

WANTS CHAIN ANALYSIS: HUMAN-CENTERED METHOD FOR ANALYZING AND DESIGNING SOCIAL SYSTEMS

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ABSTRACT

In the present paper, WCA (Wants Chain Analysis) is proposed by extending CVCA (Customer Value Chain Analysis). CVCA is a method for visualizing relationship among stakeholders for analyzing existing social systems and designing new social systems. WCA is a method for visualizing wants and needs of stakeholders in CVCA. In WCA it is shown that people's wants or needs are finally realized through the looped and linear chain of relationship among stakeholders. With various examples, effectiveness of WCA is shown by describing that characteristics of business/social system structure can be clearly visualized using WCA. It is described that WCA is useful when it is used for analyzing existing systems as well as creating new systems. It is also shown that "think of others" should be more and more important for humans' satisfaction and happiness in the near future. WCA can be a tool for clarifying what is for others.

Keywords: Wants Chain Analysis, System Design, Needs, Wants, Customer Value Chain Analysis

1 INTRODUCTION

Technological and social systems have become large scale and complex due to globalization driven by internet technology and social change. Accordingly, the range of people's needs or wants has widened. Hence, there is a need for business systems and non-profit organizations which reflect the various needs of customers and social environment. In particular for designing consumer products or services, it is needed to design not only products/services themselves but also business model of products or services corresponding to various requirements of customers and environment. In order to design products or services in accordance with various requirements, numbers of researches have been conducted for developing design methodology and method. Ishii et al. [1] used numbers of tools for concept design of products in graduate school education. Customer Value Chain Analysis (CVCA) is one of the methods developed by Donaldson as a tool for engineering design [2]. In the CVCA, relationship of stakeholders and flow of various values including money and products are visualized. So it is an effective tool for understanding existing technological and social systems as well as designing new types of systems. Its usage is targeted for product development teams engaged in group discussions to express their thoughts and generate ideas during meetings such as design reviews and presentations. While CVCA focuses on "how" the stakeholders are related to each other, it does not explicitly focus on "why" the system structure (relationship among stakeholders) is formed. In order to solve this problem, we should analyze why and how of human behavior. Human behavior is motivated by various needs that manifest consciously or non-consciously. Hence, people's needs in their mind should be analyzed and visualized, even though it is not easily quantifiable. Various psychologists including Murray [3] and Maslow [4][5] have classified human's needs. However, since psychologists' interests have been on person's mind, they do not utilize those results for analyzing or designing social systems where human relation plays an important role. Also, various subjects and objects of needs that will be explained in detail in the next chapter have not been analyzed. Hence, in the present paper, a new method is proposed for analyzing stakeholders' relationship focusing on "why" or the motivation. We call it "Wants Chain Analysis" (WCA) because people's "wants" or "needs" are finally realized through the looped and linear chain of relationship in WCA. Kotler defined that needs are the basic human requirements such as air, food, clothing, recreation, education, and entertainment as Murray and Maslow also mentioned, whereas these needs become wants when they are directed to specific objects that might satisfy the need [6]. In WCA, general needs and specific wants are both used case by case. WCA is a method made by adding humans' wants or needs on CVCA. WCA is useful for analyzing and designing complex business models or non-profit social systems models with numbers

of stakeholders having various needs or wants in mind. In chapter two, background of personal psychology on needs is briefly explained. In chapter three the method of WCA is described in detail. In chapter four, it is shown that WCA can be used for analyzing existing systems as well as creating new systems. Then in chapter five, this study is summarized.

2. ANALYSIS OF PERSONAL NEEDS

In order to propose WCA by adding needs or wants on CVCA, we should first clarify what the basic human requirements are. Hence, psychological researches of personal needs are briefly reviewed in the following.

Murray categorized human needs [3] by primary and secondary needs. The primary needs are based on biological demands, such as the need for oxygen, food, and water. The secondary needs are generally psychological, such as the need for nurturing, independence, and achievement.

Maslow succeeded and improved the idea by assuming that the needs form hierarchy known as “Maslow’s hierarchy of needs” [4]. Maslow assumed five levels of needs: physiological needs; safety needs; belongingness and love needs; esteem needs; and self-actualization needs from the bottom to top. He also added self-transcendence need later. We don’t mention this need now because it is metaphysical. He thought that upper needs become important for person when the lower needs are mostly satisfied. One of the criticisms is that Maslow’s idea has not been verified. However, from a classification point of view, five steps can be used as categories. We also note that Maslow described two other needs outside the hierarchy of five needs. Those are called basic cognitive needs. They are desires to know, understand and fulfill the aesthetic needs [5]. Hence, from classification point of view, we utilize seven categories of needs of humans as shown in Table 1 and Figure 1.

