Article

Evaluation of relative weight of balanced personnel index in Korean Public Offices through AHP

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Abstract: This research was conducted with the aim of developing indexes for diagnosis of balanced personnel levels in Korean Public Offices through Analytic Hierachy Process (AHP). The research found that 62.3% of 'structural improvement' and 37.7% of 'inclusive organizational culture' were weighted in large classification items. In the middle classification items, it was found weights of 27.5% for 'gender equality', 23.5% for 'disabled', 16.2% for 'science and engineering', 17.7% for 'regional talent', and 15.2% for 'social integrated type'. In the small classification items, 9.4% of 'employment rate of social integrated talent', 5.3% of 'the percentage of grade 7 and 9 selection of regional talent' and 5% of 'the percentage of women at the head of a department level' were shown as important evaluation indicators. In addition, the 'inclusive organizational culture' was derived by allocating weights of 9.45% each for four areas: fairness, disclosure, cooperation and support. As above, this research constructs items of the balanced personnel index through prior research and designs detailed indexes. However, it is meaningful that surveys and others have confirmed the usefulness of the balanced personnel index, which will contribute to the achievement of balanced personnel objectives in public offices.

Keywords: Korean Public Offices; AHP; balanced personnel index; evaluation of relative weight

1. Introduction

In an ever-evolving society, the need for balanced personnel management has become increasingly paramount. The Korean government's implementation of the first basic plan for balanced personnel management on 17 July 2018, aimed to actively respond to the diversity of our society and realize social values such as equity and fairness in public offices in Korea. The first basic plan for balanced personnel management was established to overcome the limitations of existing balanced personnel policies being single-shot separated by policy targets such as women and the disabled and focusing on short-term achievement. To this end, the Ministry of Personnel Management organized and operated a "balanced personnel consultative body" consisting of related ministries and private experts in February 2018 to establish a master plan for balanced personnel management. In addition, on-site opinions were collected after 10 meetings and workshops, including policy research, high-ranking female public servant' workshops, and meetings for the severely disabled.

In the meantime, the Republic of Korea operated a government organization in a relatively homogeneous environment, and its entry into public office was centered on men, Koreans, and liberal arts. However, such operations have faced numerous

administrative problems. Riccucci (2002), in the past, argued that there was a limit to leading an organization by managing heterogeneous work forces, and that there was a need for a management strategy, including diversity. Palmer (1989) argued for the valuing diversity paradigm, and argued that organizations that were good at it would perform well. Wang (2018) also argued that the harmony with various people and the advancement of various people into public office in the era of internationalization have a positive impact on the organization's performance by reflecting their needs. As a result, various workforces configurations must be optimized for organizational success (Naibitt and Auburdene, 1990).

The concept of balanced personnel management can be defined as a personnel system that is independent of region, gender, academic background, major, etc. in the process of appointment and personnel management of public posts. Discussions on the representation of bureaucrats related to balanced personnel in the past were raised earlier in the United States, Britain and other advanced countries, and continued to consider the democracy and equity of administration. In the case of the Republic of Korea, the controversy over the representation of bureaucrats has been long lasting as a political character. This discussion continued, especially during the authoritarian regime before the democratic regime. With the launch of the participatory government, the balanced personnel policy was implemented in earnest with the establishment of a balanced personnel department in the Office of the Senior Secretary for Personnel Affairs of the Blue House and the Central Personnel Committee. If you look at the participatory government's balanced personnel policy, it can be tangibleized as a target of women, the disabled, science and engineering, and regional talent. Therefore, the government undertook to prepare balanced personnel policy tasks across recruitment, personnel management, and organizational culture with the vision and mid to long term strategy of a comprehensive balanced personnel policy that encompasses all government ministries. Balanced personnel management is the government's personnel policy aimed at resolving discriminatory personnel management elements in public offices and realizing social values such as diversity, equity and fairness. Through the "First Basic Plan for Balanced Personnel Management," it includes enhancing gender equality, creating conditions for public offices that are friendly to the disabled, strengthening regional representation, efficient utilization of science and technology personnel, and expanding recruitment of socially integrated human resources. Therefore, in order to establish balanced personnel management, it is necessary to develop a balanced personnel index that can identify and diagnose the current status of balanced personnel management by institution.

There are four main advantages of such a balanced personnel management. First, in terms of reducing social costs, enhancing the self-sufficiency of minorities through balanced human resource utilization harmonizes distribution and growth, and reduces the social cost of discrimination (Kossek et al., 2006). Second, it encourages participation from various classes and fields in the important policy-making process of the state in terms of enhancing representation and democratization of policy decisions and inducing social integration. This may enhance the representation and democracy of policy decisions, reduce conflicts among classes through preferential treatment of minorities, and induce practical and psychological

social integration. Third, in terms of balanced development society construction, it is possible to actively discover and utilize competent regional talents and to expect balanced development of the entire country through rational allocation of limited national resources. Fourth, in terms of enhancing national competitiveness, diversity is the source of competitiveness in the human capital management of the knowledge and information society. Therefore, it is possible to actively cope with social change and innovation when respecting and actively utilizing the differences in knowledge, experience, and value of various groups.

The purpose of this research is to develop index for measuring the current status and level of balanced personnel in public offices in various fields in terms of diversity management. Since Korean society is progressing into a multicultural society, balanced personnel is essential. Already, countries such as the United States and Singapore have solved the problem of diversity for years, laying the groundwork for recruiting world-class talent and becoming a world-class country. In this way, it can enhance social equity in the long run and become a world-class human nation by recruiting various talents.

By diagnosing the level of balanced personnel management by institution, it is intended to develop index that objectively identify diversity in human composition, resolve discrimination in personnel management, and endeavor to manage diversity. Through the developed indicators, it is intended to diagnose the level of balanced personnel management for each institution related to the entire government agency and to present measures to implement, spread, and improve policies.

