

Original Article

Development of a Tailored Analysis System for Korean Working Conditions Survey



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ABSTRACT

Background: Korean Working Conditions Surveys (KWCS), referencing European Working Conditions Surveys, have been conducted three times in order to survey working condition and develop work-related policies. However, we found three limitations for managing the collected KWCS data: (1) there was no computerized system for managing data; (2) statistical KWCS data were provided by limited one-way communication; and (3) the concept of a one-time provision of information was pursued. We suggest a web-based public service system that enables ordinary people to make greater use of the KWCS data, which can be managed constantly in the future.

Methods: After considering data characteristics, we designed a database, which was able to have the result of all pairwise combinations with two extracted data to construct an analysis system. Using the data of the social network for each user, the tailored analysis system was developed. This system was developed with three methods: clustering and classification for building a social network, and an infographic method for improving readability through a friendly user interface.

Results: We developed a database including one input entity consisting of the sociodemographic characteristics and one output entity consisting of working condition characteristics, such as working pattern and work satisfaction. A web-based public service system to provide tailored contents was completed.

Conclusion: This study aimed to present a customized analysis system to use the KWCS data efficiently, provide a large amount of data in a form that can give users a better understanding, and lay the ground for helping researchers and policy makers understand the characteristics.

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1. Introduction

The Korean Working Conditions Survey (KWCS) is planned to identify workers' exposure to working factors by investigating the working conditions of Korean workers nationwide. Looking into the history of KWCS, the KWCS for workers was conducted as a nationwide sample survey to contribute to industrial health and safety policy establishment for the improvement of working conditions in 2006 [1]. In 2010 [2] and 2011 [3], the KWCS was also carried out to collect additional data necessary for changes and policy decision making on working conditions. The following limitations in storing and managing the data collected from the KWCS have been recognized as obstacles to efficient KWCS data utilization.

First, there is no computerized system to manage the data from the KWCS. The only method that uses the KWCS data currently involves downloading the processed data via the homepage of Statistics Korea. However, not many people know that Statistics Korea provides KWCS data; although users know where they can get the KWCS data, ordinary users who are not experts in analysis or interpretation may have difficulty in understanding the meanings of these data and in gaining knowledge because these are mass basic data that have gone through cleansing. Second, most interactive applying statistical technique to open data are limited to one-way communication, which provides precalculated results for the users to select from; it is difficult to induce users' participation and constant attention through one-way communication [4] based on a service provider's design without considering users' need. In

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contrast, a two-way communication system can perform an analysis of all possible combinations of variables, allowing diverse exploration according to users' interests. For example, some users may wonder about the employment contract type for people under the same conditions (occupation, region, etc.) as theirs, while others may wonder about the health conditions of individuals whose age is similar to theirs, including their smoking or drinking rate. Current services cannot reflect such requirements. Third, it is important to go beyond one-time provision of information. The KWCS data aim to be open to general users, as well as to researchers and policy-makers; satisfy their right to know; and provide useful information. However, it is difficult to expect general users' constant participation and continuous use of the current KWCS data due to limited information and the absence of optimum service to arouse interest.

This study then aims to suggest a web-based public service system that enables ordinary people to make greater use of the KWCS data, which can be managed constantly in the future. To achieve the main goal of our study, two objectives were created: the first was to design a database and establish an analysis system so that general users can be provided with the contents of analysis based on the KWCS data, and the second was to present an analysis algorithm that can reflect users' needs through a two-way communication system [5].

2. Materials and methods

2.1. Data acquisition

2.1.1. Data source

The first phase data of the KWCS in 2006 analyzed in this study included 10,043 cases [1], the second phase data in 2010 included 10,019 cases, and the third phase data in 2011 included 50,032 cases [3].

2.1.2. Data processing

Characteristics of the KWCS data were classified into sociodemographic and working conditions. The sociodemographic characteristics consist of five items—gender, age, industrial type, occupation type, and region—and the working condition characteristics consist of six items—labor structure, working pattern, work satisfaction, work environment, and the health and nutrition indices [6]. On the basis of this data classification, a database schema was drawn.