Table 1 Classification of personal needs based on Maslow’s classification

Physiological needs (PHY)	breathing, food, water, sex, sleep, homeostasis and excretion
Safety needs (SAF)	security of body, employment, resources, morality, family, health and property
Belongingness and Love needs (BEL)	friendship, family and sexual intimacy
Esteem needs (EST)	self-esteem, confidence, achievement, respect of others and respect by others
Self-actualization needs (ACT)	morality, creativity, spontaneity, problem solving, lack of prejudice and acceptance of facts
Desires to know and understand (KNO)	satisfy curiosity, to know, to explain and to understand
Aesthetic needs (AES)	aesthetic needs and needs of beautiful surroundings

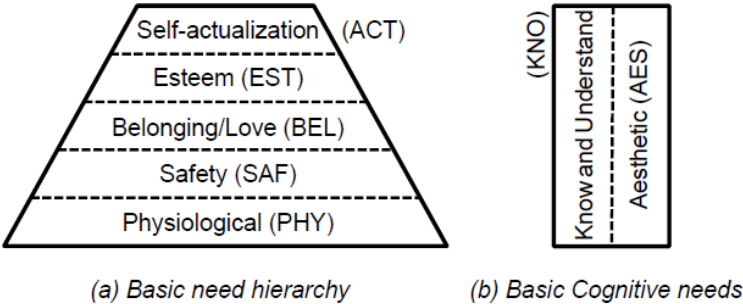


Figure 1 Maslow’s basic need hierarchy and basic cognitive needs

One important thing we noticed is that subject and object of those needs are not usually focused on in psychological studies. For example, when we are discussing “safety” needs, we usually think of one’s own safety.

Some may state that the object of personal needs is usually himself or herself because humans are fundamentally selfish. Others may say that there exist altruistic needs for others. Similarly, subject of needs do not need only be themselves but also be others. Following example of “safety” shows that, if we consider relationship among people, safety needs appear in four cases as follows;

- (1) I want to protect myself.
- (2) I want someone to protect me. ex) *I want car companies to produce safe cars for me.*
- (3) I want to make someone safe. ex) *I want to donate to the flood victims.*
- (4) I want someone to protect someone else. ex) *I want my son’s teacher to provide good education to my son.*

Those four situations can be described by a two-by-two matrix based on the subject and the object of needs as shown in Figure 2. In the figure physiological needs (needs of food) are illustrated. Symbols in the hearts represent seven categories of needs described above. They will be used in WCA figures. Colored heart represent that the subject of needs is himself/herself. On the other hand, white heart mark with colored outline represent that the subject of needs is someone else. Red color represents that object of needs is he/she, whereas green color represents that object of needs is someone else (Monochromic version will be shown in Figure 5 (b)). Four different features of heart mark will be important for analyzing relationship of stakeholders using WCA.

For designing systems taking into account various stakeholders, structure of personal needs described in Figure 2 should be considered. Hence, in the next chapter, we visualize stakeholders’ needs using seven categories shown in Table 1 and the two by two matrix shown in Figure 2.

