ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.123-135, February 16-18, 2017

A Critical Look at Peace Education Curriculum in Japan

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ABSTRACT: This report was previously submitted in partial fulfillment of the author's graduate studies action research task. This paper includes an assessment of research concerning the Peace Education system supported by Japan's Ministry of Education and adopted by local Boards of Education. Research is based on assessments of academic articles, interviews, questionnaires, and student guestbook feedback from the Nagasaki National Peace Memorial Hall for Atomic Bomb Victims. Both qualitative and quantitative methods of research are used to obtain information concerning Peace Education.
Keywords: peace education; World War II; Nagasaki; Hiroshima

1. Introduction: In Pursuit of Peace.

The word "peace" takes on different meanings and connotations based upon the age, social conditioning and experience of the individual. The first law of nature is self-preservation. Self-preservation is an underlying concept of what peace means to those who are the victims of war. However, there is an adage which suggests peace is not simply the absence of war—peace is the opposite of war. In the wake of World War II, Japan has observed 平和教育 *Heiwa Kyoiku* (Peace Education) as a standard part of compulsory and secondary education as delegated on a local level by participating Boards of Education throughout Japan. The following assessment is based upon local research concerning the effectiveness of peace education. The researcher would like to acknowledge and express appreciation for the cooperation of the Nagasaki Atomic Bomb Museum and the Nagasaki Peace Memorial Hall for their understanding and allowing the author to conduct questionnaires and interviews with museum and memorial hall guests.

The researcher is presenting data obtained during an action research task for his graduate school studies as a basis for further discussion and to promote continued study among academics. Upon reading past articles on Peace Education in the GISUP International Journal, and hearing the various interpretations, comparisons, and suggestions concerning Peace Education, the author was forced to reflect upon his own experiences of his involvement in Peace Education. Although most of the data for this study was taken nine years ago, the author feels the relevance still stands. This article is to

promote further study and to provide balance and perspective to already existing opinions on Peace Education curriculum.

Upon soliciting for remarks about Peace Education, the author has encountered offhand statements such as "America is bad!" Such remarks make the author question the agenda of the Peace Education curriculum. If "America is bad" is the entire sum of the Peace Education indoctrination, it makes one question whether Peace Education is promoting peace or instilling hate and nationalism. To remark that "Nuclear weapons are bad!" or "War is bad!" would support that some concept of peace was being promoted. Peace Education is important for promoting a safe future removed of animosity toward other nations and cultures. The author believes that the interpretation of the meaning of "peace" goes beyond nuclear weapons. Peace Education should be free of bias as well as free of a negative hidden agenda.

Statistics and research data are often cold numbers that remove emotion from events. Seeing the death count of World War II atrocities as merely numbers tends to desensitize one as to the importance of human life. The bombing of Hiroshima and Nagasaki represents an extreme loss of human life and data research concerning the event such as war should be conducted out of respect. President Truman's decision to drop the atomic bomb on Hiroshima and Nagasaki has been a topic of continued debate on both sides of the ocean. The author, by residing in Nagasaki is able to assess and research directly the public opinion and perspective concerning the bombing. Under the Peace Education system endorsed by the Japanese Ministry of Education, many students throughout the country are required to visit the Atomic Bomb Museum in either Hiroshima or Nagasaki. Is this requirement effective? How is World War II remembered in relation to the promotion of peace? How does Peace Education affect students and knowledge concerning the history of the Pacific War? How has public opinion and knowledge concerning the bombing of Hiroshima and Nagasaki changed over the years since the end of the war? These are the questions that have been chosen for research.

2. Research Method: Student Opinion.

Qualitative research involved with participants of direct interviews and discussions provided valuable insight and information concerning common beliefs and knowledge about World War II and the bombing of Hiroshima and Nagasaki. Qualitative research provides human emotional value and insight to statistics. Researcher conducted interviews with target population in addition to a questionnaire survey. Answers to the survey provide numerical data which represents quantitative research. Such statistics provide credibility and balance to qualitative research information. Quantitative research is detached from the individual and the goal is context-free generalizations (McMillan et al, 2002).

Local opinion concerning the bombing of Nagasaki remains strong even 71 years after the event. However, according to a former survey conducted by the 平和文化研究会 *Heiwa Bunka Kenkyu Kai* (The Peace and Culture Research Organization) and the Nagasaki Institute for Peace Culture (NIPC), statistics indicate that specific knowledge of the atomic bombing has started to fade from public memory (NIPC, 1992). In order to test this hypothesis, the researcher chose to conduct a survey at the Atomic Bomb Museum in Nagasaki. Most of those interviewed were students who reside from distant prefectures and were visiting the museum as part of their compulsory Peace Education school trip. The date of the atomic bombs were dropped on Hiroshima and Nagasaki, the American president who made the decision to drop the bombs, the reason for using the atomic bomb, the date of the signing of the Potsdam Declaration ending World War II as well as questions concerning the re-writing of the Japanese Constitution's 9th Amendment allowing military rearmament were among the questions asked to visiting students.

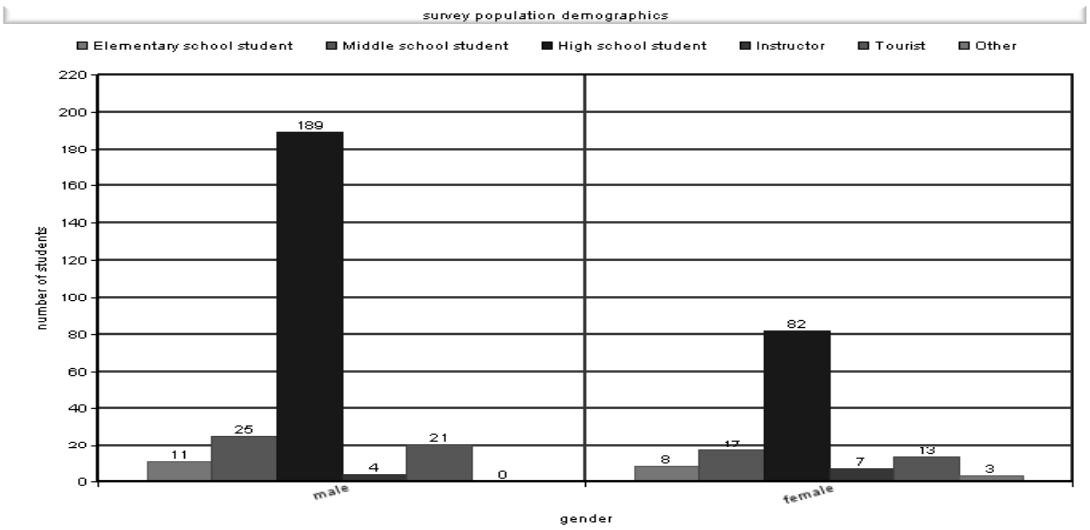

Figure 1. Histogram of Survey Population Demographics, 2007.

The primary target population for this survey was focused on high school aged students. Researcher made an effort to interview as many participants as possible. Large crowds visit the museum and participation in the survey came relatively easy. A questionnaire was distributed at the Nagasaki Atomic Bomb Museum ticket and information desk on May 12th and May 19th of 2007. With the cooperation of the museum, visiting students and teachers a population of approximately 300 participants responded to and participated in the survey. Results of the survey indicate that knowledge and opinions concerning the details of the bombing of Hiroshima and Nagasaki as well as World War II have changed over the past 3 decades. Further research concerning the comments left by visitors in the museum guestbook also indicates social changes in Japan.

3. Survey Results.

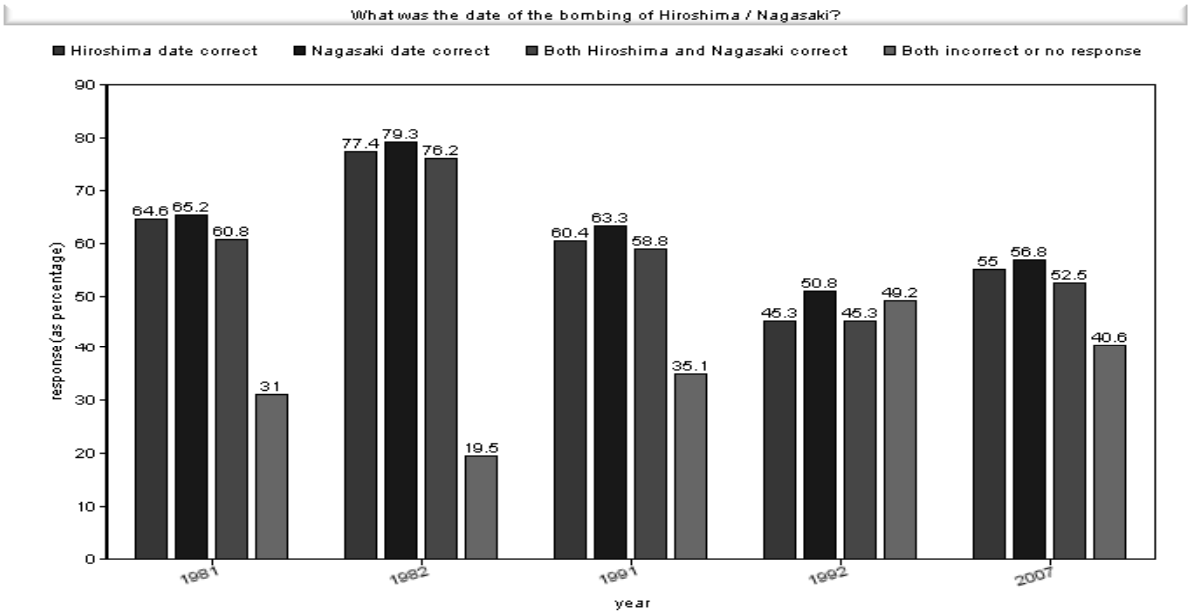

Figure 2. Histogram of Questionnaire Response for "What was the date of the bombing of Nagasaki and Hiroshima?"

Hiroshima was bombed on August 6th 1945 at 8:15 AM, and a second atomic bomb was dropped on Nagasaki on August 9th 1945 at 11:02 AM. When asked to recite the date that the atomic bombs were dropped on Hiroshima and Nagasaki, fewer students were able to answer correctly than two decades ago. While slightly increased compared to 1992 the 2007 total is 20% less than the 1982 results. Researcher believes that the 60th commemoration of the end of the war might have had an influence on the results from having a positive skew distribution since a renewed interest in the war has most likely been a topic in education recently. Researcher conducted a separate poll on students at a local high school in Nagasaki and students were able to answer questions concerning the times of the bombings with 100% accuracy including the time of day the atomic bombs were dropped. Local residents express a greater knowledge on the atomic bomb since the city's history and school curriculum has no doubt focused on this point. Therefore, to avoid biased information, the researcher chose students who reside in prefectures other than Nagasaki or Hiroshima that were visiting the Atomic Bomb Museum on a school trip as the target population.

