

Designing a Complex System of Coffee Shop by Using Cognitive Work Analysis to Evaluate the Operations

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Abstract

The development of coffee shops is increasing whether in Europe or Asia. The system in the coffee shop needs to be improved as the human mobile is getting higher and people have no more time in waiting. The demand of consumers for coffee shop systems is getting wider so a system in it needs to be discussed. Cognitive Work Analysis (CWA) is expected to outline parts of the system so that they can be extracted to analyze and evaluate the existing system. This tool is a method to analyze industrial complex systems which is useful for industrial design. CWA are extracted into five phases which have different aims in each phase. The result of this research produces seven functions and five situations in control task analysis. In collecting the data, this research used brainstorming as a qualitative method and found four categories in WDA, seven categories in CTA, and nine categories in WCA. The coffee shop system needs to be improved as the human mobile is getting higher and people have no more time to wait. The customer demand for coffee shop systems is getting vary so an improvement needs to be discussed. CWA is expected to outline parts in the system so that it can be extracted to analyze and evaluate the existing system. This tool is a method to analyze industrial complex systems which is useful for industrial design. The result of this research produces seven functions and five situations in control task analysis.

Keywords: Cognitive Work Analysis, Work Domain Analysis, Coffee Shop System.

Abstrak

Perkembangan kedai kopi semakin meningkat baik di Eropa maupun Asia. Sistem di kedai kopi perlu diperbaiki karena mobilitas manusia semakin tinggi dan orang tidak lagi memiliki waktu untuk menunggu. Tuntutan konsumen tentang sistem kedai kopi semakin luas sehingga sistem di dalamnya perlu dibahas. Cognitive Work Analysis (CWA) diharapkan dapat menguraikan bagian-bagian dalam sistem sehingga

dapat digali untuk menganalisis dan mengevaluasi sistem yang ada. Alat ini merupakan metode untuk menganalisis sistem kompleks industri yang berguna untuk desain industri. CWA diekstraksi menjadi lima fase yang memiliki tujuan berbeda di setiap fase. Hasil penelitian ini menghasilkan tujuh fungsi dan lima situasi dalam analisis tugas kendali. Dalam mengumpulkan data, penelitian ini menggunakan metode kualitatif brainstorming dan menemukan empat kategori di WDA, tujuh kategori di CTA, sembilan kategori di WCA. Sistem kedai kopi perlu ditingkatkan karena ponsel manusia semakin tinggi dan orang tidak punya waktu lagi untuk menunggu. Tuntutan pelanggan terhadap sistem kedai kopi semakin beragam sehingga perlu adanya pembahasan untuk perbaikan. CWA diharapkan dapat menguraikan bagian-bagian dalam sistem sehingga dapat digali untuk menganalisis dan mengevaluasi sistem yang ada. Alat ini merupakan metode untuk menganalisis sistem kompleks industri yang berguna untuk desain industri. Hasil penelitian ini menghasilkan tujuh fungsi dan lima situasi dalam analisis tugas kendali.

Kata Kunci: *Cognitive Work Analysis, Work Domain Analysis, Sistem Kedai Kopi.*

1. Introduction

Coffee time has become a lifestyle currently, not only in Europe the development of coffee shops has also spread in Asia. As the business of coffee shops is increasing, the competition between them also getting higher. The system needs to be improved to create a good system to prevent the losses of consumers. The coffee shop is a kind of restaurant that has many food options, cakes, and beverages to be served to customers. All the system in a coffee shop is demanded by the customers. However, with the growth of coffee shops worldwide, some complicated problems such as customer service, management, and competition have affected this market. The reason why it has to be analyzed is that complex work can never be avoided so a specific process to support these situations is needed (Dadashi et al, 2010). Therefore, to explain the system, this report demonstrates the analysis of café shops as five phrases of CWA to identify the abilities and constraints of both individuals and organizations including focusing on cooperation between people.