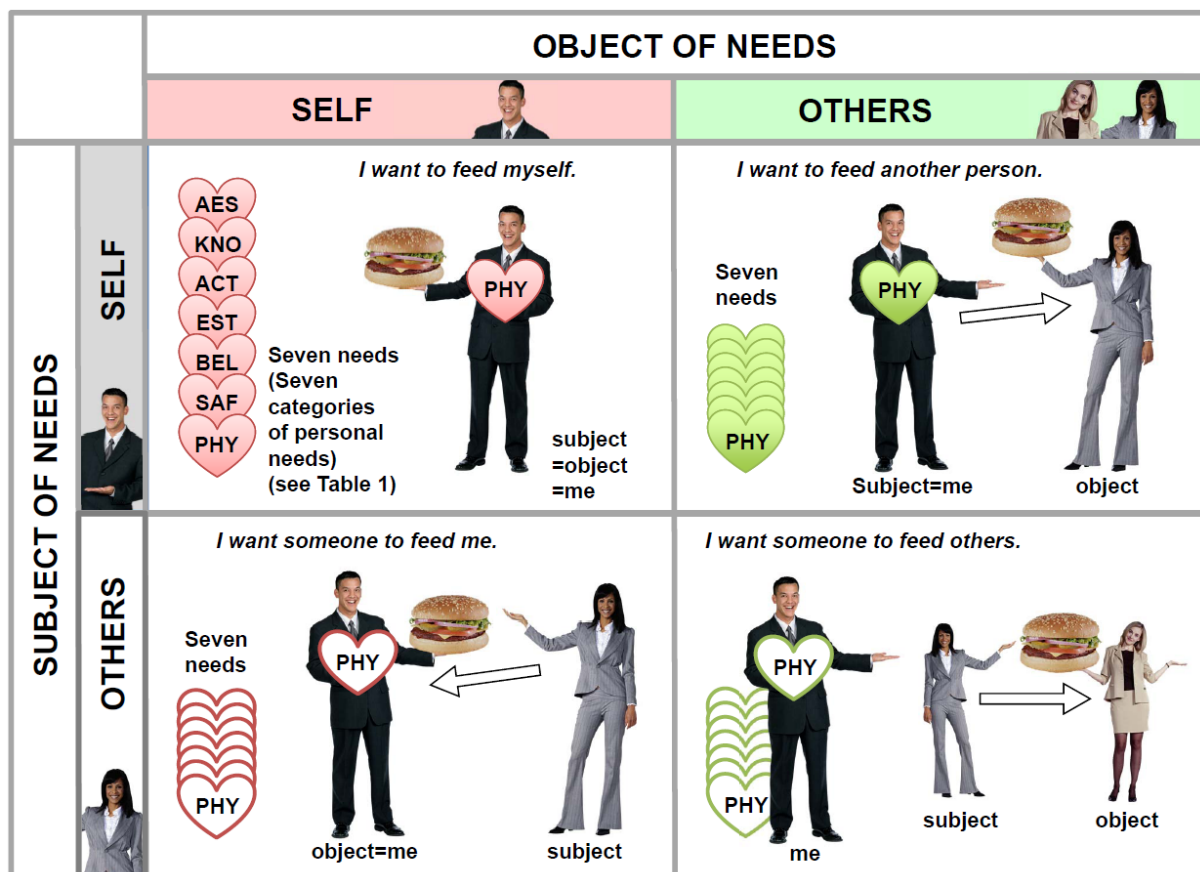


Figure 2 Seven Personal Needs and Relationship of Personal Needs Described in Subject/Object Matrix

3. HOW TO USE WCA

3.1 Procedure and rule of WCA

First half of the procedure of WCA is almost the same as Customer Value Chain Analysis (CVCA). Steps for conducting WCA are as follows (also see examples of WCA shown in Figure 3):

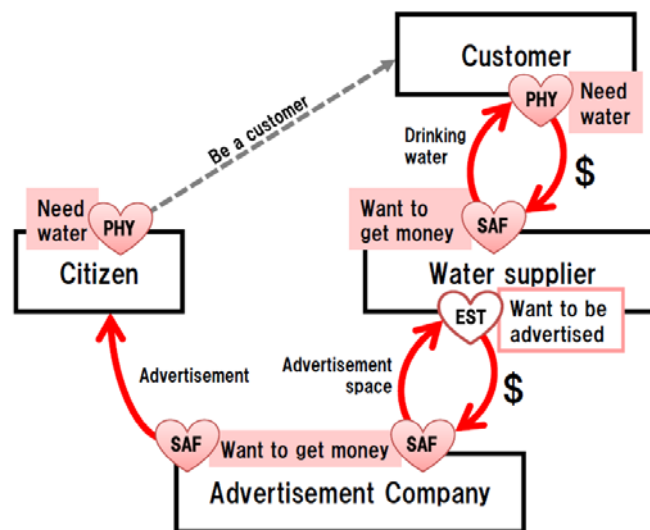
1. List the main stakeholders involved in developing products or services. Stakeholders can be humans, company, government, NPO/NGO, school, private activities and any other organization.
2. Draw arrows for representing flow of money, information and things between stakeholders.
3. Draw a heart figure at the root of each arrow with color representing subject/object of the needs and the enclosed text representing one of the seven needs (see Fig. 2). Adjacent to the each heart figure, delineate the detailed needs in a rectangle of the same color as the heart figure. If it is difficult to decide one of seven needs, you can write plural heart marks and arrows (see “Customer” of Fig. 3 (b)). Color of arrows should be replaced with the color of the heart at the root as well. If there are needs or wants of stakeholders that is not related to any of the arrows, draw a heart only as shown in a red heart of citizen in Figure 3 (a) and a red heart in “people without safe water” in Figure 3 (b). Heart alone means that the needs or wants are not in relation to his/her action.
4. If you need to add any explanation, you may add figures or text (see dotted line from “People” to “Customer” in Fig. 3. WCA in its current form does not focus on highlighting dynamic changes so dotted line was added to show historical change). If you want to change the thickness of arrow to represent how much money or information is flowing, you may change it accordingly (see arrows between “Customer” and “Volvic” in Fig. 3 (b)).
5. When the figure is complete, verify the relationships using the following rules. If there exists a heart without satisfying following rules, it means that the needs or wants of the heart is not satisfied.
 - (1) One of the arrows should be facing red hearts or white hearts with red outline because those hearts mean that they have their own wants or needs.
 - (2) One of the arrows should go out from green hearts or white hearts with green outline because those hearts means that they want to do something for others.
 - (3) Red arrow is often a part of a loop because the needs of stakeholders at the base of the arrow (red hearts or white hearts with red outline) is usually satisfied by someone’s action. Arrows of the loop should be facing the same direction, i.e., direction of all the loops should be completely clockwise or counter-clockwise. The case when a red arrow is not a part of a loop is that there exists green heart or white heart with green outline without having arrows facing that heart because green heart does not need arrows facing from somewhere.
 - (4) Green arrow does not have to be a part of a loop because it represents a need from someone to others. It sometimes forms chains.
 - (5) When there is a white heart with red outline, there should be a colored heart with an arrow facing the white heart because the need of white heart with red outline means that he/she needs someone’s help.
 - (6) When there is a white heart with green outline, there should be a colored heart at the end of the chain of arrows because the white heart with green outline means that he/she want someone to satisfy his/her needs. The arrow from the heart is to relay his/her wish. Hence, at the end of the relay, green heart should be there to realize their wish.