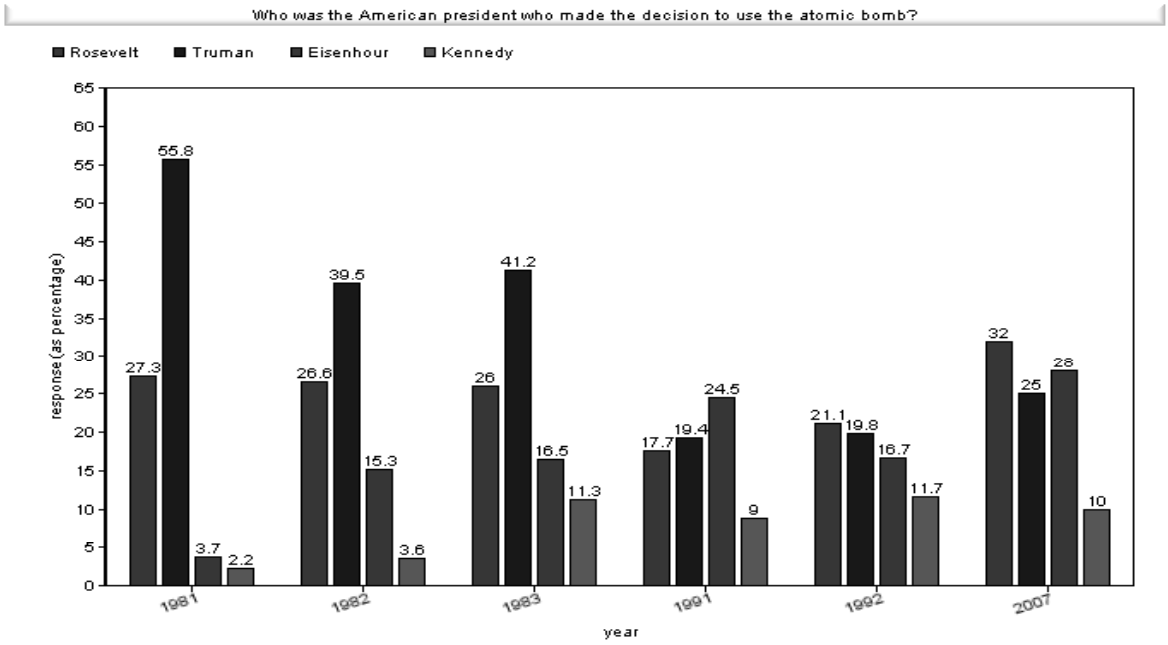

Figure 3. Histogram of Questionnaire Response for "Who was the American president who made the decision to use the atomic bomb?"

Students were asked to name the American president who made the decision to use the atomic bomb. President Truman, the correct answer, was not recognized by students who were polled by the Nagasaki Peace Culture Research Organization (平和文化研究会 *Heiwa Bunka Kenkyu Kai*) in 1981. However, the 1991 and 2007 results yielded an incorrect response that President Eisenhower was the U.S. president recognized for using the atomic bombs. Moreover, when the researcher conducted a second survey at his high school—including teachers and students, results suggested President Kennedy as the common answer. As percentages balance out and no exact answer took the lead in percentage, there is obvious uncertainty concerning the correct answer. Survey results might indicate that there is not a strong interest among high school students in specifics concerning who the American president was during the end of the Second World War.

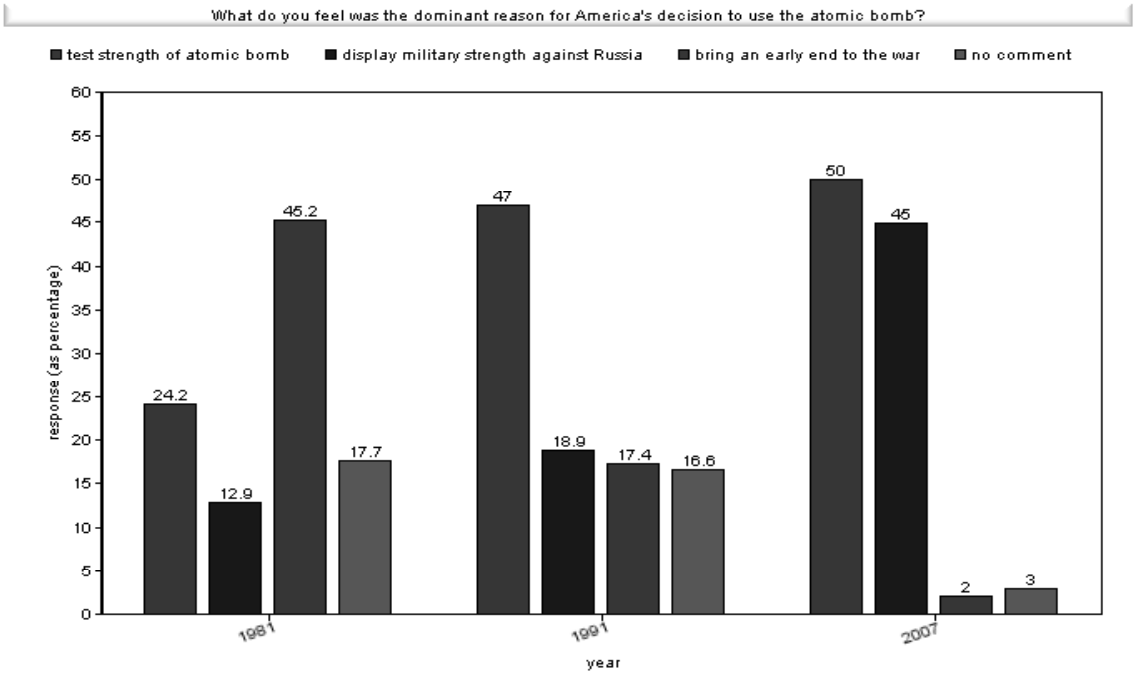

Figure 4. Histogram of Questionnaire Response for "What do you feel was the dominant reason for America's decision to use the atomic bomb?"

A paradigm shift is noticeable concerning the question of the reasons that the atomic bomb was used on Hiroshima and Nagasaki. In 1981, the dominant opinion was that the atomic bomb was used to bring an early end to the war and to limit future casualties for both nations. However, according to 2007 results, 50% of the students polled believe that the reason was to test the strength and influence of the atomic bomb followed by 45% who answered that the atomic bomb was used as a display of strength against Russia's military campaign and show America's military power as the cold war began. Opinions became stronger considering that 17% had no exact opinion on the matter in 1981 compared to only 2% that were of no opinion in 2007. Other answers given included comments expressing America seeking revenge for Japan's attack on Pearl Harbor. The atomic bombs used as a way to ensure an early end to the war and to prevent further casualties for both nations is not a widely accepted view. Emperor Hirohito, who ultimately began Japan's military campaign in Asia and against the United States, refused conditions of surrender until Russia invaded Japan on the 10th of August. Although, Japan chose not to surrender, Emperor Hirohito is not considered by Japanese to carry any burden of World War II or the attack on Hiroshima and Nagasaki. On January 18th 1990, former Nagasaki Mayor Hitoshi Motoshima, after briefly commenting that the Emperor also shared responsibility for the war, was shot by a member from the right wing extremist group called

the 正氣塾 *Seikijuku* (Anderson, 1990). The researcher, with knowledge of the Japanese respect for monarchy deliberately refrained from asking questions concerning Emperor Hirohito.

During early stages of the research, the Hawthorne Effect was observed concerning questions concerning the reasons for using the atomic bomb. When a native who acted as a proxy asked questions concerning the decision of using the atomic bomb, results were skewed against America's decision whereas when asked directly either a neutral opinion was expressed or the event was written off as an act of war that could not have been helped. However, interview results allowed further insight on the opinion of the students. High school students avidly enjoy reading comic books. Among the popular comic books is a comic series on history and war written by Mr. Yoshinori Kobayashi, a right wing artist historian and a textbook-style comic book written by Mr. Tsunezo Murotani and the history department professors of Waseda University.

Figure 5. The above refers to the covers of comic book version of history authored by Tsunezo Murotani (on the left) and Yoshinori Kobayashi (on the right).

The comic written by Mr. Murotani is commonly used by elementary schools in Japan. According an instructor interviewed, both Murotani and Kobayashi's opinions have a profound influence on the youth. The researcher found that both comic series are easily available at local book stores and libraries and confirmed that the atomic bomb was described as a tool used by America in order to inflict fear on Russians.

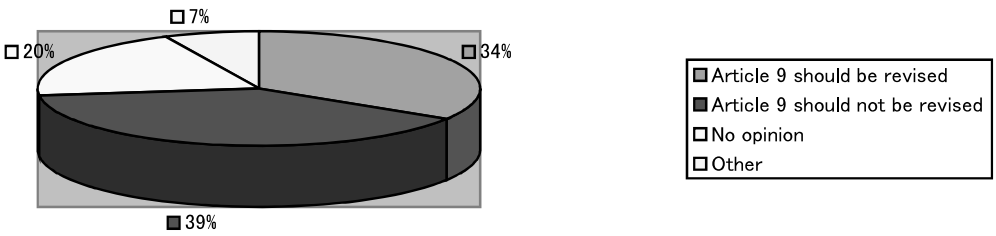

Figure 6. Histogram of 2007 Questionnaire Response for "Do you feel that the 9th Article of the Japanese Constitution should be revised?"

The Constitution's 9th Amendment revision is a highly controversial national issue and various views correspond with left and right wing political campaigns. The 9th Amendment of the Japanese Constitution states that Japan will not have an army other than a Self Defense Force (SDF) that acts as a non-aggressive unit to serve and protect the Japanese islands (Takahashi, 1991). For reference, the full Japanese text and official English translation of the 9th Amendment of Japan's Constitution is as follows:

第九条　日本国民は、正義と秩序を基調とする国際平和を誠実に希求し、国権の発動たる戦争と、武力による威嚇又は武力の行使は、国際紛争を解決する手段としては、永久にこれを放棄する。

二　前項の目的を達するため、陸海空軍その他の戦力は、これを保持しない。国の交戦権は、これを認めない。

ARTICLE 9. Aspiring sincerely to an international peace based on justice and order, the Japanese people forever renounce war as a sovereign right of the nation and the threat or use of force as means of settling international disputes.

(2) To accomplish the aim of the preceding paragraph, land, sea, and air forces, as well as other war potential, will never be maintained. The right of belligerency of the state will not be recognized. (Wikipedia, 2013)

Asking questions concerning the 9th Article is a sensitive subject in Japan. Political parties are dramatically divided over this issue. At the time of this writing the 9th Article of the Japanese Constitution is an issue in the media. If the 9th Article of the Constitution is revised then Japan will be allowed to rebuild its military. Researcher sought current high school student opinion concerning the revision of the 9th Article. Opinions concerning revising the 9th Article were divided with 34% in favor of revision and 39% in favor of leaving the Article as is. 20% had no opinion concerning the matter and another 7% had various responses included a compromise such as an increase in weaponry of the SDF army without a total military buildup. When asked to explain their opinions, students interviewed explained that their views often reflected their parents.

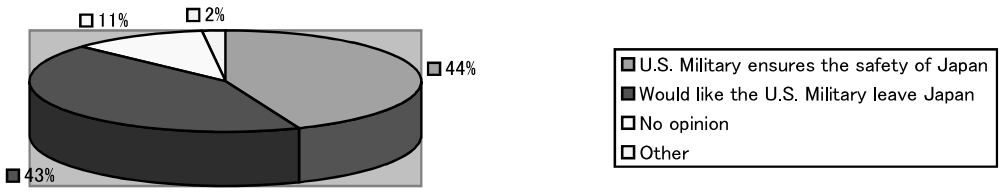

Figure 7. Histogram of 2007 Questionnaire Response for "How do you feel about the presence of United States military bases in Japan?

Similar to the 9th Article issue is the United States occupational army stationed in Japan. When students were asked about American military bases in Japan opinions were heavily divided. 44% of the students believe that the military bases ensure the safety of Japan specifically against threat from North Korea. 43% were of the opinion that the United States should leave Japan. When asked for reasons of the later, American soldier violence, reports of soldiers raping civilians, and xenophobia concerning an increased crime rate due to foreigners were mentioned reflecting right wing political opinions concerning U.S. military bases as reported by the media. This also reflects opinions expressed by comic artist Yoshinori Kobayashi and Tokyo mayor Shintaro Ishihara and recent opinions of Osaka mayor Toru Hashimoto. 11% were of no opinion or did not respond to question. Other comments included that the military bases help the local economy in Sasebo and Okinawa and that America would receive more support if military bases were accessible to the public.