Cognitive Work Analysis (CWA) is a framework that is considered a complex socio-technical system for the analysis, design, and evaluation of the interfaces. CWA was created by Rasmussen and colleagues and then developed by Vicente (Naikar, 2017). It is defined as the set of boundaries and constraints that contains five phrases: Work Domain Analysis (WDA), Control Tasks Analysis (CTA), Strategies Analysis (SA), Social Organization and Cooperation Analysis (SOCA), and Worker Competencies Analysis (WCA). This framework points out to cognitive aspects of work, functional capabilities, and constraints (Suroso and Revadi 2019; Jenkins et al. 2018).

Work Domain Analysis (WDA) is the first phase which considers the environment in the workplace and assesses the basic constraints (McIlroy et al. 2011; Jenkins 2018). This explains the system at each level that can be connected by means-ends relationships from the how-what-why method. At the highest level from Fig.1 is the functional purpose which is to provide coffee and hot food because of the reason for the existence of the café shop. The second level from the top, value and priority measures, customer service, management, competition, and policy and strategy should be the standard to meet its purpose. At the middle level of the hierarchy, the purpose-related function is the general function that the system must be operated and coordinated in the café shop. An Object-related process is the second level from the bottom. It is the physical object that the system can afford including directed-linking to the physical objects. At the lowest level, Physical objects are the physical elements of this hierarchy. The linking of each level requires answering the how, what, and why questions. For example, the method that can answer the question “how to make hot food” is to heat by microwave and/or heat by oven because it is the process of providing the hot food.

2. Method

2.1 Overview of Study Design

This study was done by using a brainstorming method that involved a key person of coffee shop system maker. This person was chosen because they have a great impact on the system design. Experience related to the coffee shop complex system should be had by the key person in charge of this study. The result of brainstorming was recorded in a voice as long as it was held. Therefore, the researcher will take notes of the recording to be a consideration in creating CWA.

2.2 Brainstorming Method

A tool famous for creative thinking is brainstorming. It is called a casual discussion for creating new ideas. Brainstorming is also believed as a technique of problem-solving to maximize group creativity. There are two types of brainstorming and they should be selected based on the benefits between them (Naser et.al 2015; Lukmandono et.al 2020).

2.2.1 Structured Brainstorming

Members of the group sit in a circle and there is a leader who facilitates brainstorming. The facilitator will write their ideas in a rotational form which means each member should contribute an idea. However, if the idea has not come up, it can be passed and later should be mentioned.

2.2.2 Unstructured Brainstorming

Members of the group sit in a circle or other arrangement. There is no order of response to the idea and problem. The facilitator only has a role as a motivator to escalate the ideas. Unstructured brainstorming was used in this part because, in this qualitative research, a brilliant idea needs to be explored.

2.3 Participant

Participants involved in this research are the owner of the coffee shop itself, the barista, the server, and the cashier.