3.2 Example of WCA

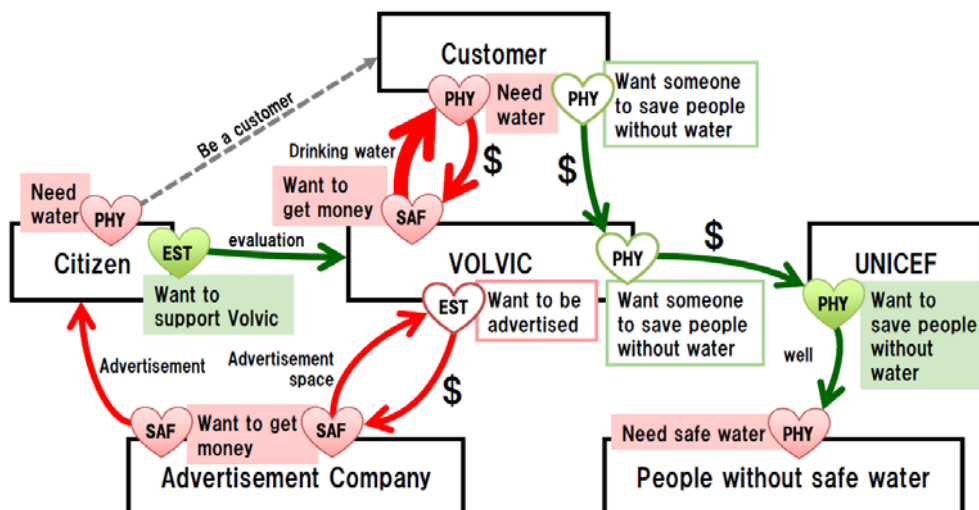
Let us explain in detail the example of the WCA shown in Fig. 3. Fig 3 (a) shows a usual business model of selling things. Stakeholders are customer, seller (in this case drinking water supplier), advertising company and citizen in general. Water source is omitted. Similarly, other stakeholders are sometimes omitted. They can be added if necessary. The most fundamental part of this figure is the relationship between the customer and the water supplier. The customer wants to buy and the supplier wants to sell. What are their personal needs or wants? The customer usually wants to drink water because he/she is thirsty. It is a physiological need. Hence, the customer’s heart shows “PHY”. The color of the heart is red because the subject and object of the need is himself/herself. The supplier sells water to get money. What are the supplier’s needs or wants? Many reasons are plausible. If the

obtained money is used for paying housing loan, it can be a safety need to maintain the activity of the company. If the money is used for saving people in trouble, it can be a need for self-actualization because it is related to morality. Hence, it is sometimes difficult to decide which need should be selected. In such a case, you can select one you think is more important or include both. One must note that WCA is not a deterministic tool but a tool for supporting design thinking. Especially, if you use WCA for creating new business or social model, you should not mind the difference by small choice.

Fig. 3 (b) is an example of a Cause Related Marketing (CRM) [7]. CRM refers to a type of marketing involving the cooperative efforts of a for-profit business and a non-profit organization for mutual benefit. This case shows “Drink 1, Give 10” campaign (or 1L for 10L campaign) by Volvic. This campaign is to bring safe drinking water to children in Africa. For each liter of Volvic bottled water, Volvic makes a donation of four cents to fund UNICEF to provide at least ten liters of clean, safe drinking water to residents of Ethiopia, where more than half the population lack access to safe water and sanitation facilities.



