

# Measuring Digital Divide with Korea Personal Informatization Indices (KPII)

KOREA AGENCY FOR DIGITAL OPPORTUNITY & PROMOTION

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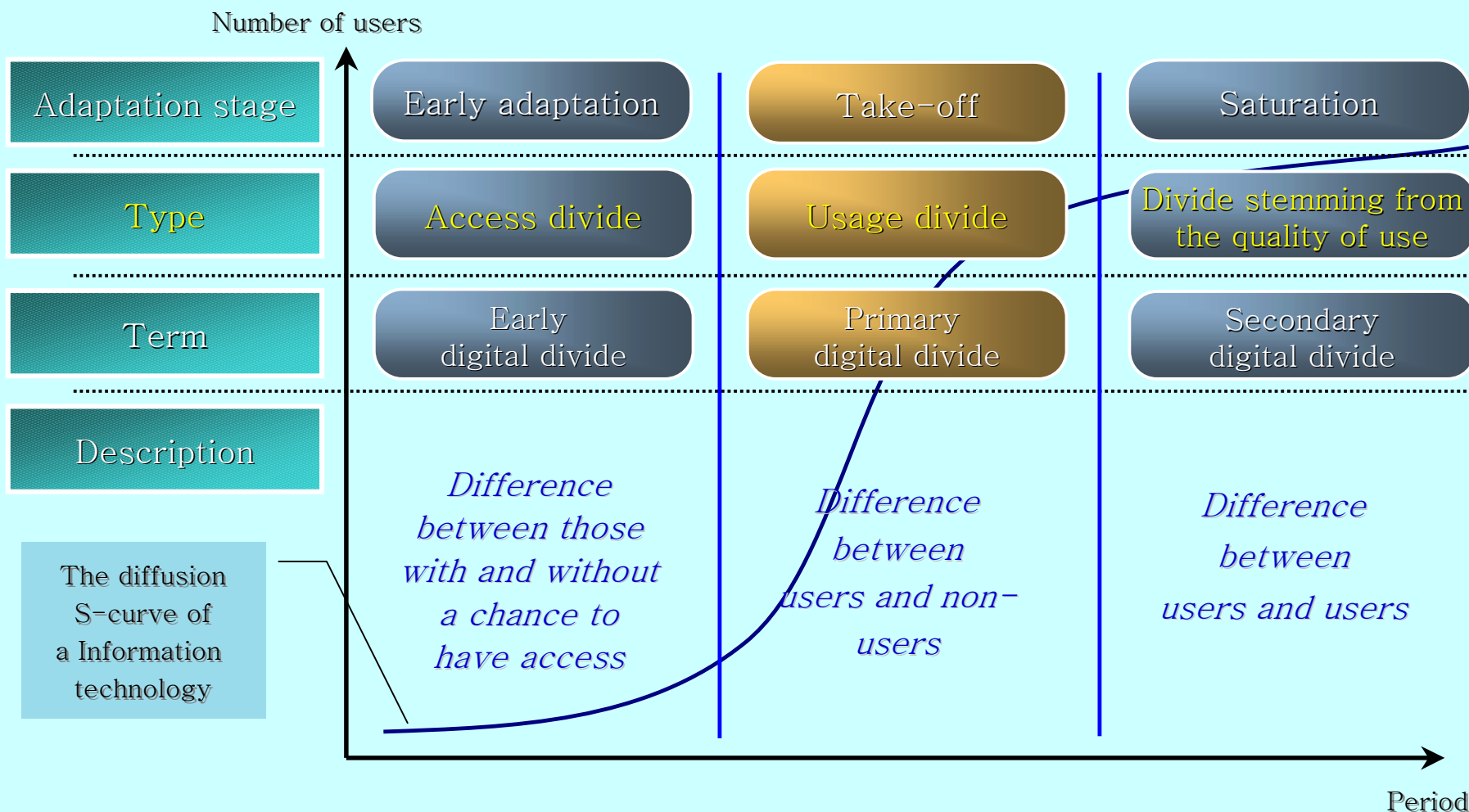
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# I. Characteristics of Digital Divide