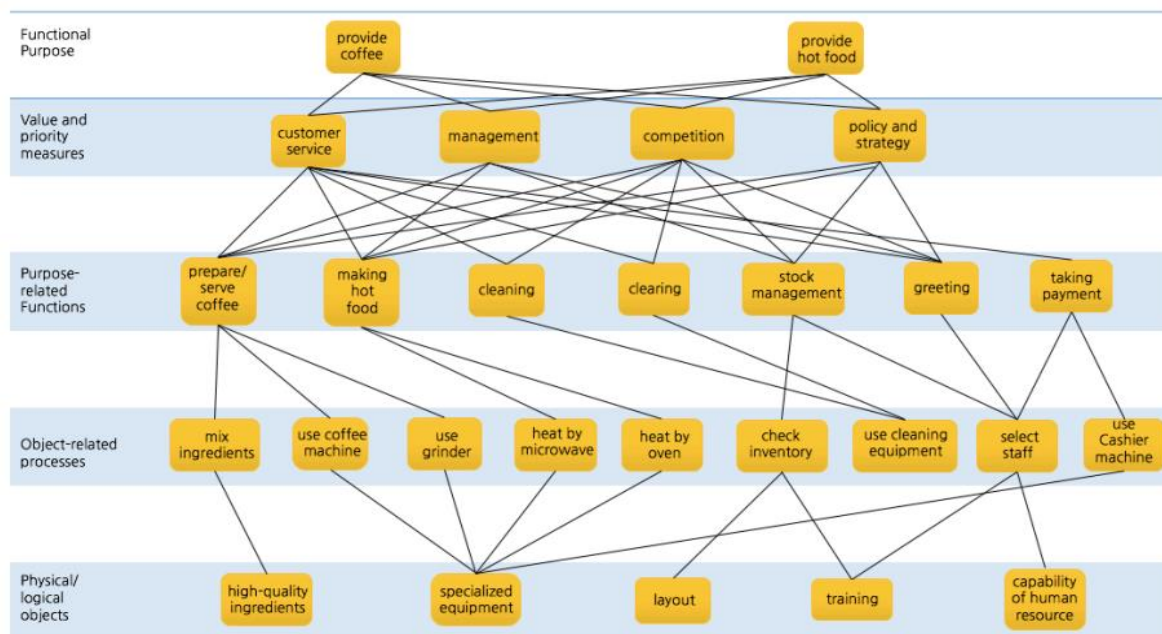
2.4 Procedure of Brainstorming

There are several steps to brainstorming such as (Al-Samarraie and S. Hurmuzan 2018):

- Person in charge of identification to develop the coffee shop system
- Ethics form arrangement before data collection
- Ethics form signing to all the participants involved
- Start the structured brainstorming

3. Results and Discussion

3.1 Work Domain Analysis



Source: Hastawati and Saruda, 2021

Figure 1. Work Domain Analysis of Coffee Shop

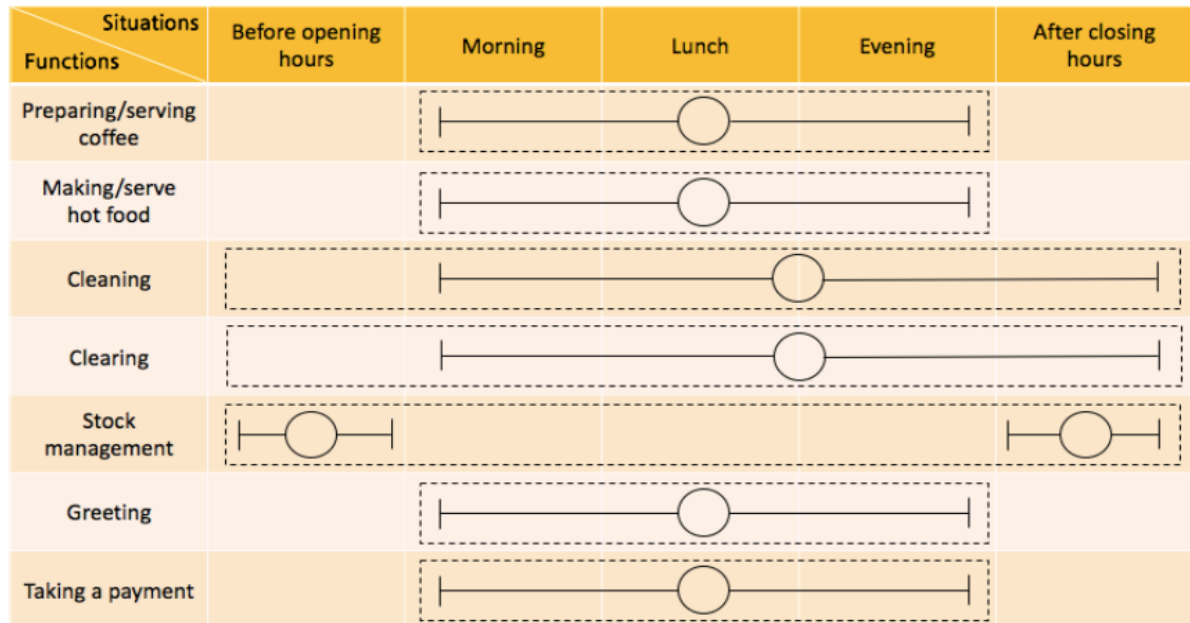
The first step in the CWA is usually called Work Domain Analysis (WDA) which is used for structuring the information. The step in WDA is divided into five stages, those are domain purpose, domain value, domain function, physical function, and physical object. All five levels are linked into the next step so that the interaction will be get. The main purpose of the WDA is to explore the environment of the system that will be developed and border the constraints to keep the system focused.