(a) Business model of usual drinking water supplier



(b) Business model of typical CRM, “Drink 1, Give 10” Campaign by Volvic

Figure 3 Examples of WCAs for business

Comparing the Fig. 3 (a) and (b) paying attention to colors, you can clearly see the difference. Color of Figure 3 (a) is red only. Red color represents needs for self. So, fundamentally, red needs are “selfish” needs. On the other hand, in Figure (b) green heart and arrows are added to Figure (a). Green hearts represents needs for others. Hence, they are relatively altruistic needs. That’s why CRM is accepted to people in recent world and good for satisfying Corporate Social Responsibility (CSR) as well. We can say that WCA is a visualizing tool of selfish or altruistic actions made by various people. What is important is that the two white hearts with green outline in “Customer” and “Volvic” are connected by green arrows to the green heart in “UNICEF”. It means that wish of “want someone to save African people” is realized by “UNICEF” through green arrows’ chain. The reason why we use heart figure is that people’s hearts are connected by arrows chain to relay their wish until it is realized by a heart filled with green color.

Another important thing is that citizen’s wish is increased from red only to red and green from Fig. 3 (a) to Fig. 3 (b). We can say that by adding green color, i.e., by adding altruistic wish to selfish wish, value of business/social system changes. It will change the sales of the company and change the world at the same time.

WCA is useful in the recent world because social values including social safety, security, health, welfare, sustainability of environment, food, water and materials are becoming more and more important. For example, climate change problems cannot be solved if all people are selfish. Everybody has to get together to save the earth. However, not everybody’s moral is high enough to try to save the earth as a first priority. It means that people’s personal needs are not at the “Self-Actualization” level. Many people want to fulfill various other needs to live balancing with morality. That’s why we should systematically construct business and social systems taking into account various needs of people. Volvic’s case implies that it is important to construct sustainable and robust systems by adding a little green heart even if the majority of people are driven mostly by red heart.

In the next section, we will show that WCA can be used for various analysis and design of business/social system structure.

4. WHEN TO USE WCA

WCA can be used as an analysis tool of existing systems as well as a design tool for designing new business/social systems. Both cases are explained below.

4.1 Analysis of existing systems

Analysis of existing systems can be conducted by drawing WCA following the procedure explained in chapter 3. As shown in chapter 3, existing systems can be verified by the following way.

- (1) Check if six rules are satisfied or not. If not, the system is not adequate for satisfying all stakeholders’ needs/wants. For example, NPO without money for salary of office workers’ is not sustainable. Introduction of money for this purpose is needed for the system to start moving. Another example is that a new product by a company cannot be successful if customers’ needs are not satisfied. Hence, requirement analysis is important.
- (2) Check which category in seven needs is written in each heart. In general, business is often for satisfying lower needs of Maslow’s hierarchy such as physiological needs and safety needs. Non-profit activities including government, NPOs, NGOs, education and private activities are often for satisfying lower to higher needs. Social business is often between them.
- (3) Check which color is used in each heart figure. As explained in chapter 3, red hearts are for self, whereas green hearts are for others. If you compare Figure 3 (a) and (b), you can see how much social values are considered in each business model.
- (4) If amount of flow of money, information and things are shown, you can analyze which arrow is important.

As an example, authors have analyzed 55 social business listed by ministry of economy, trade and industry in Japan [8]. We discovered that all the business can be categorized into several similar structures. We also found that relationships among stakeholders are always a combination of two fundamental patterns of two stakeholders, bilateral exchange and unilateral donation. The exchange forms a feedback loop between two stakeholders, whereas the donation forms one way arrow from the green heart or white heart with green outline. We can generally say a common company is

fundamentally run by red heart, whereas non-profit organization such as government, NPOs, NGOs, schools and private activities are run by green heart. We will describe in detail the result of analysis of numbers of social business in different paper to discuss that WCA can be a categorizing tool of existing business/social systems.

As WCA is a visualization tool, it can be used for communicating ideas. It is easy to show business/social system structure to others. It is one of the strength of WCA.

Note that WCA is a qualitative design tool. It is not a tool for determining the optimum structure. For example, question arises in which category gaining money is allocated. If one's income is too small to live a safe life, it should be the needs of safety. On the other hand, if one wants to donate money for making better world, it can be the need of self-actualization.

4.2 Design of innovative systems

Another strong point of WCA is that it can be an aid for creative design. WCA can be used for creating whole new businesses/activities as well as re-designing existing businesses/activities.

The way is simple. You can follow the following four steps.