2. Theoretical background

2.1. Balanced personnel index

1) Spoils system, merit system and career public servant system
(1) Spoils system
Prior to the spoils system, there were complaints about the elitist and high society-oriented public servant system in consideration of personality and social status in accordance with the principle of eligibility (Park et al., 2016). Against this social background, President Jackson said that spoils system is a system that allows anyone to enter office on the premise that public office is simple and plain, and based on political support regardless of class (Park et al., 2016). Senator Marcy's words "spoils belong to winners" well represent this, and later expanded to increase the social representation of public servant. This is also referred to as Jacksonian Bureaucracy.

However, this spoils system damaged the professionalism and fairness of public servant (Park et al., 2016), extending unnecessary government posts and, above all, the occurrence of corruption and administrative continuity caused by public servants' intervention in politics were violated.

(2) Merit system and career public servant system
Born out of this spoils system, President Garfield was killed by a person who was dissatisfied with the allocation of public offices. Pendleton then argued for a merit system that appoints government posts based on performance based on open competition tests, which provided the basis for the merit system under the name

Pendleton Act (1883) (Park et al., 2016). This social atmosphere later became the background of political administration theory through Wilson's study of administration (1887), and influenced the scientific management movement (Park et al., 2016). In the case of the career public servant system, it developed relatively late compared to the performance system (Park et al., 2016).

However, strict personnel regulations in the merit system have resulted in uniformity, documentism, and efficiency reduction, and the protection of public servant' rights and interests has caused difficulties in flexible operations. In addition, scientific personnel management has developed a problem that is rather obsessed with measuring performance in personnel (Park et al., 2016). And despite promoting political neutrality, the merit system has limited political freedom and made it difficult for women and minorities to enter public office despite its fair merit system (Park et al., 2016). In addition, the general competency-oriented career public servant system and strong identity security have problems that lead to limitations and inefficiencies in professionalism and lower responsiveness (Oh, 2016). As such, representative bureaucracy has emerged in response to problems such as inefficiency, responsiveness, expertise, and inconsistency due to politics.

2) Similar concepts: Diversity management, equal employment opportunity and affirmative action.

(1) Diversity management

Thomas (1991) argued for diversity beyond gender and race in his research paper "From affirmative action to affirming diversity" and argued for diversity management, including age, background, education, job functionality and personality.

Diversity management includes age, occupation, sexual orientation, nationality, lifestyle, and status in organizations in addition to race and gender (Thomas, 1991). It includes a number of different differences with people, ultimately to maximize organizational productivity (Fernandez, 1999; Thomas, 1990, 1991). This is the view that affirmative action involves affirmative action rather than being completely distinguished from diversity management (Kelly and Dobbin, 1998).

Pitt (2006) argued that recruitment is the beginning of diversity management and has a positive impact on increasing diversity as a representative factor. Supporters of diversity also perceive diversity management as a means of achieving socially valuable objectives (Sandel, 2009). For example, Harvard University argued that without diversity, the vitality, intellectual excellence, and quality of education would have decreased (Sandel, 2009).

Increasing diversity in organizations on the one hand is an opportunity, but on the other it can be a crisis (Cox and Black, 1991). This is because the more people who belong to underprivileged groups, the more they consider diversity when choosing a job (An, 2016). Some studies have argued that smart work systems (Jeong, 2015) and flexible work systems (Park and Han, 2017) also help improve women's satisfaction with the organization and prevent them from leaving.

(2) Equal employment opportunity

Equal employment opportunity is that governments, regardless of race, color, religion, sex, age, disability, or national origin, should try to give equal employment opportunities (Noe et al., 2010). With the advent of the title VII of the civil rights act and the attention of the public, such measures were extended through the Equal

Employment Opportunity Act (Ma, 2010). The Americans with Disabilities Act (1991) prohibited discrimination against individuals with disabilities (Noe et al., 2010) and mandated employers to have reasonable accommodations under the Disabilities Act (Noe et al., 2010).

(3) Affirmative action

Affirmative action was launched in 1961 by President Kennedy with the intention of having social fairness, giving preferential treatment to the historically and socially minorities or disadvantaged classes and groups when selecting freshmen (Cho, 2014). Those selected by this policy were students who achieved excellent results within their environment and opportunities, and after graduation, they are active in various fields of society as leaders. Eventually, the policy was controversial as "reverse discrimination" among white upper class and mainstream groups, but it has paid off in terms of strengthening university creativity and diversity and social integration and continues to date (Cho, 2014). Since then, the policy has spread to various sectors of society and has been introduced and implemented by some private companies as well as the government.

Thus, affirmative action is a differentiated and more active concept from equal employment opportunity in that it heals previous discrimination rather than present discrimination (Ma, 2010). This is a proactive measure to prevent past discrimination and to diversify the composition of personnel in terms of race, color, religion, sex, age, disability, nationality, etc. (Ma, 2010).

Affirmative action such as this can be seen as compensation logic as an act of correcting past wrongdoings (Sandel, 2009). However, critics argue that those who receive these rewards may not be the original victims, and that class should be considered rather than race (Sandel, 2009). They also doubt the policy effects of raising racial pride and racial tensions (Sandel, 2009). Riccucci (2002) argued that Affirmative action is a more proactive measure than equal employment opportunity in terms of legal obligations.

However, there are aspects that are focused on a particular race or gender (Ma, 2010), which violate the basic premise by the existing merit aspect. The reason for considering race and ethnicity in the test is to correct the possible disparities in families, societies, cultures, and educational backgrounds in standardized tests (Sandel, 2009). It was also the American human rights activist Martin Luther King who entered the school under the system (Sandel, 2009). Riccucci et al., (1997) argued as shown in **Table 1**.

Table 1. Comparison of affirmative action and equal employment opportunity (Riccucci et al., 1997).

