantaged

- 63 online contents for the disadvantaged and elderly ('02~'08년)
 - disadvantaged(33), elderly(22), low-income(3), etc.
- 20,160 auxiliary IT devices ('03~08)
 - screen reader, magnified reading, voice output, screen phone, special keyboard, etc.

VIII. Programs to Reduce Digital Divide – ease of use

● Ease of use for the disadvantaged and elderly

- R&D support for auxiliary device development
- Telecommunication Relay Service



● Improved access

- Guideline and evaluation for S/W for improved access
- Certification system for S/W

VIII. Programs to Reduce Digital Divide – education

Info education for 10 million('00-'02.6) & 2nd stage informatization Education for ('02.7-'04.12) → 25 million

● '08 Informatization Education

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category	Number of people	category	Number of people
Disadvantaged	63,281	North korean refusee	4,384
Elderly	25,964	Immigrant	2,388
Illiterate	13,437	Info teacher training	60,844
Educational content	146,003	Sum	316,301

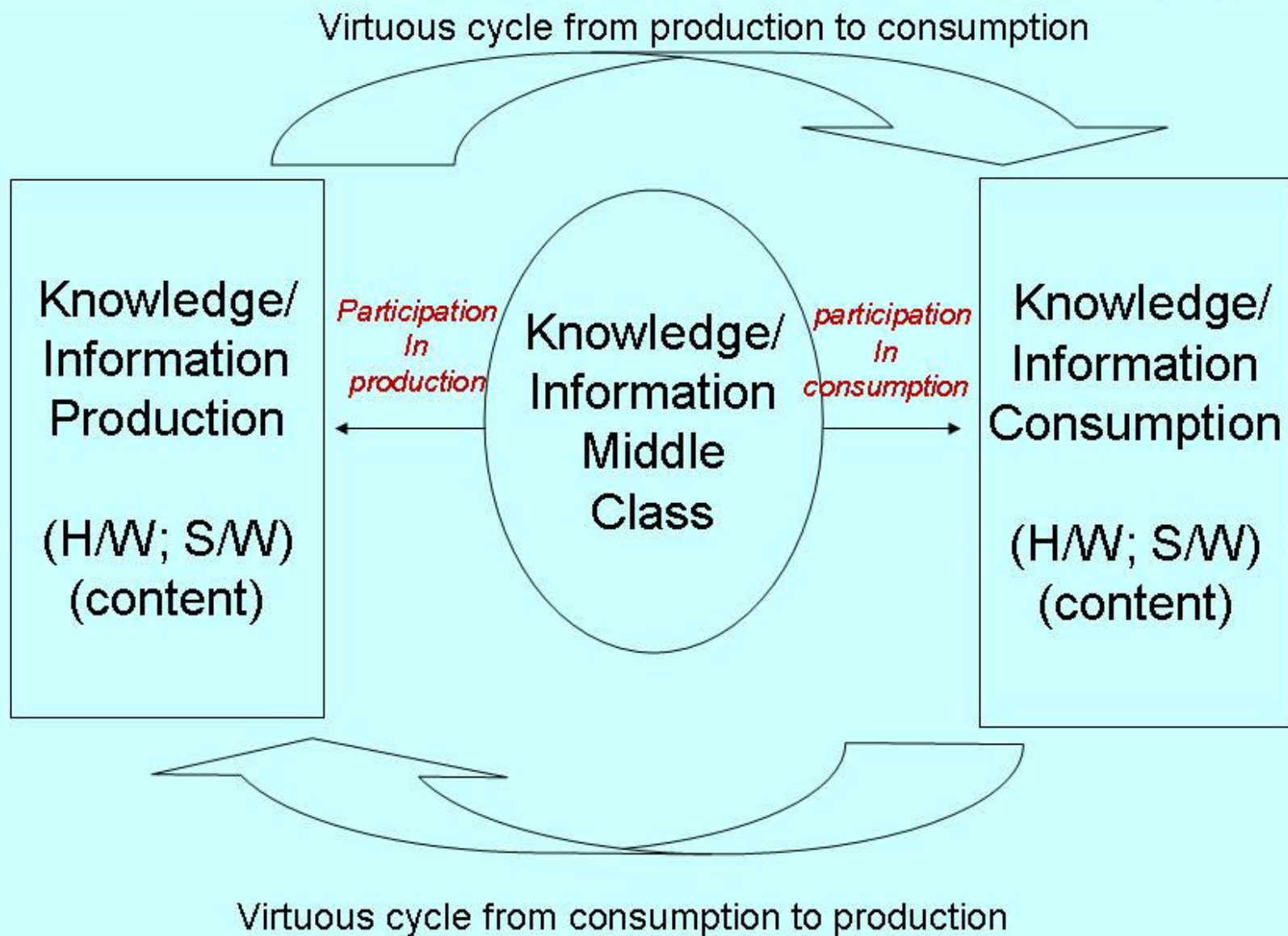
IX. Characteristics of Digital Divide in Korea

- Taking account of the KPII and Digital Gini Ratio which were calculated by using the existing data, in the case of Korea, the gap in information utilization is larger than the gap in access to information.
- On the basis of the rate of individuals that use internet and PC ownership rate of household, Korea has entered the stage of latter 'take-off' or 'saturation' on the diffusion stages of IT
✕ The diffusion stages of IT : Early Adaptation →take-off →Saturation
- The digital divide in utilization, not in access, could get larger as the diffusion of IT progresses from early adaptation to saturation.
- In case of the nation with high level of IT infrastructures, usage divide among computer users (productive vs. counter-productive) and ability to use information is a more serious problem than the access divide.

VIII. Characteristics of Digital Divide in Korea

- **Need to promote knowledge/information middle class for knowledge/information society – *behavioral study of info/knowledge use, processes to create values from info/knowledge use, etc.***

VIII. Characteristics of Digital Divide in Korea





Thank you !