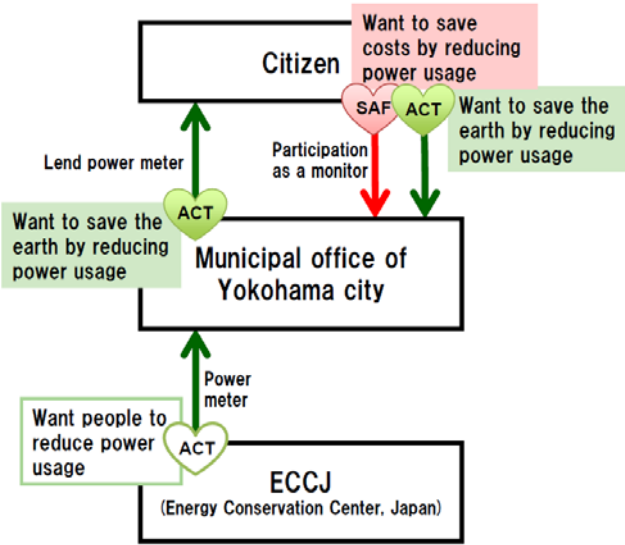
- (1) To begin brainstorming, draw WCA of existing business/social systems or simple system that can easily come up in mind.
- (2) Try to change seven categories hearts in the figure. Then try to think what kind of needs can be satisfied by the new category of needs. In some cases, by changing the needs, system starts working. Simple example is as follows: If somebody is not environmentally conscious, you can give him/her money for his environmentally conscious action. This means that appeal to self-actualization needs do not work, whereas appeal to safety needs (needs of money) works. It can be explained by Maslow's hierarchy of needs. This person did not move by self-actualization needs because his lower needs, i.e., safety needs, were not satisfied. Sometimes it is the opposite. Someone else would move if higher needs are aroused because his lower needs are already satisfied. For example, honor might be better than money for someone.
- (3) Try to change the color of heart. By changing the color of heart among red, green and white with colored outline, system structure will change. If you try to complete the system to satisfy rules of WCA explained before, system structure will become much complex. However, it will work differently from the original one.
- (4) Try to satisfy various needs of various people. It will also make the system complex, but it will be a new system that is difficult to construct from mere brainstorming due to its complexity.

Figure 4 shows an example of (4). Figure 4 (a) is a system that Yokohama city, Japan used to try. Yokohama is selected as an eco-conscious city by the Japanese government. Using a part of government funds, Yokohama began a campaign to nudge its citizens to be more eco-conscious. One of the ideas was to lease power meters to selected citizens to display their electric power consumption of their house every day. By looking at the value, citizens notice how much electricity they use. Yokohama city thought it will lead citizens to be more eco-conscious. However, the effect of this action was limited. It did not become big movement. Problem was that few eco-conscious people became more eco-conscious, but most of the citizens remained indifferent to the campaign.

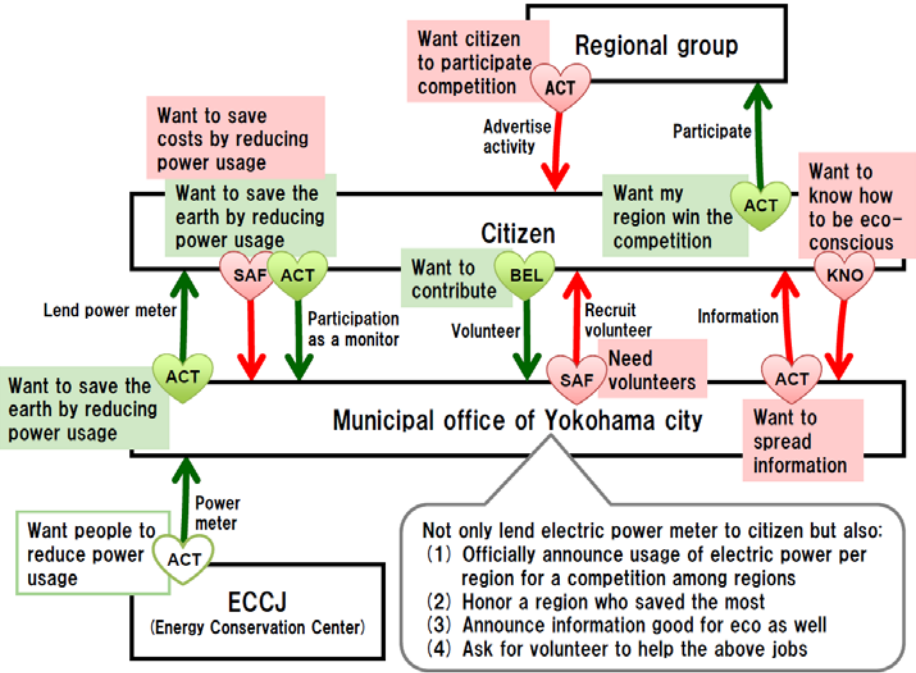
One way of solving this problem is to stimulate various needs of various people as shown in Figure 4 (b). If not only showing result of power consumption of each house to each citizen, but also open result of power consumption to the public by adding regional improvement of saving electricity and start competition among regions, people may try to make regional area win the competition. Someone may just want to win to get rewarded. Someone wants to get money as a winner. Someone wants to contribute to the region. Someone might just want to save money. Someone might want to save the earth. Hence, various needs of people are satisfied by constructing relationship among stakeholders using WCA. In Figure 4 (b), additional needs are drawn as well as an example. This system needs volunteer to help summing results and open it to the public. Someone wants to know more about the system as well as what is needed to be eco-conscious. By adding those people in WCA, the system starts working. Of course, other needs can be added to this figure. What is important is that by adding various needs of people using WCA, much more complex system can be constructed. This is why WCA is needed in recent large scale and complex world.