4. Conclusion.

Quantitative interview data is perhaps inconclusive when it comes to proving the success or failure of the current Peace Education curriculum. Qualitative data however, according to this researcher, suggests that the success of Peace Education is highly debatable. As specific events and facts concerning the Pacific War and World War II fade from the minds of the public, a form of selective amnesia takes place (Ienaga, 1994). The bombing of Hiroshima and Nagasaki are well recorded events in world history; however, tragic events such as the Nanking Massacre, D-Day as well as battles at Normandy, Tsushima, Okinawa, and Bataan were also tragic events that form the history of World War II. The "Peace Education" program focuses on the bombing of Hiroshima and Nagasaki. Remembering the bombing of Hiroshima and Nagasaki as the only event of World War II would create a strongly biased opinion and anti-American sentiment. As one can easily observe by reading through the comments in the Atomic Bomb Memorial Museum guest books, Japan is viewed by its citizens as the innocent victims of the war. The aggressor that started conflict views itself as being the victim and not the cause (Ienaga, 1994). Japanese children, under the Peace Education program are forced to visit the atomic bomb museums. This act does not necessarily foster feelings of peace, rather, a new found nationalism is emerging and anti-American sentiment prevails. The researcher found such views manifested in the guest books at the atomic bomb museum in Nagasaki. Students visiting the museum are candidly asked to share their impression and thoughts of their visit—often comments are on seeking revenge instead of contemplating peace and avoiding war. Effective "Peace Education" should promote feelings of unity and not encourage ill sentiment which might lead to future aggression (Ito, 1994). Likewise, one could effectively argue that nationalism and violence would be promoted if students in the United States were required to visit the War Museum in Pearl Harbor as part of a nationalized "Peace Education" program. Remembering the

war is important, but seeing the war in perspective and understanding the hideousness of war helps one contemplate upon the true meaning of peace. A more in-depth study of Peace Education will manifest more conclusive results whether the information being learned is biased or not. Selective amnesia does not remove the truth of historical events nor the delegates that testify of such events. Although there are many interpretations of historical events, educators have the responsibility to teach what is cross-culturally accepted as truth and to seek for ways to promote peace through education.

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Appendix 1: “Peace Education” Survey 平和教育アンケート

１． 広島原爆投下の年月日を答えてください。

(What was the date of the bombing of Hiroshima?)

＿＿＿月＿＿＿日＿＿＿年（＿＿＿時＿＿＿分）

２． 長崎原爆投下の年月日を答えてください。

(What was the date of the bombing of Nagasaki?)

＿＿＿月＿＿＿日＿＿＿年（＿＿＿時＿＿＿分）

３． 太平洋戦争開始は何時でしたか。

(When did the Pacific War begin?)

＿＿＿月＿＿＿日＿＿＿年

４． 太平洋戦争終戦は何時でしたか。

(When did the Pacific War end?)

＿＿＿月＿＿＿日＿＿＿年

５．アメリカが原爆を投下した一番の理由は何だと思いますか。

What do you feel was the dominant reason for America's decision to use the atomic bomb?

ア． 戦争を早く終わらせ、相互の被害を少なくするため。

To bring an early end to the war and to limit future casualties for both nations.

イ． ソ連の進出をおさえ、外交上の主導権を握るため。

As a display of strength against Russia’s military campaign.

ウ． 原爆の成力・影響を、実際にたしかめるため。

To test the strength and influence of the atomic bomb.

６．原爆投下命令を下したアメリカ大統領は誰ですか。

Who was the American president who made the decision to use the atomic bomb?

ア．Roosevelt ルーズベルト

イ．Truman トルーマン

ウ．Eisenhower アイゼンハワー

エ．Kennedy ケネディー

７．原爆資料館を見学したことがあるかどうか。

Have you ever visited the atomic museum in Hiroshima or Nagasaki?

ア．修学旅行で見学したことがある。

During a school excursion or field trip.

イ．家族旅行で見学したことがある。

During a family vacation.

ウ．見学したことがない。

Never visited.

８．日本国内にある米軍ベースにつてどう思いますか

How do you feel about American military bases in Japan?

ア．米軍ベースは日本の治安の為、必要だと思う。

U.S. military bases ensure the safety of Japan.

イ．米軍ベースを日本から去って欲しい。

Would like the U.S. military to leave Japan.

エ． 無意見。

No opinion.

オ． 他に（詳しく書いてください

Other (please specify)

９．日本国憲法第 9 条（戦争軍備・戦力不保持）につて変法する必要があると思いますか。Do you feel that the 9th Article of the Japanese Constitution (concerning military armament) should be revised?

ア．反対、日本国憲法第 9 条はそのままで良いと思う。日本自衛隊（SDF）は十分だと思う。No, I believe the 9th Article should remain as is. Self Defense Force army is sufficient.

イ．賛成、日本国憲法第 9 条は変法した方が良いと思う。日本自衛隊（SDF）は不十分だと思う。Yes, I believe the 9th Article should be revised and that Japan should have its own military.

ウ．無意見。No opinion.

エ．他に（詳しく書いてください）Other (please specify)

１０．自分のことについて教えてください。Please share about yourself

ア．小学生 Elementary school student

イ．中学生 Middle school student

ウ．高校生 High school student

エ．教師・先生 Instructor

オ．観光客 Tourist

カ．その他 Other

１１．自分の性別を教えてください。Please share your gender

ア．男性 Male

イ．女性 Female

１２．故郷はどちらですか。Please share your hometown

ア．日本国内、広島か長崎 Hiroshima or Nagasaki

イ．日本国内、広島か長崎以外 Japan, outside of Hiroshima or Nagasaki

ウ．外国人 Expatriate or foreign national

エ．その他 Other

Appendix 2: Interview Questions for Local Educators used in addition to Survey (English Version)

1. What is “peace education”?
2. What do you think of first when you hear the words “peace education”?
3. What does “peace education” mean to you?
4. Does your school contribute to “peace education”? If so, how?
5. What are your interests in the field of “peace education”?
6. What are some important measures to be taken to contribute to “peace education”?
7. What would be some of the possible differences in peace education approaches among younger and older students in schools?
8. How can teachers help make students more conscious and more prepared for problems of peace within the subjects that they instruct?
9. In international debates, the terms “disarmament education” “global education” and “education for international understanding” have been used as terms for “peace education.” What do you feel are the similarities and differences in these programs?
10. In many countries, questions related to disarmament and peace is highly controversial. Would you anticipate any difficulties for example with parents or other members of the community, when introducing peace education in schools?
11. If so, what kind of difficulties? What are possible solutions?
12. What needs to be done in teacher training in order to prepare future teachers more adequately for the area of “peace education”?
13. In many schools in the U.S., Osaka and Tokyo, the students represent a variety of nationalities and cultural backgrounds. To what extent would it be possible to use this fact as an aid in education for peace?
14. Would you expect some difficulties in doing so?
15. Is there anything else that you would like to add about your school and peace education?

Ito, Takehiko et al (1994). *Peace Education: Perspectives from Costa Rica and Japan.* Peace Education Miniprints No. 62. 22 pages. Published by Lund University Press, Sweden. April 1994.

ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.136-139, February 16-18, 2017

Community-based disaster management and community involvement in sloped urban districts of Nagasaki city

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ABSTRACT: Community involvements in ordinary times contribute positively against disaster management. This study aimed to assess community-based disaster management in sloped urban districts of Nagasaki city. Three typical sloped urban communities were investigated the existence of disaster prevention equipment, and group interviews with community leaders were conducted. As results, despite the similar geographical and demographic characteristics of the three selected communities, substantial differences were found in their preparedness towards disasters. The community-based preparedness towards disasters through positive community involvement and active functions of the community association were effective in sloped urban districts.

1. INTRODUCTION

Nagasaki city has a characteristic hilly geography where 43% of the urban residential area is built on slopes (Sugiyama, 2003). We have already reported the difficulties residents of these hilly areas face as well as problems of the aging and decreasing population. We also reported in GISUP 2016 that examination of a fire accident that occurred in the sloped urban district in 2015 showed that community involvement in disaster management in ordinary times contributed positively to minimize damage and victimization from disasters. This study aimed to assess community-based disaster management in sloped urban districts of Nagasaki city. The findings aim to provide effective measures regarding preparation against and management of disasters in the geographically disadvantaged sloped urban districts.

2. METHODS

1) Assessment of community preparedness towards disasters in the sloped urban district

Three typical sloped urban communities in Nagasaki city were selected (Table 1) and

the authors investigated the existence of disaster prevention equipment such as fire hydrants and fire water tanks, and road conditions of evacuation routes through field survey.

2) Group interviews with community leaders

Group interviews with community leaders including the community association's chairperson were performed regarding geographic characteristics and preparedness towards disaster in each selected community. Data obtained were qualitatively analyzed by key-wording and structuring.

3. RESULTS

1) Current conditions of preparedness towards disasters in the sloped urban districts

The higher up the slope ("upper slope area"), the narrower the roads and the larger the number of stairs tended to be. At the same time, the upper slope area had also taken measures against poor transportation such as adopting a slope transportation system, installation of stair railings and operation of a mini-bus service. There were fire hydrants and fire hose storage boxes in all three selected communities. One community had consciously installed fire extinguishers in easily noticeable places. Another community had equipped its community center with helmets and an automated external defibrillator (AED).

2) Community involvement regarding preparedness towards disasters

There was a clear difference in community involvement among three selected communities. Figure 1 demonstrates a matrix that categorizes the group interview findings into "advantages" and "disadvantages". The group interviews showed that disaster prevention management could be classified in to the following three categories: "the characteristics of the community residents (human resources)", "equipment for disaster prevention (materials)", and "implementation of disaster prevention measures (involvement)". Equipment for disaster prevention also included evacuation facilities, information management related to disaster prevention, and disaster prevention maps.

Table1. Background information of three selected communities

As of 2015.12.31

Community	Population (n)	Household (n)	Pop./household (n)	Proportion of 65 y. or older (%)
A	2,034	1,091	1.9	34.9
B	698	472	1.5	33.8
C	1,079	630	1.7	45.7

A; Ebira community B; Juninmachi community, C; Mizunoura community

Table2. Historical background and present situation

Community	Historical background	Present situation
A	Devastated community by atomic bomb There has been Urakami Catholic church with the largest number of believers in Japan.	Most dwellers are postwar incomers. About 50% of dwellers are Catholic and belonging to the church. Mini-bus service is operated within this community.
B	Historical community continuing from the period of isolation	There are university, high school, and welfare facility in district. Welfare facility's residents clean the road in this community. The stair assist railing is installed.
C	There has been a big shipyard company close to this community. Most of the company's employees lived in this community.	Population has been remarkably reduced because the shipyard company has fallen into recession. Many elderlies who have retired from the shipyard company in this community The slope transportation system is installed.

4. DISCUSSION and CONCLUSION

Despite the similar geographical and demographic characteristics of the three selected communities, substantial differences were found in their preparedness towards disasters. The findings from this study demonstrated that community-based preparedness towards disasters such as installing disaster prevention equipment, preparing disaster prevention maps and performing emergency drills through positive community involvement and active functions of the community association were effective in sloped urban districts. Furthermore, findings suggest that human resource shortage may be solved through collaboration with private companies, welfare facilities and religious facilities within the communities.