For example, in Fig.1 at the level of “customer service“ this explains the “what“ question. Moving up a level in the hierarchy to “provide coffee“ explains the “why“ question, and moving down a level from the entry point to “prepare/serve coffee“ explains the “how“ question.

Therefore, “customer service“ serves the end of “provide coffee“ by the way of “prepare/serve coffee“ corresponding means-end relationship for other entry points in the hierarchy as well.

3.2 Control Task Analysis

The second step in the CWA is control task analysis which is used to give the several activities that might happen in the complex system. Figure 2 shows that control task analysis is divided into two axes, the horizontal shows the situation, and the vertical axis shows as function. The link between work domain analysis and control task analysis was obtained by taking the purpose-related function in the third level of WDA to become a function in CTA.



Source: Hastawati and Saruda, 2021

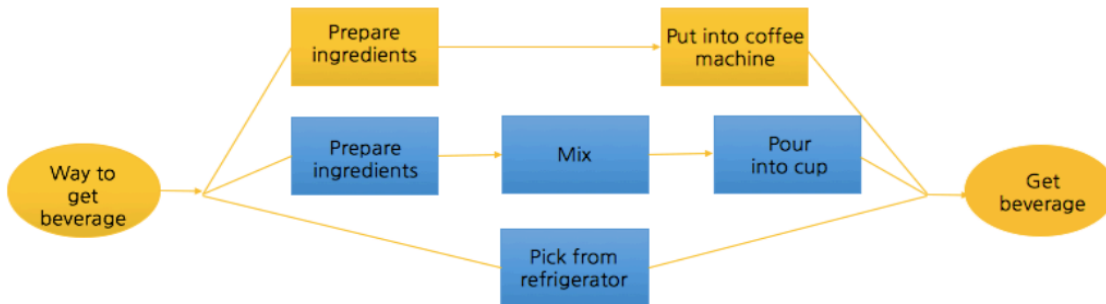
Figure 2. Control Task Analysis of Coffee Shop

The icon inside the CTA box shows the relationship between situation and function. The dashed line shows that it can be relevant, the circle shows that it is usually relevant, and the blank box shows that it is impossible to happen. The greeting function in the sixth row shows that the dashed line is in the middle part of the box. There are only three situations in the greeting function that might happen among the five functions. Those are morning, lunch, and evening situations that possibly happened when the greeting function was applied. Meanwhile, the others are impossible to happen.

3.3 Strategies Analysis

The third step in the WDA is strategies analysis which is used to analyze how things are done by several steps. There are possibilities the user can do different steps even if the destination are same. In this project, the researcher chose three goals related to the coffee shop complex system, those are getting beverages, getting hot food, and making payments.

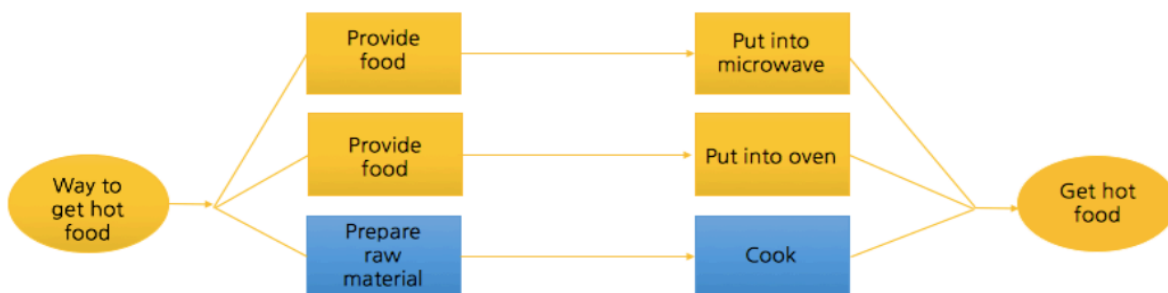
Strategies analysis aims to determine the different steps to get the beverages. There are three different steps, the first step is to prepare the ingredients and then put them into the coffee machine, the second step is to prepare the ingredients - mixing the coffee - and pour them into the cup, the third step is to pick the coffee from the refrigerator.