The database was established as shown in Fig. 1. First, the basic structure was classified into sociodemographic items and working condition items from the raw data. Second, we defined and identified the input and output entities. Data from sociodemographic items were difficult to analyze because the data were either continuous with an undefined range or discrete with a lot of permissible values. Thus, they were clustered on the basis of similarity among data. For example, the typical continuous data “age” was divided into three clusters—< 30 years, 30–39 years, and 50 years or older—while the permissible values of discrete data were divided into 10 or fewer categories. They constituted an input entity. By contrast, for the KWCS data of working condition items, there was a well-defined classification system for the values of discrete data. Thus, they were directly reflected in the design. For example, the labor structure entity included properties such as employment contract type and continuous working period. They constituted an output entity. Finally, databases were designed and built as having data with all pairwise combinations between the sociodemographic characteristics (input entity) and the working environment characteristics (output entity).

We applied a clustering technique for the major items of the questionnaire, including age, gender, service period, income,

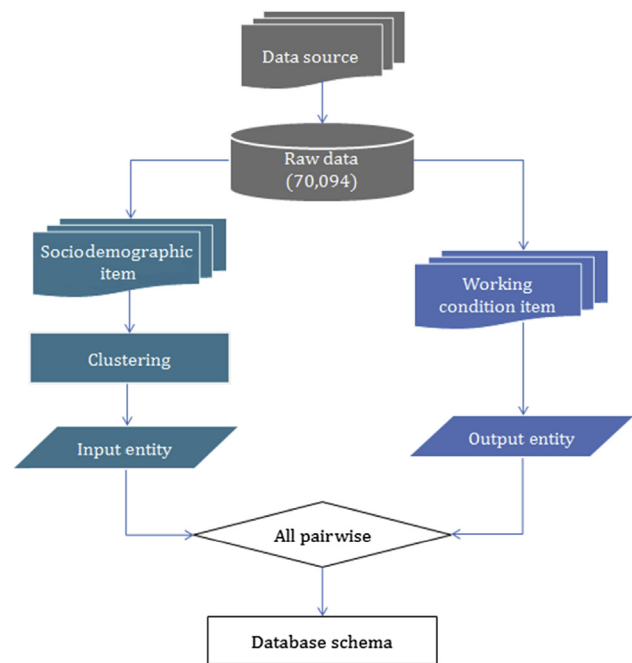


Fig. 1. Flowchart for developing the database schema.

region, industrial classification, employment contract type, and labor hours. The classification technique was also applied to guide new KWCS data into the constructed database. In other words, while clustering serves to be conducted for grouping in the given data, classification is a technique used to judge to which group new data or information will belong when the new data or information comes in from the grouping classification system [7,8]. The purpose of classification, based on the user's (new) inputted information, must be to obtain information on user's similar group and reference (control group) (Fig. 2).

2.1.3. Data representation

Information visualization (or infographic) [9,10] is a methodology used to express data that contain certain information or knowledge, and to show the data efficiently and conveniently. Using graphical factors, infographics aims to express and efficiently convey information to users so that significance can be extracted from the information. Our study suggested to users how to apply a dress code, which was friendly and more readable through “avatars” [11,12] for reflecting themselves. In other words, we used this infographic method to transform users' input (gender, age, occupation type, etc.) into information. The dress code of users' avatar was changed according to the input to set “my own appearance.” For example, if a user wants to represent a man of < 30 years in the industrial category of financing and insurance as an office worker, the mascot is a green avatar (which means a male) in the dress code of a protective helmet with one logo (which means having an age of < 30 years), and in a white shirt (which means an office worker) [13].

2.2. Analysis algorithm

Johari's window is a conflict analysis method based on communication. It examines conflict causes on the basis of communication in a relationship between the user and others [14,15]. Following this method, the two-way communication proposed in this study functions in a way where conflicts (problems) are solved by receiving feedback from others after exposing oneself

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