The authors conclude that the community associations' proactive effort to activate

community involvement and collaboration with human resources within communities are beneficial for strengthening preparedness towards disasters in the sloped urban districts.

Photo1. Disaster prevention equipment in community

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Session-5

ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.140-143, February 16-18, 2017

Distribution of Total Mercury and Methylmercury in the Sediments of Kaohsiung Port, Taiwan

Chih-Feng Chen • Guan-Ting Lin •Cheng-Di Dong • Chiu-Wen Chen*

ABSTRACT: Six surface sediment samples collected at the Kaohsiung Port of Taiwan were analyzed to investigate the pollution status of mercury (Hg). Sediment samples were characterized for total mercury (T-Hg), methyl mercury (MeHg), water content, organic matter (OM), oxidation-reduction potential (ORP), and grain size. The results showed that the T-Hg concentrations of sediments were varied from 0.48 to 8.43 mg/kg dw with an average of 0.54 ± 0.71 mg/kg dw. The T-Hg concentration is relatively higher in the river mouth regions, especially at the Canon River mouth. The MeHg concentrations were ranged from 0.077 to 0.742 mg/kg dw in sediments of Kaohsiung Port. The highest concentration was found in Jen-Gen River mouth. The contribution of MeHg was 7.4–99.3% of T-Hg concentration. Moreover, MeHg concentrations correlated closely to the OM and ORP of the sediments, suggested the distribution of MeHg is mainly influenced by the organic property and ORP.

Keywords: Mercury; Methylmercury; Sediment.

1. INTRODUCTION

Mercury (Hg) and methyl mercury (MeHg) are extremely toxic and highly bio-accumulative, and its presence threats the water ecological environment. Anthropogenic activities including municipal wastewater discharges, agriculture, mining, incineration, and discharges of industrial wastewater are the major sources of Hg pollution [1]. Mercury has poor solubility in receiving water; it is easily adsorbed on water-borne suspended particles. After a series of natural processes, the water-borne Hg finally accumulates in the sediment, and the MeHg may be produced [2]. Kaohsiung Port is the largest international harbor in Taiwan. It is located on the southwestern shore of Taiwan and receives effluents from four contaminated rivers: Love River (LR), Canon River (CR), Jen-Gen River (JR) and Salt River (SR). The results of previous research indicate that Kaohsiung Port is heavily polluted with Hg, and that these four rivers are the main pollution sources leading to harbor contamination, especially Love River and Canon River [3].

The objectives of this study were to investigate the distribution, and pollution levels of Hg and MeHg in the surface sediments of Kaohsiung Port, and provide the pollution status of Hg as a future management and pollution remediation strategies for reference.

2. EXPERIMENTAL SECTION

Surface sediment (0–15 cm) samples were collected at 6 sampling sites located in the Kaohsiung

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Port (Taiwan). The collected sediments were measured the Eh (mV) with an Microprocessor ORP Meter SP-2500 and then placed immediately in amber glass bottles pre-washed with n-hexane and sealed with Teflon-lined cap and stored in a refrigerator at -4°C until they were sent to the lab.

Surface sediment were freeze-dried for 72 h, ground to pass through a 0.5 mm sieve and fully homogenized. The dried sediments were placed at -20°C in amber glass bottles pre-washed with n-hexane and sealed with Teflon-lined cap until further processing and analysis. The particle size analysis was using a Coulter LS Particle Size Analyzer. OM was analyzed according to Standard Methods 209F. T-Hg was analyzed according to NIEA Standard Methods (M301.00B). Briefly, About 0.5 g dry weight of the sediment sample was mixed with a mixture of ultra-pure acids (HNO_3:HCl:HF=9:3:3), and was then heated for digestion. The digested sample was filtered through 0.45 μm filter paper; the filtrate was diluted with ultra-pure water to a pre-selected final volume. The Hg content was determined using a cold vapor atomic absorption spectrophotometry (CVAAS) (Hitachi FHS-2 and Hitachi Z-6100, Japan). MeHg of sediment was determined following [4]. Briefly, the procedures include ultrasonic extraction, derivatization (sodium tetraethylborate potassium), dewater (anhydrous sodium sulphate) for preparing the sample before it is analyzed using gas chromatography with mass selective detection (GC/MSD). Mass spectra of MeHgEt is shown in Fig. 2 (a). The identities of MeHg was confirmed by the retention time and abundance of quantification/confirmation ions in the authentic MeHg standards (Methylmercury Ⅱ chloride Sigma-aldrich). The quantitative and confirmation ions were 217 and 246 m/z, for methylmercury derivatives. Fig. 2 (b) shows the selected ion chromatogram of MeHg for standard solutions and sediment sampled of Canon River mouth.

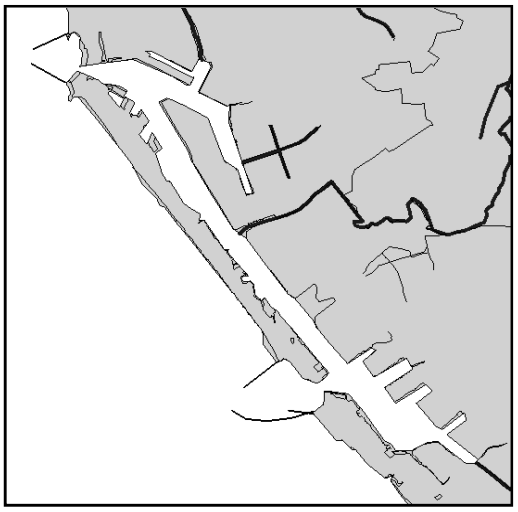

Figure 1 Map of study area and sampling point.

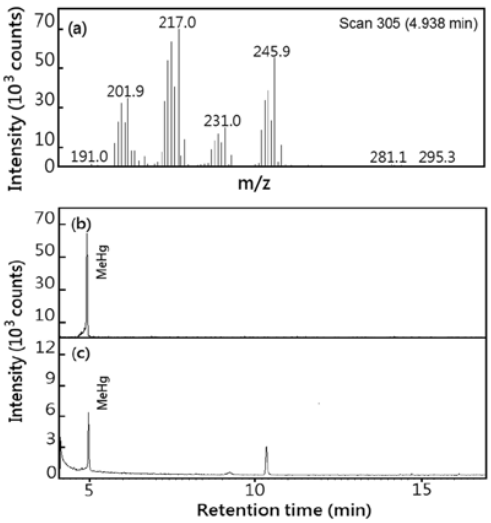

Figure 2 (a) Electro impact mass spectra of MeHgEt, (b) selected ion chromatograms of MeHg standard solution, and (c) selected ion chromatograms for MeHg from sediment sampled of Canon River mouth.

3. RESULTS AND DISCUSSION

Table 1 shows the distribution of grain size, OM, ORP, WC, T-Hg, and MeHg contents in the surface sediments of Kaohsiung Port. The results of sediment particle diameter analyses show that the sediments were mainly composed of sandy silt except sites E I and LR, which have shown high

percentage of sandy particle (>63 μm). OM and WC are relatively high in the vicinity of river mouths compared with those at the harbor entrance areas. The ORP values were negative in the four sediment samples at river mouth indicated that there was no free oxygen for aerobic respiration of animals.

The concentration of T-Hg in the sediment samples ranged from 0.48 to 8.43 mg/kg dw with a mean value of 0.54 ± 0.71 mg/kg dw (Table 1). The highest T-Hg concentrations was observed in CR site, and it was exceeded ERM value (effects range median; 0.71 mg/kg), which indicates that the biological effect would frequently occur [5]. MeHg concentrations of the sediment samples ranged from 0.077 to 0.742 mg/kg dw with a mean value of 0.54 ± 0.71 mg/kg dw (Table 1).

The percentage of MeHg to T-Hg in the sediment samples were between 7.4 to 99.3% (Fig. 3). At most sites, MeHg made up more than 10% of the T-Hg. The high percentage of MeHg to THg was a cause for concern as an increase of available Hg here could result in higher MeHg production. Nonetheless, it should be noted that the two stations with the highest MeHg percentage were also stations with the lower T-Hg concentration (Fig. 4). The concentration of MeHg was positive correlation (r = 0.37) with OM (Fig. 5a), and was negative correlation (r = 0.85) with ORP values (Fig. 5b). The results suggest that the OM contents and ORP values are important in controlling the MeHg production in the sediments.

Table 1 Distribution of grain size, OM, ORP, WC, T-Hg, and MeHg contents in the surface sediments of Kaohsiung Port.

Site	Clay (%)	Silt (%)	Sand (%)	OM (%)	ORP (mV)	WC (%)	T-Hg (mg/kg)	MeHg (mg/kg)
E I	0.9	7.4	91.7	0.95	96	36.2	0.53	0.077
LR	2.4	19.4	78.2	2.41	-270	38.6	0.70	0.691
CR	8.6	73.4	19.0	4.04	-294	73.2	8.43	0.626
JR	11.0	84.5	4.5	4.57	-195	85.8	0.79	0.742
SR	8.0	64.5	27.5	4.72	-25	87.2	0.66	0.161
E II	9.4	79.9	10.7	1.81	206	38.2	0.48	0.223

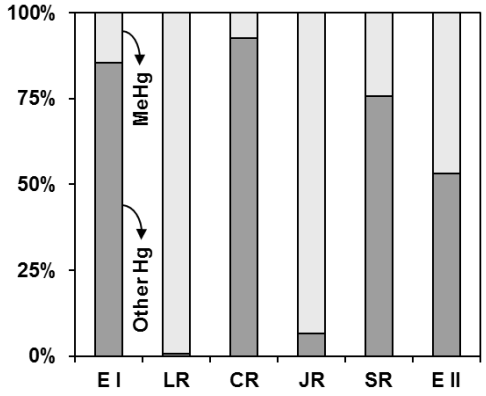

Figure 3 MeHg to T-Hg percentage ratio of sediment in Kaohsiung Port.

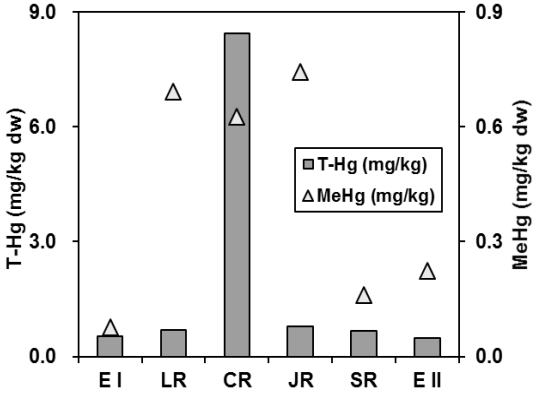

Figure 4 Distributions of MeHg and T-Hg of sediment in Kaohsiung Port.

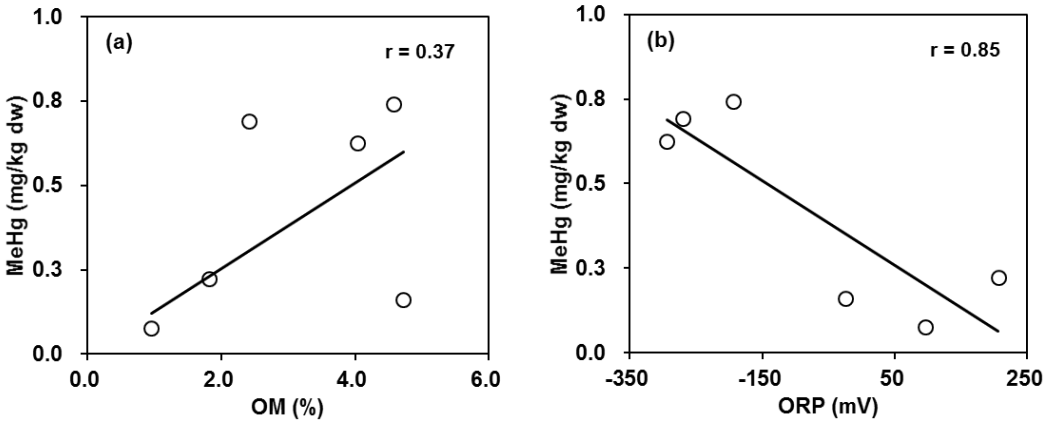

Figure 5 The relationship between the concentration of MeHg with (a) OM content; and (b) ORP values of sediment samples in Kaohsiung Port.