Another merit of WCA is that we can easily think from the position of others. Many people say, “Look through the eyes of others”. It is easy to say, but difficult to do. However, using WCA, we can think as if our standpoints are other stakeholders’. By doing so, we can construct a system that is reasonable to realize, acceptable to people, sustainable to manage and robust to environmental change. Off course, WCA is effective as a visual presentation tool by clarifying and visualizing the flow of needs of newly developed system. It is also good to be accepted by people.

As mentioned in the previous chapter, WCA is a qualitative design tool. It is not a tool for determining the optimum structure. Hence, creative structure of new system cannot be the same among designers even though WCA is used. It depends on user’s creativity. However, what is important is, similar to other tools used in systems engineering, people having moderate creativity can think of creative ideas using this systematic method. Without WCA, genius can think of quite new system. On the other hand, with WCA, usual people can create new ideas by following procedure described above.



(a) Action by Yokohama city



(b) Proposal by use of WCA

Figure 4 Example of WCAs to non-profit activity of municipal government

4.3 Potential of WCA

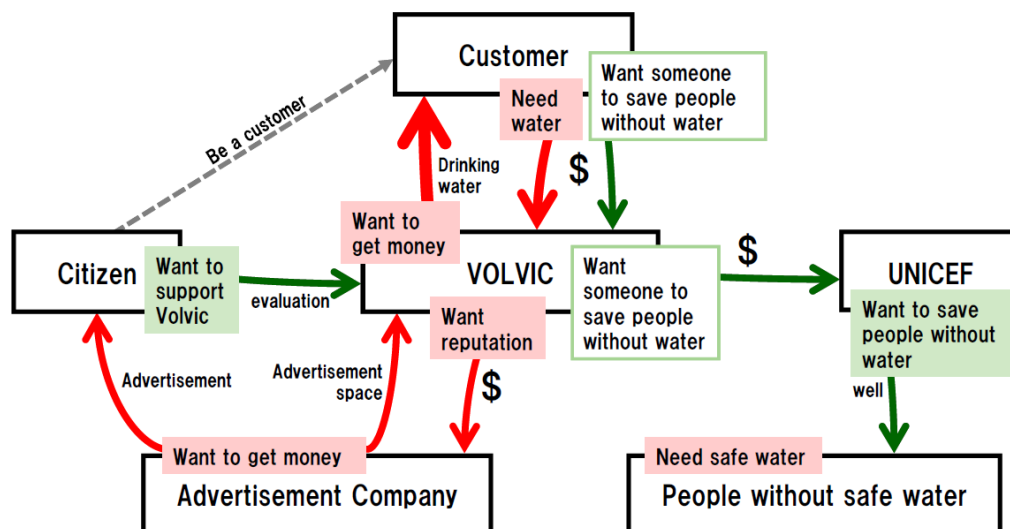
In the present paper examples of WCA for business model and municipal government model are shown. WCA can also be used for wide variety of area when more than two people are related each other. Application area is as follows:

- Requirement analysis, design and marketing of products and service
- Non-profit activities including NPO/NGO, government, school and private activities
- Psychological and medical analysis of human relations
- Sociological studies on human relations
- Ethics study of humans' decision making and behaviors based on various needs/wants
- Human development by coaching and training