## The explanation frame of the digital divide



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

## II. 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.**

### III. 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.**

## IV. Structure of KPPII

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

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

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

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



- **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.**

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

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.**

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

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

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

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

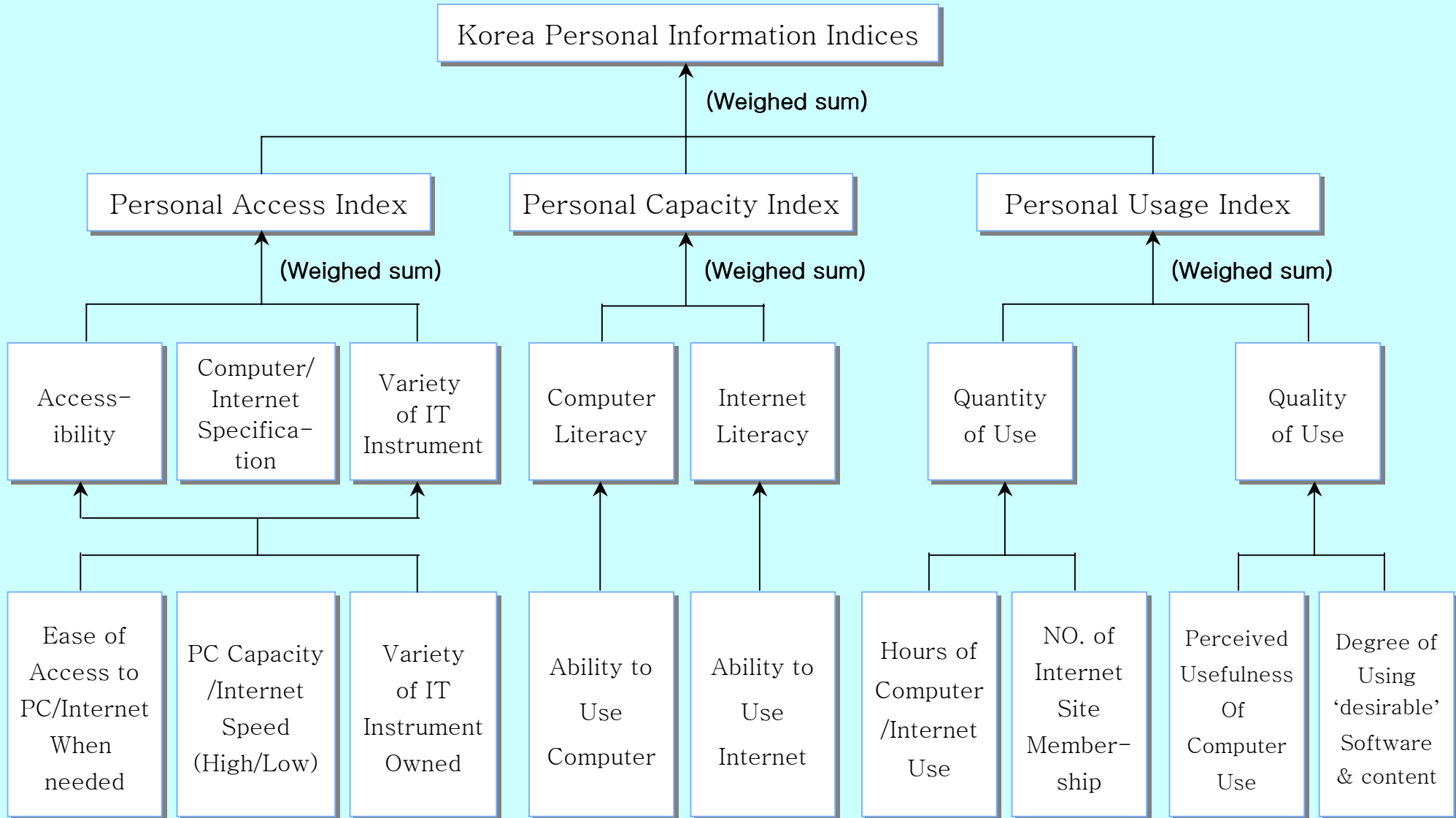
Where,

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

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

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

## The following figure depicts the structure of KPII



## V. 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 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

## VI. The calculation of Digital Gini Ratio Using KPII

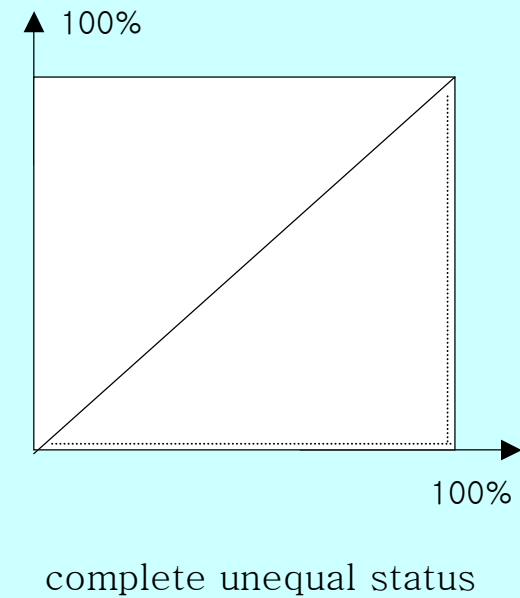
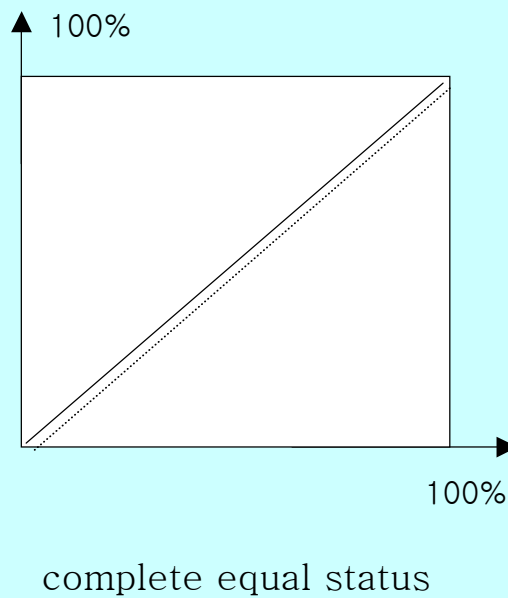
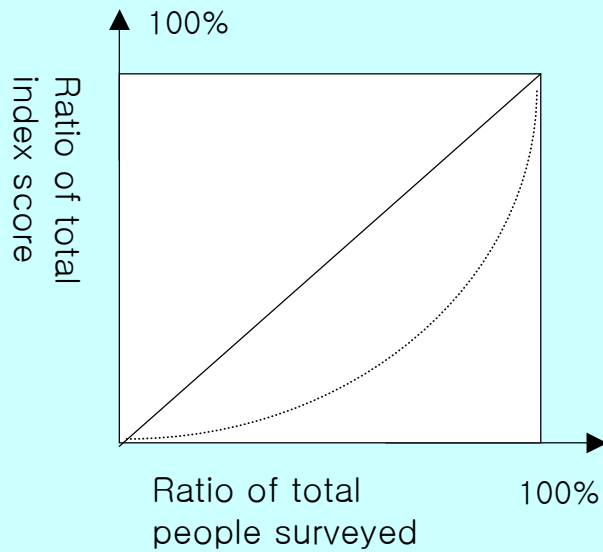
### The Concept of Digital Gini Ratio (Information Inequality Ratio)