4. CONCLUSION

T-Hg and MeHg concentrations were between 0.48 to 8.43 mg/kg dw and 0.077 to 0.742 mg/kg dw, respectively. The relatively high concentrations of T-Hg and MeHg were found in the river mouth of Kaohsiung Port. The results suggested that Hg in the study area likely originated from the catchments of river. MeHg made up 7.4 to 99.3% of the sediment's T-Hg. There is positive correlation between MeHg and OM concentrations, and negative correlation was observed between ORP values with MeHg concentrations in the sediment in the study area.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.144-145, February 16-18, 2017

Identifying spatial pattern of urban functions in Seoul, Korea

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ABSTRACT: Identification of urban functional area is important in urban planning. With the development of technologies, various kinds of urban data that are publically available are produced. These data make it possible to analyze urban functions from a new perspective. In this regards, this study explores the urban functional areas using urban data including transit smartcard data and statistical data. Clustering was performed from each dataset and the results of each clustering were compared to find out the urban functional characteristics. Different types of urban functional areas in Seoul were obtained and the result indicates that urban functional areas can be discriminated by integrating different urban dataset.

1. INTRODUCTION

In cities, numerous people and facilities are concentrated and various socio-economic activities occurs. The spatial arrangement of places and activities within cities affects lots of aspects of how those cities function. Spatial structure of cities has been investigated as a fundamental theme in urban studies (Yang et al., 2009; Zhang, 2008).

Recently, as the technology for analyzing the data with a large capacity and high complexity has been developed, related research has been done more actively (Wu et al., 2014). In Korea, many statistics about population, housing, land, transportation, industry, infrastructure have been produced and updated by government agencies. These urban datasets; from conventional data such as census data to transit data from smartcards are publicly available. They could help to understand spatial structure and functions of cities and be used for various applications such as urban development, migration or transportation management.

In this regards, this study explores the urban functional areas in Seoul using urban dataset including transit smartcard data and socio-demographic data. Clustering is performed on each dataset; transit data and socio-demographic data. By comparing the results of each clustering, the spatial pattern of urban functions in Seoul would be explored.

2. WORKFLOW

Our workflow comprises three steps: (1) deriving clusters with transit smartcard data, (2) clustering using factor analysis with socio-demographic data, (3) inferring urban functions and major regions based on both clustering results.

Before analysis, the data needs to be rearranged into unit areas. Statistics Korea (KOSTAT) provides census block in format of shp and there are 16230 census blocks in Seoul. Because the census block

was based on resident population, bus stops and subway stations is not evenly distributed in each census block. So we tied up adjacent blocks to make unit areas larger than original census block. After deciding unit areas, the statistical data including population, household, house, and business and transit data were rearranged.

With transit smartcard data, we could know the incoming and outflow population of each unit area. Clustering was performed using the difference between the inflow and outflow. For this, K-means algorithm was utilized. The socio-demographic data includes a lot of variables (more than 150) and many of them have a high correlation. To find meaningful variable, factor analysis was performed. Using factor scores, dendrogram tree clustering was performed. As a result, differentiated spatial clusters from different clustering were identified. And the urban functions of Seoul were inferred based on spatial clustering results.

3. CONCLUSIONS

In this study, we identified spatial pattern of urban functions in Seoul using transit data and socio-demographic data. Different clusterings were performed using different dataset, and their results were compared each other. Seoul city was split into six clusters and clusters classified by travel pattern and socio-demographic characteristics. In future study, additional information about local environments should be further considered. If we investigate the relationship between travel patterns and surrounding environments by using various data, the results of research can be used to reflect transport or urban development policies.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.146-149, February 16-18, 2017

GIS-Based Railway Route Selection:

A Case Study of Kathmandu-Birgunj Electric Railway Line

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ABSTRACT: Transportation plays important role in sustainable development through cost effective movement of good and human beings with less environmental issues. Nepal is developing country with increasing urbanization and increasing transportation demands. The currents routes are not good enough which lead government to propose forward ambitious project of Mechi-Mahakali, Kathmandu-Pokhara Electric Railways. With highest import from Birgunj and shortest distance from India, the Kathmandu-Birgunj is also forward for possible railway. Taking such considerations, based on GIS and free data, alternative routes are derived and found that the shortest route connecting cites and lower slope routes are in contrast and varies much more. This study shows that GIS and open source data can be used for preliminary study of route planning.

1. INTRODUCTION

Transportation plays an important role in the modern world. Effective transportation network is a sustainable development basic need that helps to carry goods as well as helps us to commute from one place to another in short time via land, water and air ways. Railways are one of the high speed, bulk transportation means that redefines the standard in terms of distance and journey time. They strengthens national economy and help in environmental issues as well. In many developed countries, railways has changed commuters' habits in large cities. Construction of railways requites special consideration rather than normal highways. Being long and heavy, curves as well as gradient has to be specific.

Nepal is hilly country with more than 80% being covered with hills and Himalayas in North. Two wheeler motorbikes are very common means of personal transportation whereas van, microbuses and buses are common for inter and intra city transportation. In recent years, with increase in population in the capital cities, the long distance commute and goods transfer has been much demanding and using small vehicles leads to scarcity of roads as well as environmental issues (Yang, 2014). Railway provide a great alternative means of bulk transport to meet the demand of such growing population and development. But currently, Nepal has 53 kilometers of rail track, the narrow gauge trains are currently operational only on the 32-kilometres Janakpur-Jayanagar route. With the intent of providing the bulk railway transportation, Department of Railways (DoR) has forwarded the Mechi-Mahakali (MM), Kathmandu-Pokhara (KP) and Kathmandu-Birgunj (KB), Kathmandu- Rasuwagadhi railway (KR) Electric Railway Line. Also, the government has kept the

construction of the Mechi-Mahakali Railway in high priority and as national pride considering the inevitability of the reliable development of roadway and railway for attaining long-term socio-economic prosperity in the country. The construction of first phase 108 km of the planned 945 km east–west Mechi-Mahakali line that will run from Simara to Bardibas has started from June 15, 2014.

Recently, DoR has started the process for the feasibility study of KB railway line. The line is significant as transportation from Birgunj to Kathmandu for passenger and freight trains will be cheaper, secured, less time consuming and environment-friendly. Although these are very ambitious and expensive projects but it pays in long run. Birgunj is a major trading point for Nepal as over 70 percent of its import and export are done through the border entry point. Kathmandu-Birgunj Railway Line is supposed to connect Birgunj and Rasuwagadhi with the rail networks in long run that connects China with India. The feasibility study for KR has also been in pipeline and Chinese companies has shown much interest in that route. DoR has global tender in order to present three routes for the railway line and recommend the best one (Koirala, 2016).

New routes proposed should be made such that they satisfy the constructions possibility, cost and current and future demands. Effective route selection process is very important for minimizing economical cost. In planning a suitable road network, planners put into consideration factors like gradients or slope of the area, available land-use and soil type, community or national landmarks and governmental interest. This is where technologies such as GIS helps in greater deal. GIS is a system of storing, retrieving and presenting both spatial and non-spatial data in an efficient, quick, and structured way. It is considered as an important and useful tool in the field of transportation engineering and providing the capability to perform transportation analyses. By using GIS the transportation engineers and planners have the ability to organize, store, and analyze spatial information about transportation systems. Furthermore, it considered as a useful tool in transportation planning because of its abilities to display information to the public or decision makers about the transportation system. In design process, GIS help minimize the impact on environment by properly selection of railway route, which is a critical first step in the process of design and construction and has a potential significantly impacting the construction and environmental of the area. Usually, Geotechnical, Geometrical, social and economic factors are used for the multicriteria evaluation in selecting route.

In this study, we will be selecting the optimal railway alignment for the newly forwarded KB electric railway line using GIS based least cost path algorithm. The cost of the path is based on the slope, landuse and the displacement buffer. All the data used in the study are freely available database for the public.

2. Materials and Methodology

To complete the purpose of the study, data were collected from the internet source and the rasterized for the weighted overlay in order to calculate the cost for path. Least cost path algorithm was used to align the possible route for the railway line. Figure 1 shows the overall method adopted.

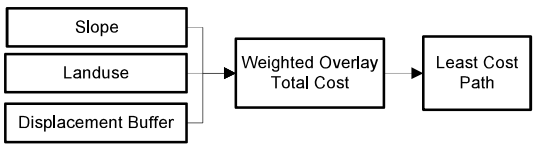

Fig. 1. Flow Chart of the Study

2.1 Study Area and Data Used

Study area in the study is the alignment that connects Kathmandu to Birgunj Custom Office. Along the study alignment area, four cities are supposed to be connected namely Hetauda, Amlekhgunj, Simara and Jitpur. The figure of the study areas is shown in figure 2 (a).

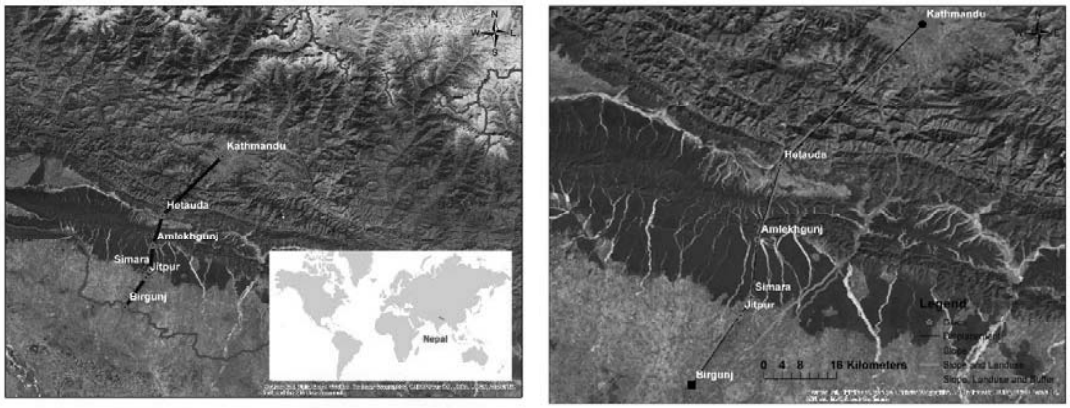

Fig. 2. (a) Study Area for the railway track (b) Railway track derived.

The data used in the study area are chosen based on the requirement of the railway line construction. SRTM 30m DEM is used for the extraction of DEM after filled for pits/sinks. Landuse derived from Landsat for the year 2010 obtained from ICIMOD has been used for the alignment that passed through cities. And finally the displace alignment were used for the buffer calculation so that the path is as much least as possible.

2.2 Weighted Overlay Coast and Least Cost Path

Weighted overlay combines the raster in terms of scale of the user requirements. Weighted overlay are based on the scale of the input raster and the whole weight of 100%. Important factors are given higher percentage and lower scale whereas opposite for the less important conditions.