Sortation	Affirmative action	Equal employment opportunity
Goal	Seeking compensation and correction of the court while encouraging voluntary participation.	Prohibiting discrimination and providing a fair opportunity.
Emphasis	Correcting past discrimination and maintaining diverse and representative human composition.	Prohibiting discrimination.
	To have an active influence on the promotion and employment of an organization.	Ensuring fair opportunity and access.
Legal elements	Encouraging voluntary participation while having court powers.	Regulation by federal law.

(4) Conceptual comparison of diversity management, affirmative action

Conceptual differences between affirmative action and diversity management can be compared as follows.

First, employment equality measures and affirmative action are legal approaches to employing legally enforced minorities, but diversity management is an organization's voluntary program for its own benefit (Carrell and Mann, 1995).

Second, although affirmative action has the problem of selecting and hiring underqualified people based on quota (Whitmire, 1984), diversity management is not obsessed with "number" and seeks competitive advantage in terms of cost, resource acquisition, marketing, creativity, problem solving, and organizational flexibility (Cox and Blake, 1991).

Third, affirmative action focuses primarily on women and minorities, diversity management considers age, occupation, sexual orientation, nationality, lifestyle, and status in the organization, in addition to race and gender (Thomas, 1991).

Fourth, affirmative action is used as a means to hire many ethnic minority employees, but diversity management focuses on creating a culture that values 'different' and respects appropriate differences as shown in **Table 2** (Ma, 2010).

Fifth, affirmative action focuses on human resource management, diversity management plays an important part in the strategic goals of the organization as a whole, indicating changes in organizational culture that promote population, race, and individual differences (Gilbert et al., 1999).

Table 2. Comparison of affirmative action and diversity management (Ma, 2010 (reorganization)).

Affirmative action	Diversity management
Relative consultation	Relative inclusiveness
Legal enforceability	spontaneity
The issue of reverse discrimination is in mind	To make a profit
Mainly women and minorities	In addition to race and gender, consideration of age, occupation, sexual orientation, nationality, lifestyle, status in the organization, etc.
One means of hiring a large minority staff	Create a culture that values 'different' and respects appropriate differences
Focus on human resources management	Changes in organizational culture

2.2. Representative bureaucracy

1) Concept of representative bureaucracy and background of appearance

Representative bureaucracy is a complement to the limitations of the merit system (Park et al., 2016) and Selden (1997) said that the application of Affirmative action in public organizations was a representative bureaucracy (Bae and Cha, 2006). Kingsley (1944) presented the concept of a representative bureaucracy after discovering through bureaucratic research that the bureaucracy in the UK is recruited from the Middle-Upper Class. Therefore, the representative bureaucracy system is aimed at securing representation and social equity in public offices. Thus, the system was introduced in the hope that social values would be evenly reflected in policies by organizing the human composition of public offices similar to that of general society (Kingsley, 1944).

Representative bureaucracy refers to the 'employment quarta system'

representing a 'reduced version of society' and the Clinton administration called for the realization of 'government that looks like America' (Dolan and Rosenbloom, 2003).

In terms of the definition of representative bureaucracy, Kingsley (1944), who first used the term representative bureaucracy, defined it as 'a bureaucracy that reflects the dominant forces in society'. Oh (2016) defined it as a personnel system that applies the principle that all social groups should occupy bureaucratic positions according to the percentage of the total population of a country.

The reason for the emergence of the representative bureaucracy in terms of social equity is that the establishment of a merit system in personnel administration has led to persuasive arguments that "different things should be managed differently" for the disabled and peculiar races. This is because political consideration of race, gender, and region has not been made in recruiting public offices, and the proportion of minorities and women entering public offices has been absolutely reduced, focusing only on individual ability and expertise in performing their duties. This led to the need for institutional devices to provide opportunities for underprivileged groups to hold public office in ways such as quota allocation and to provide practical opportunities for them to represent their interests.

Meier (1993) emphasized that representation requires political support and sometimes a critical public. However, the layer of protection sought to protect in these representative bureaucracy may vary from country to country (Oh, 2016). For example, in South Korea, North Korean defectors can be considered as a protective class.

2) Advantages and disadvantages of the representative bureaucracy

(1) Advantages of representative bureaucracy

The advantages of the representative bureaucracy are, first, correcting the abolition of the merit system (Oh, 2016) and representing each class of society to suit democratic values (Park et al., 2016). Second, constructive representation of public office can be secured. Third, we can expect a control function that checks internally on its own that profits are biased only on one side of a particular civil servant in decision-making. Fourth, groups that were forced to be alienated from the principle of free competition under the principles of merit system and scientific management can contribute to the realization of social equity while securing practical opportunities to represent their interests.

(2) Disadvantages of the representative bureaucracy

The disadvantage of representative bureaucracy is that, first, passive representative is assumed to be converted to active representative, which makes it difficult to guarantee the effectiveness of representative bureaucracy in situations where this premise is not fulfilled (Park et al., 2016). Second, since public offices' policy-making behaviors are not only affected by the interests and values of their groups of origin, they cannot be expected to be linked to role-based representation even if they have constructive representation. In particular, even if representation is secured at the constructive level, it is difficult to expect role-ological representation because policy decisions by high-ranking officials who actively participate in policy decisions are not only made by understanding groups of origin. Furthermore, it is difficult to expect more than realistic constructive representation in middle and lower

officials where the opportunity for policy decision making is relatively small. Third, role-ological representation cannot be expected as minority public servants move up from lower to higher positions after entering public office, creating a reference group that feels a new sense of belonging than the group from the past. Fourth, control of public office is a more democratic and effective way to control by the president and Congress, and autonomous control by internal human representation can be undemocratic. Fifth, satisfying representation by arithmetic proportions in the composition of public offices can lead to reverse discrimination in which competent people are excluded from recruitment or promotion.