Source: Hastawati and Saruda, 2021

Figure 3. Strategies Analysis to get beverage Coffee Shop

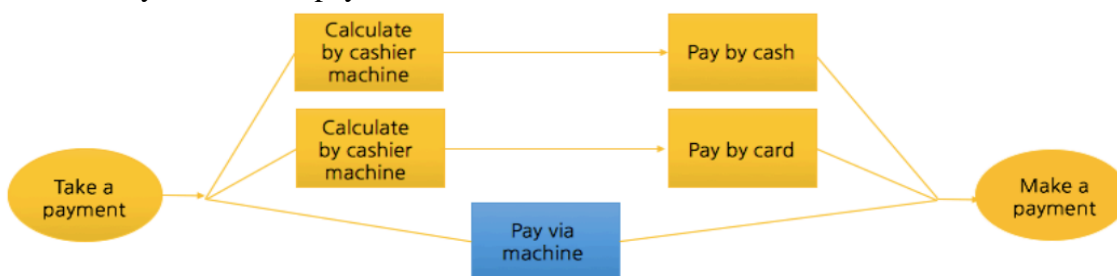
The second strategy analysis in the coffee shop complex system is to get hot food. There are three different way and all of them contains two steps. The details can be seen in Figure 4.



Source: Hastawati and Saruda, 2021

Figure 4. Strategies Analysis related to getting hot food Coffee Shop

The third strategy analysis is to do the payment. There are three different ways to make the payment, such as pay by cash, card, and machine. Therefore, from Figure 5 can be seen that the shortest way is to do the payment via a machine.



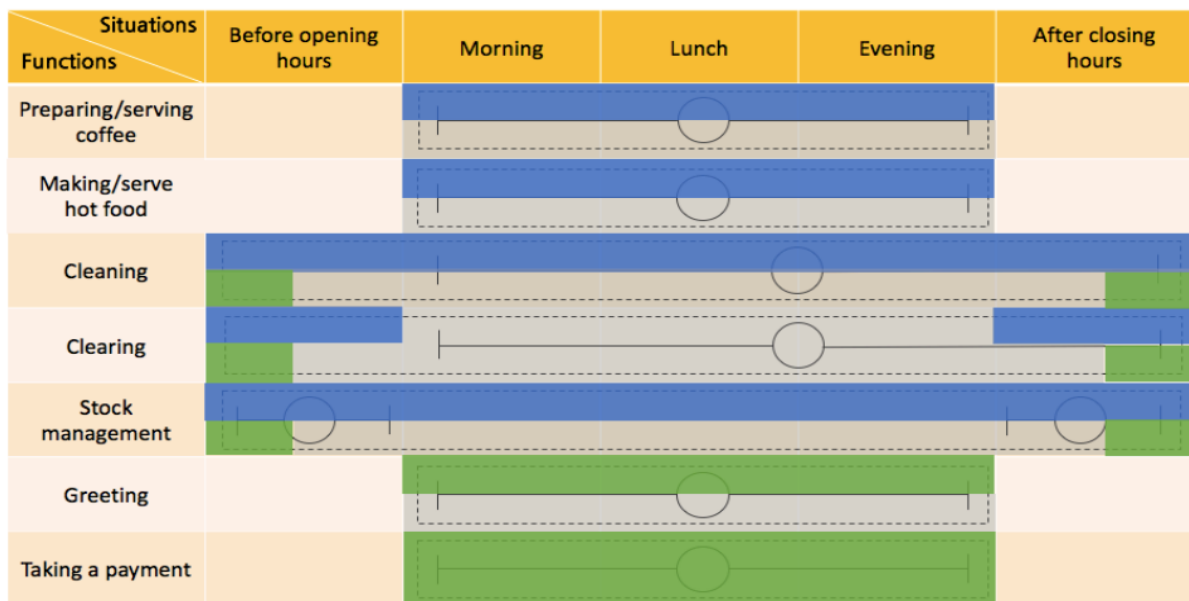
Source: Hastawati and Saruda, 2021

Figure 5. Strategies Analysis related to making a payment in the Coffee Shop

3.4 SOCA

This step will show the staff what will be needed in each situation and case. Sometimes there will be more than one staff in each situation and function. It will help to cooperate to

succeed in the system. In this term, there will be three different staff which sign in different colors such as in Figure 6. There are three different color categories as an agent, barista in the blue colour, server in the green colour, and cashier in the green colour. The barista dominates in the activities and has five responsibilities, such as preparing the coffee, making hot food, cleaning, and managing stock during operation time, and clearing during closing hours. The of the server is to help the barista when serving the food and beverages, cleaning, managing stock clearing the table, and giving a greeting to customers. However, the barista is not involved in giving a greeting to customers and processing the payment. In addition, all of them are responsible for cleaning, clearing, and management of the stock after operation time.