Cost distance analysis relies on a “cost surface”, which is a raster dataset. The value of each cell represents the cost per unit distance of crossing that cell, (which does not include the physical distance travelled as a measurement). Generally, and according to the study area characteristics, the cost is based on one or several variables such as slope, land cover class, and geology (ease of passing or possibility of passing with least damage to the area or passing with least monetary value). Similarly, backlink is connected to the destination for the direction purpose which is also the minimum in movement. Least-cost path analysis (LCPA) allows designers to find the “cheapest” way to connect two locations within a cost surface which can be computed by combining multiple criteria, and therefore by accounting for different issues (environmental impact, economic investment, etc.).

3. Results and Discussion

First of all, all the dataset were collected and the cities to be connected for the route were identified based on the landuse map of the area. First the proposed route A is proposed based on the

shortest displacement which connects the cities. Yet the train needs much smooth flat rail tracks and this it need to be with minimum slope in the route. Hence, the second route B is based on the cost of the slope. The more complexity comes when the landuse needs to be included in the process, what to preserve and avoiding water and dense cities, deciduous thick forests etc. Thus comes the route C which incorporates the slope and the landuse in 70-30 ratio of importance. And combining all the factors and for the shortest route, route D is proposed using the least cost algorithm in the ArcGIS. The results of the processing are shown in Fig 2(b) and the calculated route length and details are shown in Table 1.From the study, the proposed route to connect cities and the cost in terms of the slope and landuse seems to contrast. Minimum distance could cause abrupt difference in slope and the even slope route are far distant and on the bank of the river routes.

Table 1. Routes Factors, weightage and distance derived from GIS.

Routes	Factors	Weightage (%)	Distance (Km.)
A	Displacement		93.52
B	Slope	100	119.56
C	Slope	70	112.38
	Landuse	30	
D	Slope	60	103.69
	Landuse	25	
	Buffer	15	

4. Conclusion and Recommendations

This study aimed to calculate the routes for the proposed KB electric railway based on the slope, landuse and displacement buffer in the GIS environment. Based on various conditions, four alternative routes were derived and the cos of the slope and landuse contrast with the displacement and connecting the cities.

From the study, it is clear that the routes need to be more detailed studies based on the construction cost, bridges needed and tunnel needed as well as the future demand where the cities will be growing and locating. The study also shows that from the freely available datasets, preliminary route planning can be done and can be useful for the related planning for the management.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.150-159, February 16-18, 2017

Design and Implementation of Evaluation System for High Accuracy and Intelligent Navigation Data

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Abstract: with the rise of the automatic driving technology, the precision of the navigation map on the highway is getting higher and higher, so it is necessary to make a reasonable evaluation of the precision of the navigation data that acquired by vehicle mobile measurement system. A section of a highway as an example, this thesis presents a verification classification map data and detailed performance evaluation index, and also discusses the system design and implementation of 3D visualization and navigation data management. It has some reference value for the establishment of a perfect evaluation system of high precision navigation products and the verification of the precision of navigation data products.

1. INTRODUCTION

With the rapid development of automobile industry, automobile intelligent, automatic and unmanned driving has become the future development trend of the automobile field, and high precision intelligent navigation data as an important part of automobile driving environment, can be used to prompt the car driving direction and traffic information, and play a central role in the development of intelligent car.

At present, can realize the automatic and high precision, 360 degrees of geographic information acquisition using the navigation data collection vehicle mobile measurement system, improving the status of the traditional city surveying and mapping artificial time-consuming, greatly improve the efficiency of data acquisition. The navigation data needs the parameters of basic lane of vehicle routing and feature objects along edge of highway, including the spatial location, geometry size and other parameters. The spatial location, geometry size and other parameters of the navigation data need basic Lane accurate acquisition of vehicle routing and border features, such as the shape of sign and the thickness of the column along the highway, the height and angle of the vehicle through the bridge, the curvature of the high-speed curve and ramp mouth. The map data includes ADAS-enabled road shapes, topologies and other advanced attributes, matching vehicle location to the upcoming road segment on the map, analyzing the road conditions ahead, providing information forecasts, assisting the driver before a hazard occurs, making driver- safer and more comfortable.

The accuracy of the resulting navigation data is critical to the post-production of the navigation map, so how to verify its accuracy becomes a challenge and it is difficult to complete and guarantee accuracy in a short time by means of manual calculation alone. In order to validate the accuracy of a large number of navigation data products, this paper designs an evaluation system to validate the

accuracy of navigation data on highway as an example. Based on the data management classification and accuracy performance evaluation index, the system can be 3D visualization of comparative analysis and output validation values (navigation data products) the accuracy of assessment results.

2. OUTLINE OF THIS STUDY

2.1 Navigation Data Organization and Management

(1) Standard data collection process

The project study area to select a certain part of the highway along the border characteristics were used to evaluate the accuracy. Using the on-board mobile measurement system to quickly obtain the navigation data of the research area in advance, it is necessary to use the combination of GNSS RTK and prismless total station to obtain the high-speed road for its reliability and future navigation map. The WGS-84 coordinates of some feature points are used to validate the position, shape, curvature and slope of the features in the navigation data, which is the standard data in the validation process.

(2) Data classification

In the analysis of highway along the border conditions, the selected characteristics of the basic divided into two parts. The surrounding roads were characterized as object properties, highways own situation as road attributes. Specific verification of the contents are signs, columns, guardrail, bridge, ramp curvature, ramp mouth slope, high-speed access zebra crossing, classification shown in Figure 1.

(3) Three-dimensional display of data

For the above-mentioned navigation data product accuracy evaluation needs to combine the specific situation to analyze. When the data precision is verified, it is necessary to extract the common points of the navigation data and the standard data from the features to ensure that the coordinates of the product point and total station are in the same coordinate system, such as WGS-84 or 1954 Beijing coordinates system. In the traditional point cloud data common point precision verification scheme, first select dozens of feature points in a test area, use the coordinate obtained by the total station as the true value, and the point cloud data as the verification value. In Excel or other tools in most cases, the point error in the spatial position of a single-point cloud can only be obtained in numerical form.

$$\left.\begin{aligned} dX &= X_{test\ \ value} - X_{true\ \ value} \\ dy &= y_{test\ \ value} - y_{true\ \ value} \\ dz &= z_{test\ \ value} - z_{true\ \ value} \end{aligned}\right\}$$

Plane position error

$$ds = \pm\sqrt{dx^2 + dy^2}$$

The medium error

$$\sigma = \pm\sqrt{\frac{[\Delta\Delta]}{n}}$$

Where, n is number; Δ is the difference between the test value and the true value.

In this paper, based on the above-mentioned precision verification, we developed a set of 3D visualization interface, using human-computer interaction, convenient for users to view data through different viewpoints and different ways, observe the comparison of the verification value and the truth value under simulated physical conditions . This can avoid a large number of complicated data display, the image visually shows the comparison results, and can produce raw data in Excel format and various data graph format evaluation report.

2.2 The Navigation Data Accuracy Evaluation System

(1) Precision performance evaluation index

The system classifies and classifies the precision data of the feature data involved in this part of the highway. According to the project requirements, these features were put forward specific performance indicators classification and grading. Consider the need to verify a series of features in the WGS-84 under the relative spatial position and size of its own physical properties such as shape, the system will be divided into spatial indicators and geometric indicators, each category is divided into the following first-level indicators, second-level indicators, third-level indicators. In this project, the classification of three-level indicators can meet the purpose of product verification. Some indicators can only be assigned to the first level, and the categories of analysis can be appropriately increased in the later stage. The detailed evaluation indicators are shown in Table 1.

Table 1. Precision performance evaluation index

Object	Spatial relationship index			Geometric relationship index		
	First Level	Second Level	Third Level	First Level	Second Level	Third Level
Square signs	Feature points	Center points	Dihedral angle	Side length	area	—
Diamond - shaped signs	Feature points	Center points	Dihedral angle	Side length	area	—
Circular signs	Feature points	Center points	Dihedral angle	radius	area	—
Circular fence	Feature points	—	—	height	length	—
Column	Feature points	Horizontal angle	Center points	diameter	height	—
Bridge surface	Feature points	radian	Dihedral angle	height	—	—
Curvature	Feature points	—	—	curvature	—	—
Transverse slope	Feature points	—	—	slope	—	—
zebra crossing	Feature points	—	—	length	width	—

(2) Data Feature Coding Classification

All the features of the highway involved in the system need to be organized and managed. However, at present, there is no uniform standard for the classification of highway navigation data elements. Therefore, this paper refers to the national standards of classification and codes of geographic information elements, and combines the actual situation of the project, and designs the organization form and classification of corresponding data coding.

Considering the factors such as the quantity, distribution and classification of the projects to be verified and in order to facilitate the software loading process and the realization of internal

algorithms, a set of coding specifications was developed, which were divided into four categories: named points, feature categories , feature ID, feature number, in a linear arrangement of a total of 8 to the beginning of the letter, and the remaining seven decimal number code, the specific code organization shown in Fig. 2.

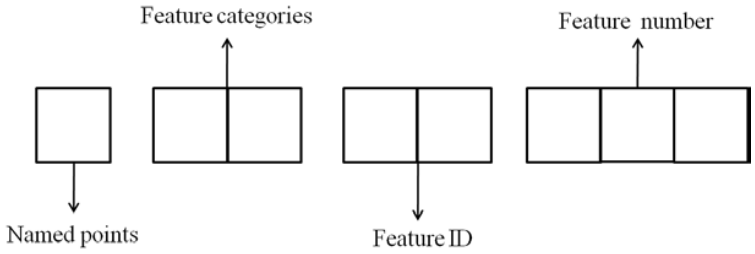

Fig. 2 The encoding specifications

Illustration:

1) From the left of the first bit for the point name, such as T on behalf of the feature points to the first letter of the naming convention.

2) From the left 2ed and 3rd position for the characteristics of categories, such as 01 on behalf of signs, 02 on behalf of the column, 03 on behalf of the barrier, and so on.

3) From the left 4th and 5th position for the feature ID, based on the characteristics of the classification of categories based on categories, such as signs in the 01 on behalf of square, 02 on behalf of round, the rest of the same token.

4) From the left, the 6th, 7th and 8th bits are the feature numbers. On the basis of the same category of the features, each feature is named in turn, and the number ranges from 0 to 999.

If the system data input standard format classification code T0101001, which represents the project of the first square on the highway signs of the feature points, finishing effect shown in Fig. 3, where the data for the test data.

对象	对象ID	编号	照片	真值			验证		
				X	Y	Z	X	Y	Z
标牌	T0101	001		4441322.196	455414.216	34.033	4441322.309	455414.244	33.899
				4441321.568	455415.886	34.026	4441321.591	455415.881	33.919
				4441321.574	455415.880	32.859	4441321.575	455415.908	32.889
				4441322.195	455414.216	32.865	4441322.305	455414.243	32.859

Fig. 3 Square sign classification and coding

3. THE SYSTEM DESIGN AND IMPLEMENTATION

The development environment of this system is Microsoft Visual Studio 2010, which is based on the interface control of Developer Express V2010. It uses SQLite as the storage foundation for large amount of navigation verification data. The whole system adopts C / S architecture. System main interface is shown in Fig. 4.