3) Research trends

(1) Domestic literature review

The trend of research on representative bureaucracy in the country is mainly focused on research on women and disabled people. First of all, women's representation issues are mainly discussed in the representative bureaucracy (Bae and Cha, 2006). Since the introduction of the representative bureaucracy theory in the 1990s and the need for it were emphasized, the focus has been on regional and school representation (Park, 2010), and the government has emphasized that social groups should be consistent (Oh, 2013). In addition, representation of female public servants was mainly mentioned after the launch of the Ministry of Gender Equality in the late 1990s, and research on the representative bureaucracy and affirmative action began to diverge after 2000. In the meantime, the focus of the research has been on women, but they have begun to show interest in balanced personnel management such as disabled people, regional talent, science and technology personnel, and multicultural families (Park, 2010). The research also argued for active representative bureaucracy in passive representative bureaucracy (Kim, 2012; Park and Kim, 2006; Yoon and Moon, 2009). After all, research is mainly being conducted on how much population diversity governments reflect based on affirmative action and equal employment opportunity (Wang, 2018).

By academic field, affirmative action and gender equality are interested in women's studies and law (Park, 2010), comparative research is mainly focused on the United States (Kim, 2002), and diversity management emphasizes that socio-cultural diversity can lead to organizational improvement (Kim and Lee, 2017).

(2) Foreign literature review

In foreign literature review, the United States focuses on securing minority representation, including race, ethnicity and gender (Bae and Cha, 2006). In the United States, equal employment opportunities and affirmative action are considered the central means of promoting representative bureaucracy (Oh, 2013).

Initially, many researches have been conducted in proof of increased employment by the government through anti-discrimination laws and higher education levels (Long, 1962; Mosher, 1982; Rosenbloom, 1973). However, since the Reagan administration, policy outcomes have not continued and remain in place (Nkomo and Cox, 1990). And Meier et al. (1999) researched the effectiveness of representative bureaucracy in school organizations.

The diversity management research has been undertaken to highlight the positive direction of socio-cultural diversity and organizational performance (Choi and Rainey, 2010; Pitt, 2009). While prior research on diversity management lacks

empirical research (Koseketal et al., 2006), the approach to diversity was largely from a system-structural perspective (van Poeltje and van Silfhout, 1997; Bogaer and Vloebergs, 2005; Riccucci, 2002; etc.). Diversity is seen primarily as a crisis and challenge to the organization, stressing the need for diversity management (An, 2016). Other researches also argued that in terms of strategic choice, it is necessary for an organization to improve its performance by managing diversity with autonomy over environmental changes (An, 2016).

Meanwhile in India, discussions were focused on caste-based employment quota system and political allocations (Park, 2010). However, there is a lot of research at the political level, but insufficient research at the enforcement level (Mukherjee et al., 2005).

Baekgaard and George (2018) summarized the research of representative bureaucracy into three points. First, it shows research into whether and why bureaucracy reflects citizens' passive presentation well (Baekgaard and George, 2018). Second, it shows to what extent passive representation is shifted to active representation. This indicates that it represents the interests and desires of the group that it wants to represent (Baekgaard and George, 2018). Third, it shows how representative bureaucracy affects public service performance (Baggaard and George, 2018). Thus, Baekgaard and George (2018) noted that there was a lack of research into why these under represented people were under represented. And they did research on this.

3. Research method

3.1. Literature research and expert meetings

This research conducted both literature research and expert meetings to derive limitations and improvement directions through balanced personnel index analysis developed and utilized by the past government. It also sought to develop inclusion metrics in public organizations by applying the inclusion index of the Federal Employee Viewpoint Survey conducted by the Office of Personnel Management (OPM) in United States. Based on this, balanced personnel indicators were largely composed of two major categories: 'structural improvement' and 'inclusive organizational culture settlement'. First of all, 'structural improvement' consists of sub-items to measure the level of achieving balanced personnel management through the ratio of employment and manpower composition of women (gender equality), disabled, science and engineering, regional talent, and social integrated talent. And the 'inclusive organizational culture settlement' consisted of a single item, the inclusion index. These balanced personnel index is designed to measure the degree of discrimination in the overall management of personnel management, such as promotion and position within the ministry (Siraj et al. 2023). The evaluation items derived from the collected data were regrouped through expert meetings and then reconstructed as shown in **Table 3** by classifying the detailed evaluation criteria in each group.

Table 3. Classification table of balanced personnel assessment index.

Large classification	Middle classification	Small classification
Structural improvement	Women (Gender equality)	The Percentage of female public servants appointed
		The Percentage of female appointments in high-ranking government offices
		The Percentage of women at headquarters level
		The Percentage of female appointments in major positions
	Disabled	The Percentage of appointment of public offices with disabilities
		Number of appointments for persons with disabilities in major positions
		The Percentage of appointment of female disabled public servants
		The Percentage of appointment of public servants with severe disabilities
	Science and engineering	The Percentage of science and engineering high-ranking offices
		The Percentage of women in science and engineering in high-ranking government offices
		Number of appointments to major positions in science and engineering
	Regional talent	The Percentage of 7th and 9th grade selection of regional talent
		Number of appointments of regional talent in major positions
		Number of appointments for North Korean defectors
	Social integrated talent	Number of low-income appointments
		Number of appointments of human resources from multicultural families
		Efforts to secure social integrated human resources
Inclusive Organizational Culture Settlement	Inclusion index	Fairness
		Disclosure
		Cooperation
		Support

3.2. AHP survey

To derive weights from competition evaluation metrics established through literature researches and expert meetings, we use the most commonly used AHP technique among multi-criteria decision making (MCDM) analysis techniques (Yilmaz et al., 2023). The AHP analysis method is one of the most frequently used methods of policy-making, as an analysis method to reasonably reflect the opinions of various interested parties in situations where different criteria exist and multiple interested parties exist (UZAN, 2020).

1) AHP question survey

The AHP question survey targets 39 government agencies and distributed AHP questionnaire to personnel managers in each department. In addition, in order to reflect various opinions, six professors of human resources administration were surveyed.