- **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 >



## 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.

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

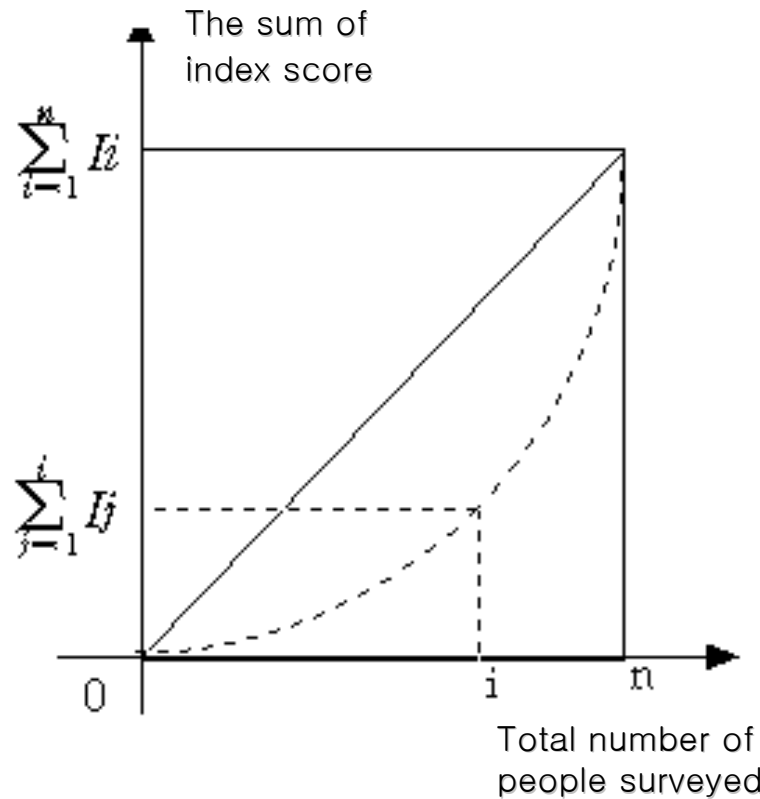
- The area below the curve, when using the Interpolation, can be calculated by adding up the formulas ④ from 1 to n.

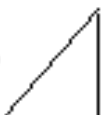
$$\sum_{i=1}^n \textcircled{4} = \sum_{i=1}^n \sum_{j=1}^i I_j \text{-----} \textcircled{5}$$

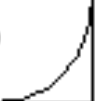
- When both areas of ③ and ⑤ are calculated, Gini Ratio is measured by the following formula.

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

## 【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. Characteristics of Digital Divide in Korea and some conclusion

- 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 is entering 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 PC ownership rate of household in Korea is 79.1%, The rate of Individual that use internet is 68.2% (2004.6)*
- As we can see from the characteristics of digital divide in Korea, the digital divide in utilization, not in access, gets larger as the diffusion of IT progresses from early adaptation to saturation.

- Therefore, in the case of the nation with high level of IT infrastructures, usage divide among computer users concerned to the pattern of use (productive vs. counter-productive) and ability to use information are the more serious problems than the access divide.
- There is a growing need to develop and apply digital divide indicators that take into account not only access divide, but also ability to use and Usage divide.
- The KPII could serve as a very useful instrument not only to monitor the state of digital divide, but also to devise better ways to reduce digital divide as they can inform us of the points of leverage for effective policy interventions.

***Thank you so much !***