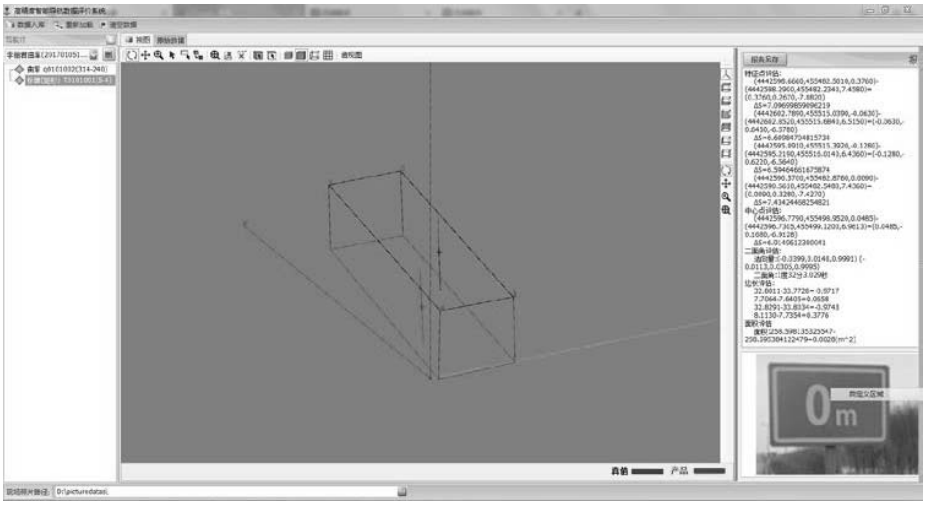

Fig. 4 System main interface

3.1 System Framework Design

The purpose of this system is to establish a platform for verifying the accuracy of standard features on the freeway as the navigation data. The system is mainly composed of data management classification module, 3D visualization analysis module and background assistant module. The overall framework is shown in Fig. 5.

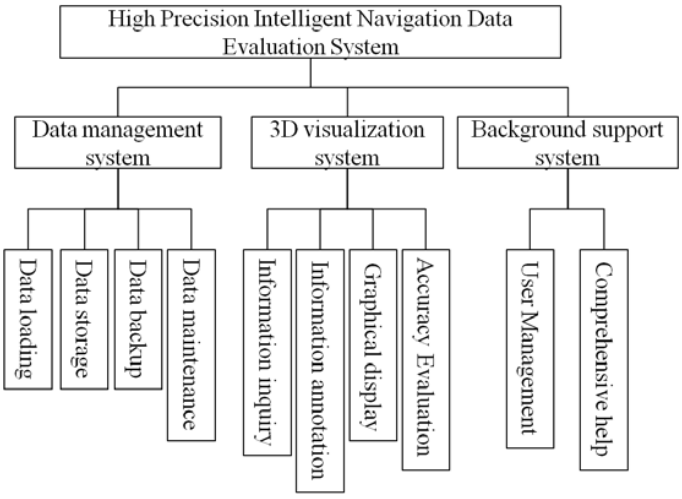

Fig. 5 System overall framework

(1) Data Management System

A series of characteristic survey data collected on the pre-designated highway are sorted and coded into the database, and the accuracy evaluation indexes of the different features are corresponding to it. The system can check verification value data for each type of material characteristics and the true value of the data acquisition time and location data features thereof. And

the system can timely operate on each object attribute information modification, data backup, data maintenance.

(2) Three-dimensional Visualization System

The system can generate the virtual graphs and display the 3D data of the features in a specific coordinate system, and let the users have a visual comparison of the features formed under different data. It avoids the numerical data generated by the traditional precision verification, the accuracy of the comparison of vertigo results. In the 3D visualization window, the users can add, delete, translate, whirligig, and so on. The users can use different viewing angles (perspective, head-up, top view). And they can customize information annotation and information query. The system selects the error range of the accuracy calculation and the corresponding performance evaluation index to meet the user's precision evaluation output requirement.

(3) Background Assistance System

The system can realize the different rights and permissions management of the administrator and the user, guarantee the system can run normally, safeguard the security and reliability of the information, carry on the log monitoring and recovering at the same time. Provide software to use the help that provides information on the current highway links, such as Baidu map corresponding sections of the streetscape situation.

3.2 Key Technology Realization

The development process of the system requires the design of specific algorithms for different features, involving spatial geometry, linear algebra and measurement adjustment and other knowledge, in order to achieve a reasonable accuracy analysis. Unlike the previous expression data analysis results in the table, the software generates a graphical visualization window in outline by the algorithm, user-friendly data analysis accuracy. The following are enumerated in this project several typical characteristics of the algorithm implementation ideas.

(1) Non-circular Plate Model Generation

For the four corners of the non-circular plate data, we need to generate the spatial plane quadrilateral in three-dimensional coordinate system, and then analyze its precision performance index. Theoretically, the data of the 4 corners should be in the same plane, but due to the presence of random error in the measurement, the results are not so pavilion on a plane, they need to be fitted in the same plane. The main algorithm is described below.

The expression of general equation in space plane is shown below.

$$A\mathbf{x} + By + Cz + 1 = 0$$

The matrix form is shown below.

$$\begin{bmatrix} X_1 & y & Z_1 \\ \vdots & \vdots & \vdots \\ X_n & Y_n & Z_n \end{bmatrix} \begin{bmatrix} A \\ B \\ C \end{bmatrix} = \begin{bmatrix} -1 \\ -1 \\ -1 \end{bmatrix}$$

The result of after matrix transformation is shown below.

$$\begin{bmatrix} A \\ B \\ C \end{bmatrix} = \begin{bmatrix} \sum x_i^2 & \sum x_i y_i & \sum x_i z_i \\ \sum x_i y_i & \sum y_i^2 & \sum y_i z_i \\ \sum x_i z_i & \sum y_i z_i & \sum z_i^2 \end{bmatrix}_{3\times 3}^{-1} \begin{bmatrix} -\sum x_i \\ -\sum y_i \\ -\sum z_i \end{bmatrix}$$

Algorithm to solve the specific solution A, B, C into the plane after the equation, the system gets the fitting plane. Respectively, the four corners of the projection to the plane, followed by connecting the formation of a planar quadrilateral space, the effect shown in Fig. 6. In the figure, two square sign virtual graphics are generated using product data and truth value data, respectively.

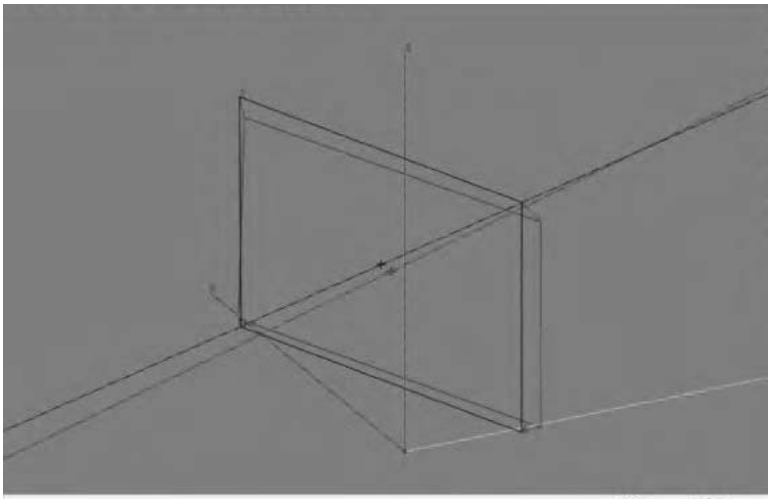

Fig. 6 Non-circular signs contrast effect

(2) Circular Plate Model Generation

For the 10 edge points of the circular sign, we need to generate a spatial plane circle in the 3D coordinate system, and then analyze its precision performance index. First, the data points are fitted to the corresponding plane; then the data points are projected onto the fitting surface. The 3D problem is transformed into a 2D problem, using the conventional 2D plane fitting circle method. The main formula is as follows.

$$v_i = \sqrt{(x_i - x_0)^2 + (y_i - y_0)^2} - R$$

Where, (x_0, y_0) is the center coordinate; R is the radius of the circle; v_i is the difference between the distance from the point to the center and the radius R.

After the approximate value of the parameter *(x0, y0, R0)* is substituted into the above formula, the error equation can be obtained as shown in the following formula.

$$v_i = \begin{bmatrix} -\frac{x_i - x_0}{\rho_i} & -\frac{y_i - y_0}{\rho_i} & -1 \end{bmatrix} \begin{bmatrix} \delta X \\ \delta y \\ \delta R \end{bmatrix}$$

The matrix form is shown below.

$$\boldsymbol{V = N\delta X - L}$$

The approximate value of the center coordinates can be obtained according to the average coordinates of each point. The radius approximation is 1, and according to the constraint conditions, the iteration is repeated until δX converges to obtain the solution of the unknown number. The result is shown in Fig. 7. The figure uses product data and truth value data to generate two circular signs virtual graphics.

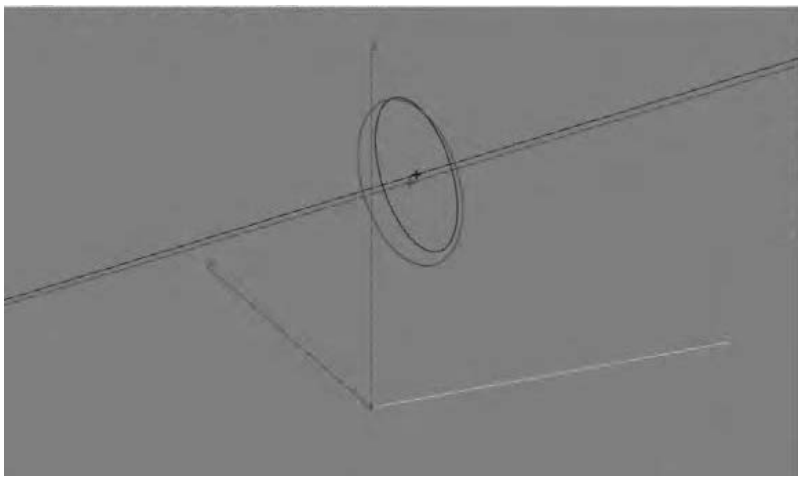

Fig. 7 Circular plate contrast effect

(3)The Center of the Column

As shown in Fig. 8, the 3D coordinates of the central point of the column on the freeway cannot be directly observed and measured by the total station. The system can be generated by software later calculation. The idea is as follows. From the field data we can see *A, B* two-point coordinates, A point for the station and *B* point for the total station eyepiece horizontal cross wire and column surface intersection midpoint, and the column radius *R* can be obtained by manual measurement. The coordinates of the column center point $(X_O, Y_O, Z_O)$are calculated as follows.

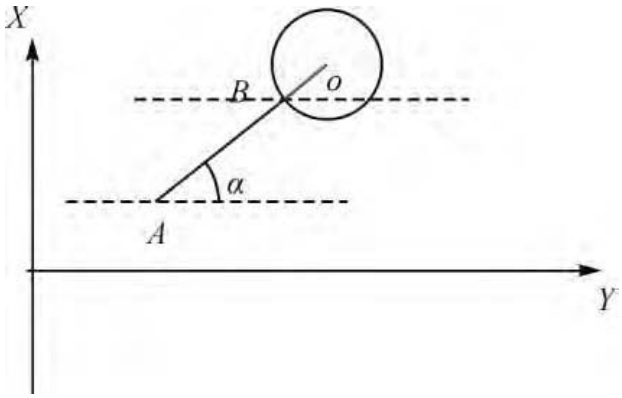

Fig. 8 Calculation of the coordinates of the column center point

Aiming at the problem of curvature model generation of freeway ramp, It is necessary to acquire the feature point data every a short distance on a specific road in advance. To calculate the curvature P of any point on the transition curve of the ramp, we select the n adjacent points before and after the point P, fitting the curve equation through the high order polynomial, and obtain the corresponding curvature through the curvature formula.