The survey period was conducted for 20 days from 5 to 24 January 2021, and a total of 112 copies were recovered, and 105 copies were used for analysis, excluding seven that lacked consistency, and the status of balanced personnel index experts and ministries' responses is as shown in **Table 4** below.

Table 4. Targets of AHP question survey.

Sortation		*n*	Sortation		*n*
Expert group (6)	Personnel Administration Specialist	6		Defense Acquisition Program Administration	3
	Personal Information Protection Commission	2		Korea Communications Commission	2
	Korean National Police Agency	2		Ministry of Justice	4
	Ministry of Employment and Labor	4		Ministry of Government Legislation	4
	Fair Trade Commission	1		Military Manpower Administration	3
	Ministry of Science and ICT	2		Korea Forest Service	3
	Korea Customs Service	2		Ministry of Trade, Industry and Energy	4
	Ministry of Education	3		Saemangeum Development and Investment Agency	2
	Ministry of Patriots and Veterans Affairs	3		National Fire Agency	3
	National Human Rights Commission of Korea	2	Personnel manager by ministry (99)	Ministry of Food and Drug Safety	2
Personnel manager by ministry (99)	Office for Government Policy Coordination	3		Ministry of Gender Equality and Family	4
	Anti-Corruption and Civil Rights Commission	2		Ministry of Foreign Affairs	2
	Ministry of National Defense	2		Nuclear safety and security commission	3
	National Tax Service	1		Ministry of Personnel Management	3
	Ministry of Land, Infrastructure and Transport	4		Public Procurement Service	2
	Financial Services Commission	2		Statistics Korea	3
	Ministry of Economy and Finance	1		Ministry of Unification	1
	Rural Development Administration	3		Korea Coast Guard	2
	Cultural Heritage Administration	2		Ministry of the Interior and Security	4
	Advisory Committee on Democratic Peace and Unification	1		National Agency for Administrative City Construction	3

In addition, the demographic characteristics of professionals and department employees responding to the balanced personnel index AHP survey are shown in **Table 5** below.

Table 5. Demographic characteristics of samples.

Sortation		Frequency (number) (*N* = 105)	Ratio (%)
Gender	Man	74	70.5
	Woman	31	29.5
Age	20s	2	1.9
	30s	26	24.8
	40s	45	42.9
	50s	32	30.5
position	Grade 3	4	3.8
	Grade 4	24	22.9
	Grade 5	27	25.7

Table 5. (*Continued*).

Sortation		Frequency (number) (*N* = 105)	Ratio (%)
	Grade 6	32	30.5
	Grade 7	12	11.4
	Professor	6	5.7
	Less than 1 to 2 years	22	21.0
Human resources work experience	Less than 2 to 3 years	21	20.0
	Less than 3 to 4 years	28	26.7
	Over 4 years	34	32.4

The survey looks at the comparison scale for the criteria presented as a pair of comparisons between A and B, and compares the criteria for each item with each other, and writes 1–9 in the blanks according to the relative importance of the two items. The questionnaire is divided into an assessment of the assessment indicators of the large classification items and an assessment of the assessment indicators of the small classification items. The evaluation indicators of large classification shall be assessed separately by structural improvement and the establishment of an inclusive organizational culture, and middle classification item shall be assessed by dividing it into detailed items of each large classification. In other words, five items of women, persons with disabilities, science and engineering, regional talent, and social integrated talent shall be evaluated. The small classification items consisted of detailed items of middle classification items, and in the case of middle classification' women (gender equality), the ratio of female public offices, the ratio of female high-ranking officials, the ratio of female head of departments, and the ratio of female major positions are evaluated.

Furthermore, it is very important for AHP techniques to determine whether the responses of the survey subjects are logically consistent. Consistency index (CI; λmax − 1/n − 1) and consistency ratio (CR; CI/RI) can be derived and verified to determine whether survey responses are consistent. If the consistency ratio (CR) is less than 10%, it can be determined that the survey response has significant consistency (Saaty, 1977). However, even if the CR value is within 20%, it is considered to be somewhat consistent. The reason for this is that CR has some validity without insisting on absolutely only 10% values because the threshold varies depending on the dimension of the matrix (Bodin and Gass, 2003). Accordingly, this work sets the threshold of the consistency ratio to 0.2 and first checks the consistency ratio above the CR value of 0.2 for all survey responses.

2) Establishing a hierarchy

To obtain an optimal alternative using AHP analysis, we first define the problem accurately and identify the relationship between the objectives of decision-making, evaluation criteria, and alternatives to solve the problem. It then constructs a hierarchy that encompasses the objective of the highest-level problem, the selection and placement of intermediate-level large classification items, and the comparison of small classification items at the lowest level (Nekooie, 2021). AHP hierarchy separation is shown in **Figure 1**.
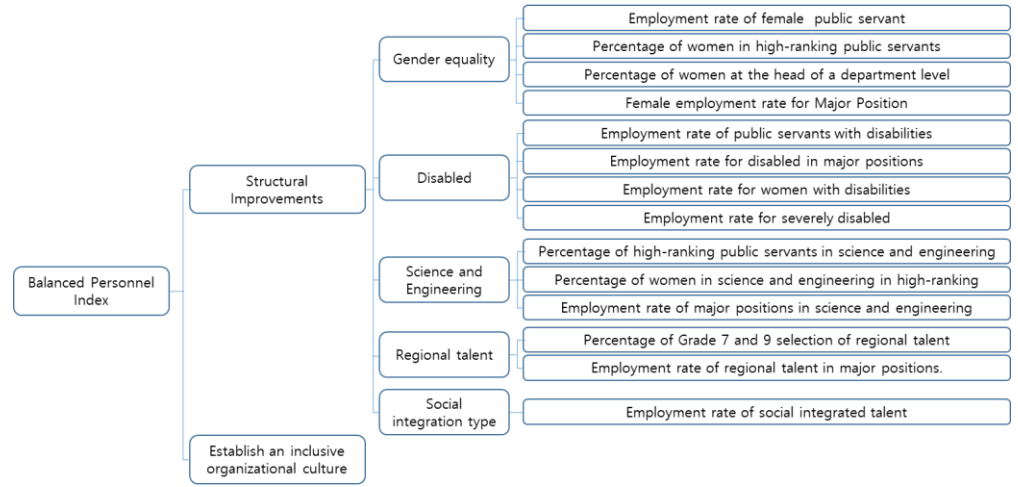
Figure 1. AHP hierarchy separation.