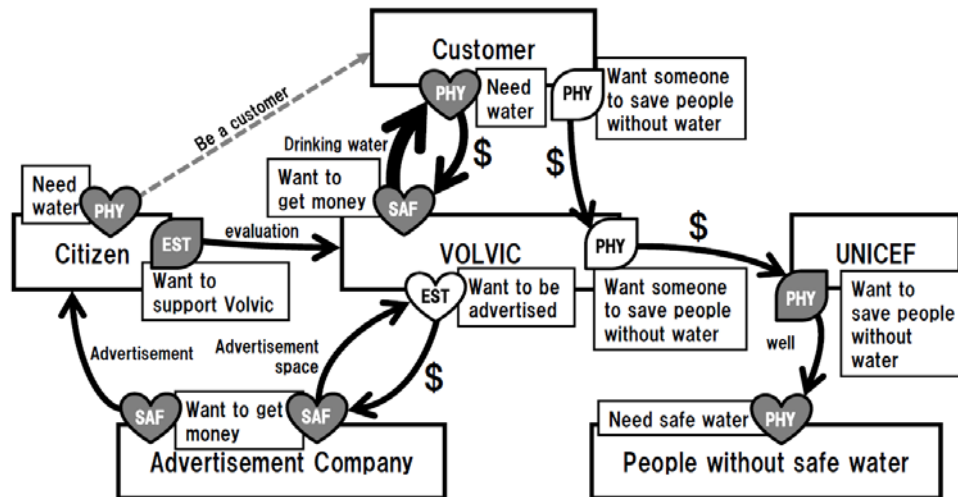
The most important part of WCA is the two by two matrix based on the subject/object of needs and the color of red and green representing needs for self or others. Other rules of WCA can be modified. For example, user can modify seven categories and heart mark for their purpose if user wants to use other categorization and other figures. Simplified WCA without heart mark is shown in Figure 5 (a). It is good enough to visualize the two by two matrix of needs. For gray scale printing, WCA can be monochrome image by replacing green hearts and white hearts with green outline into gray leaves as shown in Figure 5 (b).

WCA is also useful for educational purposes. It is a good chance to think what people needs and how they act as if you were others. It is especially important for group study. In order to understand each other, WCA can be a good communicating tool. Authors plan to teach WCA in the design project course in the graduate school of system design and management, Keio University where effectiveness of WCA will be measured.

One of the differences between CVCA and WCA is that CVCA is a simple tool for visualizing relationship among stakeholders, whereas WCA is a tool not only for visualizing but also for thinking before visualizing about stakeholders' needs and wants. Hence, it is not an easy tool but a good tool for deeply understanding why and how people act. Another difference between CVCA and WCA is as follows. CVCA is a tool for visualizing relationship among stakeholders. However, it is not clear if each relationship and flow of money, information and good are necessary and sufficient. On the other hand, necessity and sufficiency of the flow of money, information and goods can be visualized in WCA.



(a) WCA without heart marks



(b) Monochrome version of WCA by replacing green hearts into green leaves

Figure 5 Example of simplified WCA and monochrome WCA
(Volvic's case shown in Figure 3 (b))

5. CONCLUDING REMARKS

Customers' value of products/service is originally from their personal needs/wants in mind. Hence, we proposed WCA as a next generation method succeeding CVCA. First, by referring psychologists' studies, we developed WCA. Next, way of using WCA is explained. Then, with various examples, effectiveness of WCA is shown by describing that characteristics of business/social system structure can be clearly visualized using WCA. It can be used for analysis of existing systems and development of new systems. It is also shown that "think of others" should be more and more important for humans' satisfaction and happiness in the near future. WCA can be a tool for clarifying what is for others. From now on we will conduct systematic investigation of existing business/social system as well as creating new business/social model using WCA for contributing to make a better world.

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REFERENCES

- [1] Kosuke Ishii, Olivier de Weck, Shinichiro Haruyama, Takashi Maeno, Sun K. Kim, and Whitfield Fowler, Active Learning Project Sequence: Capstone Experience for Multi-disciplinary System Design and Management Education, Proc. International Conference on Engineering Design, 2009, pp. 57-68
- [2] Donaldson, K., Ishii, K., and Sheppard, S., Customer Value Chain Analysis, Research in Engineering Design, Vol. 16, 2006, pp. 174-183
- [3] Murray, H. A., Explorations in Personality, New York: Oxford University Press, 1938
- [4] Maslow, A. H., Motivation and Personality, Harpercollins College Div, 3rd Edition, 1987
- [5] Maslow, A. H., Toward a Psychology of Being, Wiley, 3rd Edition, 1998
- [6] Kotler, P. and Keller, K., Marketing Management 13th Edition, Prentice Hall, 2008
- [7] Adkins, S., Cause Related Marketing, Butterworth-Heinemann, 1999
- [8] http://www.meti.go.jp/policy/local_economy/sbcb/sb55sen.html, Selected fifty five social businesses, Ministry of Economy, Trade and Industry, Japan, 2009 (in Japanese)

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