Source: Hastawati and Saruda, 2021
 Figure 6. SOCA of Coffee Shop

3.5 Worker Competencies Analysis

The final phase of CWA is Worker Competencies Analysis (WCA) which is considered a psychological constraint related to how people recognize and respond to the process by focusing on skill-based behaviors, rule-based behaviors, and knowledge-based behaviors. The table below shows the association between object WDA and SRK. For example. Mixing the ingredients requires knowledge about which type of ingredients will be chosen to provide coffee and how to serve the coffee when the ingredients are lacking. Therefore, it requires the ability of the barista to serve the coffee while the other functions might not require the skill as much as this process, the example is checking the inventory will request rule-based behaviors by checking the checklist to prepare ingredients. Moreover, a thing to point out is all the processes that are requested by the workers to provide meals and beverages need to be included in the training.

Table 1. Work Competencies Analysis of Coffee Shop

Object related process	Skill	Rule	Knowledge
Mix ingredients	Pick the ingredients and mix them	Infer from training which elements should be used and the recipe	Understand which ingredients should be used when lacking ingredients and the reason why should use this
Use Cofee Machine	Put the bean coffee and other ingredients into the machine, press the menu button	Deduce from instruction and training what method should be used	Recognize the different types of coffee. Understand the instructions on how to use it, how long it should be checked in the system, how to fix it, the need for using the machine, the capabilities machine
Use Grinder	Pick the bean coffee put it under the grinder and wait for a while	Deduce from guidance. If the coffee was ground, then put it into the coffee machine	Recognize the different duration processing. Understand the instructions on how to use it, how long it should be checked in the system, how to fix it, the need to use the machine, the capabilities of the machine
Heat by microwave	Select the menu on the screen to heat food. Know how long the type of food should be heated	Deduce from the recipe. Set the timer, If there is an alarm from the microwave, the food ready to serve	Recognize the different duration processing. Understand the instructions on how to use it, how long it should be checked in the system, how to fix it, the need for use the machine, the capabilities of the machine
Heat by oven	Rotate the time to heat food. Know how long the type of food should be heated	Deduce from guidance and set the timer	Recognize the different duration processing. Understand the instructions on how to use it, how long it should be checked in the system, how to fix it, the need for use the machine, the capabilities of the machine
Check Inventory	Check the material when necessary	Observe the material and use experiences to manage stock. Look at the table to check the product	Understand the need for management of the inventory, how to manage the space, and how frequencies to check. Ensure the material will be enough to use
Use Cleaning Equipment	Select the equipment to clean the workplace	Deduce from training how to use the type of equipment	Understand the importance and capability of cleaning equipment
Select Staff	Select the individual physical and mental characteristics	Recruit the new employee by human resource	Understand the importance of the different individual characteristics and what information should be decided to recruit a new employee

Object related process	Skill	Rule	Knowledge
Use cashier machine	Calculate the price and use the machine	Deduce from instruction and experiences to use it	Understand the need for calculations, the abilities of machines, and the information that is required to calculate

Source: Hastawati and Saruda, 2021

4. Conclusion

CWA is used for analyzing the complex socio-technical system which consists of five phases to analyze, design, and examine the aspect of the system itself in a few parts such as user interface design and evaluation; human error management, and training need analysis. The first phase of CWA is WDA which is outlined in the abstraction Hierarchy and has five different levels and produces categories of customer service, management, competition, and policy strategy. In the second phase, CTA uses a contextual activity template to analyze how things are done by several steps and find out seven functions. The strategies analysis selected three significant activities to show how the process works. In SOCA the function of the three workers will show how they cooperate while doing the task. And the last, WCA outlines the connection between the process and SRK taxonomy.

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