3) Importance assessment

In order to determine how important the dependent assessment items in the lower layer are based on one assessment item in the middle layer, a pairwise comparison between the assessment items is conducted throughout the applicable dependent assessment items. In addition, the relative importance of dependent evaluation items for the evaluation items in the upper layer is written in a comparative matrix. The AHP assesses the importance of the assessment criteria and rating scales on the basis of relative assessment by pairwise comparisons rather than absolute assessment. If alternatives are paired in pairs and "alternative i is more important than alternative j", place them as $a_{ij} = \theta$ and compare $\frac{n(n-1)}{2}$ sessions with each other. θ uses a 9-point scale experimentally recognized by Satty as the relative importance of the two alternatives.

Importance is assessed by a score of 1 to 9 or its inverse. The $n \times n$ matrix $A = [a_{ij}]$ is created using this defined $a_{ij}(i, j = 1, 2, \dots, n)$, and the matrix A is called the comparative matrix, $a_{ij} = 1$ and $a_{ji} = \frac{1}{a_{ij}}$ as the square matrix of $n \times n$.

4) Relative weight estimation

As shown in the matrix below, the pairwise comparison matrix is $a_{ij} = 1/a_{ji}$, $a_{ij} = 1$ as a reciprocal matrix, centered around the opposite angle.

If the relative importance of the n elements being compared within the hierarchy is w_i (i = 1, 2, …, n), a_{ij} in the pairwise comparison matrix can be represented by w_i/w_j ($i, j = 1, 2, \dots, n$). Formula for relative weight estimation is shown in **Figure 2**.

$$a_{ij} = {w_i}/{w_j} \ (i, j = 1, 2, \dots, n)$$

$$A = [a_{ij}] = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{1n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{1n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix} = \begin{bmatrix} \dfrac{w_1}{w_1} & \dfrac{w_1}{w_2} & \dfrac{w_1}{w_3} & \cdots & \dfrac{w_1}{w_n} \\ \dfrac{w_2}{w_1} & \dfrac{w_2}{w_2} & \dfrac{w_2}{w_3} & \cdots & \dfrac{w_2}{w_n} \\ \dfrac{w_3}{w_1} & \dfrac{w_3}{w_2} & \dfrac{w_3}{w_3} & \cdots & \dfrac{w_3}{w_n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \dfrac{w_n}{w_1} & \dfrac{w_n}{w_2} & \dfrac{w_n}{w_3} & \cdots & \dfrac{w_n}{w_n} \end{bmatrix}$$

Figure 2. Formula for relative weight estimation.

4. Research results and discussions

4.1. Basic statistical results

The underlying statistical values were obtained by coding the left-side items as reciprocal values and the right-side items as integer values, focusing on the 'equally important' scale 1 of the two comparisons. The survey results show that the average value (*M*) and standard deviation (*SD*) are as shown in **Table 6** as the underlying statistical values for the relative importance between evaluation indicators.

Table 6. Results of AHP survey basic statistics.

Sortation	Comparison items		Personnel administration specialist	
			M	*SD*
Large classification items	Structural improvements	Establish an inclusive organizational culture	−1.65	2.84
Middle classification items	Gender equality	Disabled	−1.02	4.90
	Gender equality	Science and engineering	−1.84	4.47
	Gender equality	Regional talent	−1.75	3.49
	Gender equality	Social integration type	−2.02	2.90
	Disabled	Science and engineering	−1.12	2.65
	Disabled	Regional talent	−1.32	1.32
	Disabled	Social integration type	−0.195	2.09
	Science and engineering	Regional talent	−1.25	2.22
	Science and engineering	Social integration type	1.75	0.93
	Regional talent	Social integration type	−1.85	1.14
Small classification items (Gender equality)	Employment rate of female public servant	The Percentage of women in high-ranking public servants	1.23	2.75
	Employment rate of female public servant	The Percentage of women at the head of a department level	1.49	3.25
	Employment rate of female public servant	Female employment rate for major position	1.19	2.22
	The percentage of women in high-ranking public servants	The Percentage of women at the head of a department level	1.19	3.26
	The percentage of women in high-ranking public servants	Female employment rate for major position	1.16	2.78
	The percentage of women at the head of a department level	Female employment rate for major position	−1.09	3.47

Table 6. (*Continued*).

Sortation	Comparison items		Personnel administration specialist	
			M	*SD*
Small classification items (Disabled)	Employment rate of public servants with disabilities	Employment rate for disabled in major positions	−1.52	1.48
	Employment rate of public servants with disabilities	Employment rate for women with disabilities	−1.54	3.26
	Employment rate of public servants with disabilities	Employment rate for severely disabled	−1.64	2.78
	Employment rate for disabled in major positions	Employment rate for women with disabilities	−1.42	3.47
	Employment rate for disabled in major positions	Employment rate for severely disabled	−1.82	1.48
	Employment rate for women with disabilities	Employment rate for severely disabled	−1.03	2.65
Small classification items (Science and engineering)	The percentage of high-ranking public servants in science and engineering	The percentage of women in science and engineering in high-ranking public servants	−1.74	2.76
	The percentage of high-ranking public servants in science and engineering	Employment rate of major positions in science and engineering	−1.54	2.47
	The percentage of women in science and engineering in high-ranking public servants	Employment rate of major positions in science and engineering	1.85	2.24
Small classification items (Regional talent)	The percentage of grade 7 and 9 selection of regional talent	Employment rate of regional talent in major positions.	−1.69	3.06

4.2. AHP results

1) Large classification items

The pairwise comparison of 'structural improvement' and 'inclusive organizational culture' were carried out as large classification of the balanced personnel index. As a result of analyzing the relative importance of "structural improvement" and "inclusive organizational culture", 62.2% of "structural improvement" and 37.7% of "inclusive organizational culture" weights were found. These results have implications in that they indicate the need for indicators to assess the qualitative level of balanced personnel beyond the quantitative growth-oriented indicator system of past balanced personnel. The results of deriving the relative importance between the two items were shown below **Table 7**.

Table 7. AHP results of large classification.

Sortation	Weights	Priority
Structural improvement	0.6226	1
Inclusive organizational culture	0.3774	2
Consistency index (CI)	-	
Consistency ratio (CR)	-	

2) Middle classification items

The pairwise comparison were conducted on the five sub-factors of the 'structural improvement' of the balanced personnel index, 'gender equality',

'disabled', 'science and Engineering', 'regional talent' and 'social integration'.

Comparative analysis of the relative importance among the five lower-level factors of 'gender equality' showed that 'gender equality' factors weighed 27.5%, followed by 23.5% for 'disabled', 17.7% for 'regional talent', 16.25% for 'science and Engineering', and 15.1% for 'social integration'. The results of the analysis of the relative importance between Middle classifications were shown in **Table 8** below.

Table 8. AHP results of middle classification.

Sortation	Weights	Priority
Gender equality	0.2754	1
Disabled'	0.2346	2
Science and Engineering	0.1617	4
Regional talent	0.1768	3
Social integration	0.1515	5
Consistency index (CI)	0.0448	
Consistency ratio (CR)	0.04	

3) Small classification items

First of all, the four sub-factors of the 'gender equality' category of the balanced personnel index were carried out fairwise comparison on 'employment rate of female public servant', 'The percentage of women in high-ranking public servants', 'the percentage of women at the head of a department level' and 'female employment rate for major position'. A comparative analysis of the relative importance among the four sub-items of 'gender equality' showed that 'the percentage of women at the head of a department level' was 29.2%, followed by 'female employment rate for major position' with 26.3%, 'the percentage of women in high-ranking public servants' with 24.1%, and 'employment rate of female public servant' with 20.49%.

The 'employment rate of female public servant' was selected as the factor with the lowest relative importance. These results suggest that as the employment rate of female public servant reaches a certain level, it is necessary to establish a policy so that genuine balanced personnel management can be realized by eliminating the glass ceiling of women who entered public office in the past. In addition, according to the Balanced Personnel Annual Report (2018), the ratio of women in public recruitment for state offices in 2004 was around 26%, but increased to around 46% in 2017, similar to that of men. However, the percentage of high-ranking public servants is very low at 6.5% compared to that of men in 2017, and 20.7% for public servants of grade 5 or higher. Analysis of the relative importance of the four items of gender equality showed that **Table 9** below.

Second, the four sub-factors of the 'disabled' were carried out fairwise comparison on 'employment rate of public servants with disabilities', 'employment rate for disabled in major positions', 'employment rate for women with disabilities' and 'employment rate for severely disabled'. According to a comparative analysis of the relative importance of the four sub-items of the 'disabled', the 'employment rate of public servants with disabilities' was the most important factor at 34%, followed

by 27.8% of the 'employment rate for disabled in major positions', 20% of the 'employment rate for women with disabilities', and 18.3% of the 'employment rate for severely disabled'.

Table 9. AHP results of small classification (gender equality).

Sortation	Weights	Priority
Employment rate of female public servant	0.2028	4
The percentage of women in high-ranking public servants	0.2408	3
The percentage of women at the head of a department level	0.2922	1
Female employment rate for major position	0.2632	2
Consistency index (CI)	0.0012	
Consistency ratio (CR)	0.0014	

These results are interpreted as indicating that the percentage of mandatory employment of disabled in some government agencies and public institutions has not reached 3.2%. In other words, gender equality means that women have become more active in entering public office than in the past, but disabled still have difficulty in entering public office, so it is necessary to solve these problems first. An analysis of the relative importance among the four disabled items showed that **Table 10** below.

Table 10. AHP results of small classification (disabled).

Sortation	Weights	Priority
Employment rate of public servants with disabilities	0.3392	1
Employment rate for disabled in major positions	0.2775	3
Employment rate for women with disabilities	0.1999	2
Employment rate for severely disabled	0.1834	4
Consistency index (CI)	0.0098	
Consistency ratio (CR)	0.0108	

Third, the three sub-factors of the 'science and engineering' were carried out fairwise comparison on 'the percentage of high-ranking public servants in science and engineering', 'the percentage of women in science and engineering in high-ranking public servants' and 'employment rate of major positions in science and engineering'. A comparative analysis of the relative importance among the three sub-items of 'science and engineering' showed that the 'the percentage of high-ranking public servants in science and engineering' was the most important factor with a weight of 44.3%, followed by 34% of 'employment rate of major positions in science and engineering', and 21.7% of 'the percentage of women in science and engineering in high-ranking public servants'.

These results are interpreted as the result of the fact that the percentage of high-ranking public servants in science and engineering, was only 20.8%, falling short of the government's recommended standard of 30%, and has continued to fall since 2012. In addition, as the role of science and technology officials increases at a time when the fourth industry is emerging, securing excellent science and technology officials reflects changes in the environment in the present era, where it is important.

Analysis of the relative importance among the three categories of science and engineering showed that **Table 11** below.

Table 11. AHP results of small classification (science and engineering).

Sortation	Weights	Priority
The percentage of high-ranking public servants in science and engineering	0.4429	1
The percentage of women in science and engineering in high-ranking public servants	0.2172	3
Employment rate of major positions in science and engineering	0.3400	2
Consistency index (CI)	0.0146	
Consistency ratio (CR)	0.0252	

Finally, the two sub-factors of the 'regional talent' were carried out fairwise comparison on 'the percentage of grade 7 and 9 selection of regional talent' and 'employment rate of regional talent in major positions'. According to a comparative analysis of the relative importance between the two sub-items of 'regional talent', the 'the percentage of grade 7 and 9 selection of regional talent' showed relative importance at 62.9% and the 'employment rate of regional talent in major positions' was 37.2%. This result means that despite the importance of appointing regional talent in terms of balanced national development, the selection of regional talent is still low. In addition, it is believed that the selection rate of regional talents among the current grade 5 and diplomatic open recruitment is only about 7% to 8%. Analysis of the relative importance among regional talent categories showed that **Table 12** below.

Table 12. AHP results of small classification (regional talent).

Sortation	Weights	Priority
The percentage of grade 7 and 9 selection of regional talent	0.6283	1
Employment rate of regional talent in major positions	0.3717	2
Consistency index (CI)	-	
Consistency ratio (CR)	-	

4) Calculation of weights by balanced personnel indexes

As a result of comparing and analyzing the priorities among sub-items of balanced personnel indexes based on the results of the overall survey, the 'employment rate of social integrated talent', a sub-factor of 'social integrated type', was the highest priority with a weight of 9.4396. As the second priority, 'the percentage of grade 7 and 9 selection of regional talent' was 5.3%, and the third rank was 'the percentage of women at the head of a department level' weighing 5.0%. On the other hand, 'the percentage of high-ranking public servants in science and engineering', which is a lower factor in 'science and engineering', was the lowest with 2.2 percent weight. The priorities between the sub-items of the balanced personnel indexes are shown in **Table 13** below.

Table 13. Priorities among sub-items of balanced personnel indexes (personnel administration specialist).

Sortation			Personnel administration specialist	
			Weights	Priority
Structural improvements (0.6226)	Gender equality (0.1714)	Employment rate of female public servant.	0.034931	10
		The percentage of women in high-ranking public servants.	0.041283	7
		The percentage of women at the head of a department level.	0.050094	3
		Female employment rate for major position.	0.045126	5
	Disabled (0.1461)	Employment rate of public servants with disabilities.	0.049545	4
		Employment rate for disabled in major positions.	0.040538	9
		Employment rate for women with disabilities.	0.029203	12
		Employment rate for severely disabled.	0.026794	13
	Science and engineering (0.1007)	The percentage of high-ranking public servants in science and engineering.	0.044597	6
		The Percentage of women in science and engineering in high-ranking public servants.	0.02187	14
		Employment rate of major positions in science and engineering.	0.034237	11
	Regional talent (0.1101)	The percentage of grade 7 and 9 selection of regional talent.	0.069158	2
		Employment rate of regional talent in major positions.	0.040922	8
	Social integrated type (0.0943)	Employment rate of social integrated talent.	0.094303	1
Inclusive organizational culture			0.3774	-

In sum, the 'employment rate of social integrated talent' was selected as the number one balanced personnel appointment. This result is believed to be due to the fact that only one 'employment rate of social integrated talent 'is set as a sub-item of 'social integrated type'. In addition, the lowest priority was 'the percentage of women in science and engineering in high-ranking public servants.' These results are attributed to the low percentage of female public servants in science and engineering, not to discrimination against women such as glass ceilings, but to the low percentage of female students entering science and engineering universities. And the fact that there is already a 'the percentage of women in high-ranking public servants' as a sub-item of 'gender equality' is also believed to have affected it.

5. Conclusions and suggestions

This research was conducted with the aim of developing indexes for diagnosis of balanced personnel levels in public offices. To this end, the balanced personnel index was greatly divided into structural improvement and the establishment of an inclusive organizational culture through prior research reviews domestic and abroad.

The structural improvement was based on the employment rate of employment, head of a department level, high-ranking public servants and major positions, and detailed indexes were calculated in five categories: women, disabled, science and engineering, regional talent, social integrated type (low-income, North Korean defectors, and multicultural families). To calculate the weights for each detailed index, the AHP survey was conducted on personnel administration experts and

personnel managers from each ministry, and the weights were arithmetically averaged to derive the final weights.

The research found that 62.3% of 'structural improvement' and 37.7% of 'inclusive organizational culture' were weighted in large classification items. In the middle classification items, it was found weights of 27.5% for 'gender equality', 23.5% for 'disabled', 16.2% for 'science and engineering', 17.7% for 'regional talent", and 15.2% for 'social integrated type'. In the small classification items, 9.4% of 'employment rate of social integrated talent', 5.3% of 'the percentage of grade 7 and 9 selection of regional talent' and 5% of 'the percentage of women at the head of a department level' were shown as important evaluation indicators. In addition, the 'inclusive organizational culture' was derived by allocating weights of 9.45% each for four areas: fairness, disclosure, cooperation and support. If the achievement relative to the department's target is measured, such as the indicative evaluation method of the balanced personnel index developed in this research, it may be completely different from the existing balanced personnel related statistics. Therefore, it is considered desirable to use the developed balanced personnel indexes by adjusting the interval between the allocation points by indexes and the allocation points by grade through pilot operation.

As above, this research constructs items of the balanced personnel index through prior research and designs detailed indexes. However, due to the limitations of the data, it was impossible to verify 100% of the balanced personnel index developed in this research. However, it is meaningful that surveys and others have confirmed the usefulness of the balanced personnel index, which will contribute to the achievement of balanced personnel objectives in public offices. It also suggests that organizations related to the field of science and technology can use the results of this paper to help improve the organization's performance.

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