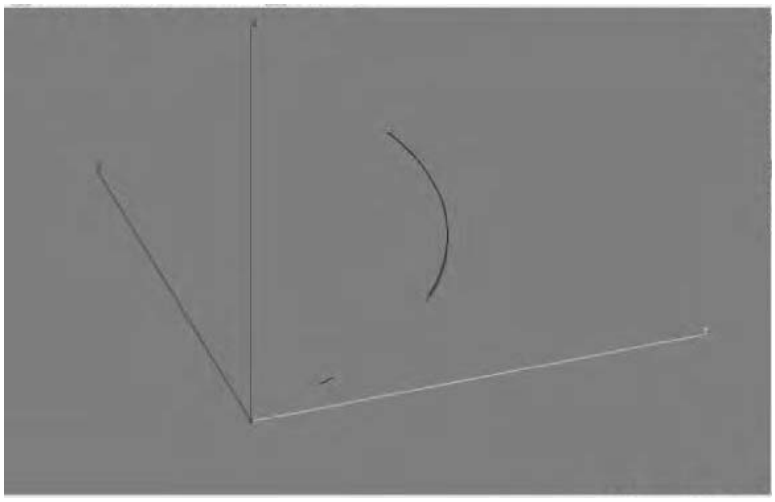

Fig. 9 Road curve contrast effect

4. CONCLUSION

In the context of the increasing demand for high-precision navigation maps, the accuracy of a large number of navigation data products needs to be verified with reliability. In this paper, an evaluation and analysis program is put forward in this paper. The evaluation system and method are put forward. Through the system, the precision analysis of the common features on the highway is given. The results of the data accuracy evaluation are given in the spatial index and geometric index. It can display the 3D visualization window to the user. At the same time, it can realize all kinds of 3D operation and attribute modification. It has certain application value in fast and accurate verification of navigation data product precision. In the future development work, it is necessary to strengthen the function in the human-computer interaction. The model establishment and the precision analysis scheme design of the remaining features on the highway still need to be further improved.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.160-168, February 16-18, 2017

Comprehensive Monitoring For Beijing Tongzhou Dipamkara Stupa, China

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ABSTRACT: In June 2016, according to the spirit of the Political Bureau of the Central Conference on planning and construction of Sub-CBD, and further promoting the work about the coordinated development of Beijing, Tianjin and Hebei, the role "subsidiary administrative center" of Beijing Tongzhou New Town has been turned into "Sub-CBD ". As cultural relic protection unit of Beijing, Dipamkara stupa is located in the bank of northern section of the canal of Beijing Tongzhou District which was built in the North South Zhou Yuwen period and rebuilt several times in Ming and Qing Dynasty. At present, the most of the relevant information on the tower are books and related text files. The digital data such as the environment of the tower and its three dimensional digital data and the detailed structure information is insufficient. This project is mainly based on sophisticated science and technology of Surveying and mapping such as UAV mapping, 3D laser scanning, GPR and so on. Through the comprehensive monitoring and dynamic monitoring of the tower, the project can achieve the goals such as the record and management of digital archives, health monitoring Dipamkara stupa and so on.

KEY WORDS: Dipamkara stupa, 3D laser scanning, GPR, comprehensive monitoring

1. INTRODUCTION

Dipamkara stupa, known as "Tongzhou tower", which is a culture relic protection site in Beijing province is located in the bank of northern section of the canal of Beijing Tongzhou District. The ancient pagoda was built in the north Zhou Yuwen period of the northern and southern dynasties and repaired again during the Ming and Qing dynasties. The ancient pagoda is a brick structure with plane octagonal, 56 meters high,13 layer dense eaves treasure heart towers. "Guta Lingyun" was one of eight scenic spots in Tongzhou.

At present, the tower is located in Sanjiao Temple, becoming one of the representative architectural heritages in Tongzhou area. With the strengthening of cultural heritage protection in the last two years, the area has been gradually incorporated into the protection and reconstruction area. The surrounding situation is more complex, there are Buddhist temples and residential buildings, near the subway line through the air there are routes through the relevant information about

The current tower for the books and related text files, the tower's environment and its own three-dimensional digital data and detailed Structural information and other digital data is lacking, the previous "catastrophe" has failed to effectively monitor the status and health status of the tower. In order to realize the goal of the digital file record, management and health monitoring of the tower, it is necessary to monitor the tower all round.

Fig.1 Dipamkara stupa

2. MONITORING AND CONTROL NETWORK DEPLOYMENT

The purpose of the control survey is twofold: one is to facilitate the registration of large amounts of building structures with high accuracy of registration to the measurement or design reference coordinate system to facilitate the comparative analysis of the data; the second is to build a permanent basis for long-term building environment and their own status monitoring.

2.1 Horizontal Control Survey

This project selects the GPS network as the first plane control network. The GPS control network should be set up with a stable point and reasonable distribution. It can not only directly observe the relevant target of Dipamkara stupa, but also facilitate the flexible laying of a fulcrum. According to the situation around the tower, we set up a total of 6 GPS points (Figure 3), the specific point shape in accordance with the optimal design principles of GPS control network observation and adjustment.

Fig.2 GPS network distribution map

On the basis of the GPS point, we set the laying wire network and level network in the tower around. Encrypted wire control is mainly served for the scanning and post-measurement, the main layout of the encryption design of post-point due to the relevant site scanning, the specific principles are as follows:

a :The overall distribution need to be more open, geometric uniformity.

b: Two observing stations can observe at least 4 common control points at the same time.

c: Considering the stability, ensure that the control point during the entire observation period will not be damaged or blocked by the construction side.

GPS network layout specification is reinforced concrete model. Specific specifications shown in Picture 4:

2.2 Elevation Control Network Layout

The project plans to establish a secondary leveling route for the three-dimensional information acquisition and deformation monitoring height control of Dipamkara stupa. 1 Elevation reference system take the Beijing elevation system; to meet the requirements of the three-dimensional digital information collection of Dipamkara stupa and the second-class leveling route in combination with the design requirements, the leveling route covers the whole surveying area to meet the demand of ground level laser scanning and routine monitoring for elevation control. The plane control conductor point and elevation control Level, you can share the same standard stone.

After finishing the adjustment at the elevation control point and meeting the accuracy requirements, no longer be connected with the external point during the information collection period of the combustion Dipamkara stupa until all the information collection and system construction are completed to ensure the stability of the elevation reference data during the project implementation period.

3 .3D LASER SCANNING AND DEFORMATION MONITORING

The three-dimensional laser scanning mainly solves the three-dimensional geometric shape of the lighthouse, the data acquisition of the lighthouse-related building and its accessories (stone, Buddha statue, relief, etc.). The three-dimensional laser scanning achieves continuous measurement of the three-dimensional spatial position of the target surface by means of high-speed laser emission to the object surface, and then obtains the whole information of the target.

Generally, the following principles should be followed for site scanning :

a : Site coverage needs to be comprehensive and as little as possible, the data between adjacent sites complement each other;

b: Adjacent sites should ensure a certain degree of data overlap;

c: The control station shall have at least four control conditions.

The control point is connected with the scanning site by the target.

For the scanning of building components, scan station can be set according to the actual location of the component.

According to the scanning range and accuracy, we choose the long-range and short-range combination of a variety of three-dimensional laser scanning equipment, include: RIEGL VZ-1000, Faro Focus3D X130, Leica Infinite 2.0 Joint arm scanner.

RIEGL VZ-1000 mainly to solve the top of the tower and the top of the need to set up from a remote site to obtain the scanning range of more than 50m of data, to meet the accuracy of the premise

to obtain the fullest possible top of the data.

Faro scanning is mainly used to obtain the target data in the range of 50m and accuracy of the target data in the millimeter level, including the tower base and the bottom of the tower subsidiary carving carvings and other targets.

3.1 Data Collection

The whole scan is mainly scanned by Riegl VZ-1000 and Faro Focus3D scanner to get the terrain data and tower profile data. The missing part can be encrypted according to the situation. Peripheral scanning station layout shows in Fig.3.

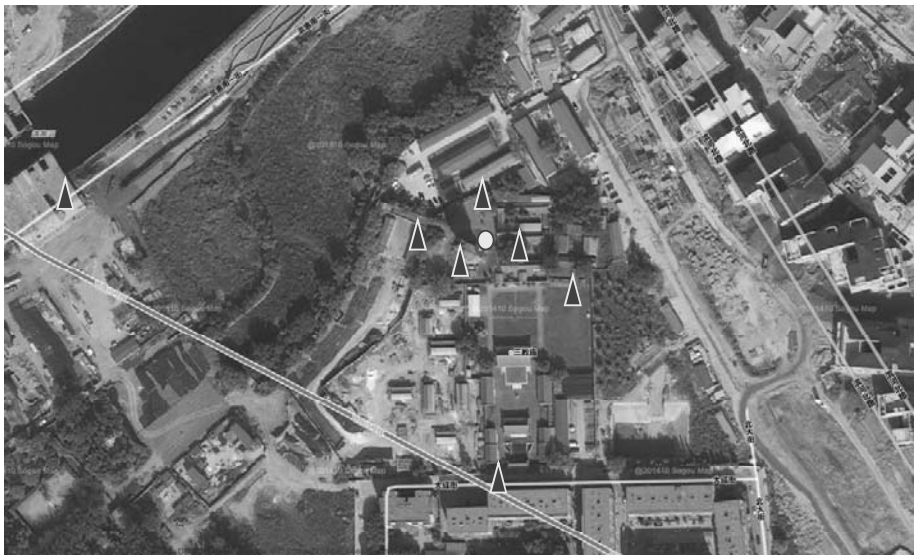

Fig.3 Overall scan layout

In order to obtain the region's data, we need to erect a suitable height platform to cover the whole area of the ground and monitored building, high-altitude scanning platform erection diagram is as follows:

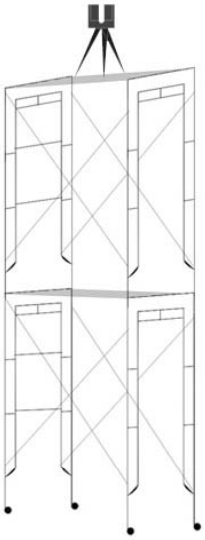

Fig.4 Erection platform diagram

3.2 Data Processing and Analysis

The following figure 2 is the data result obtained from the ground 3D laser scanner through a series of operations such as splicing, drying, modeling, etc.,

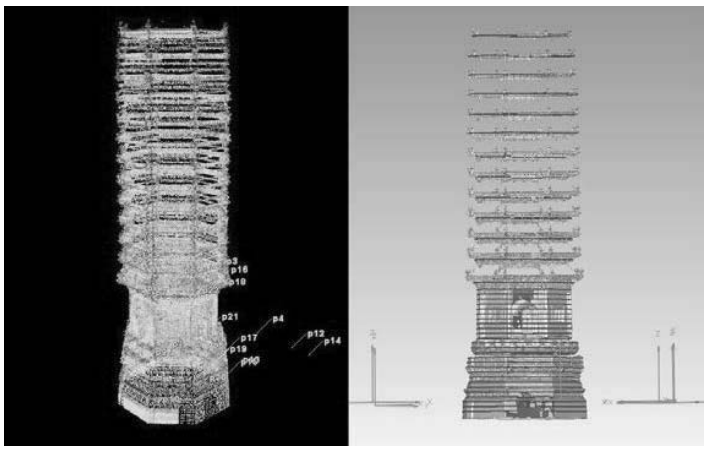

Fig.5 Joint point cloud data and modeling results

After three-dimensional data analysis, the tower has been tilted to the southeast. The analysis results are shown below:

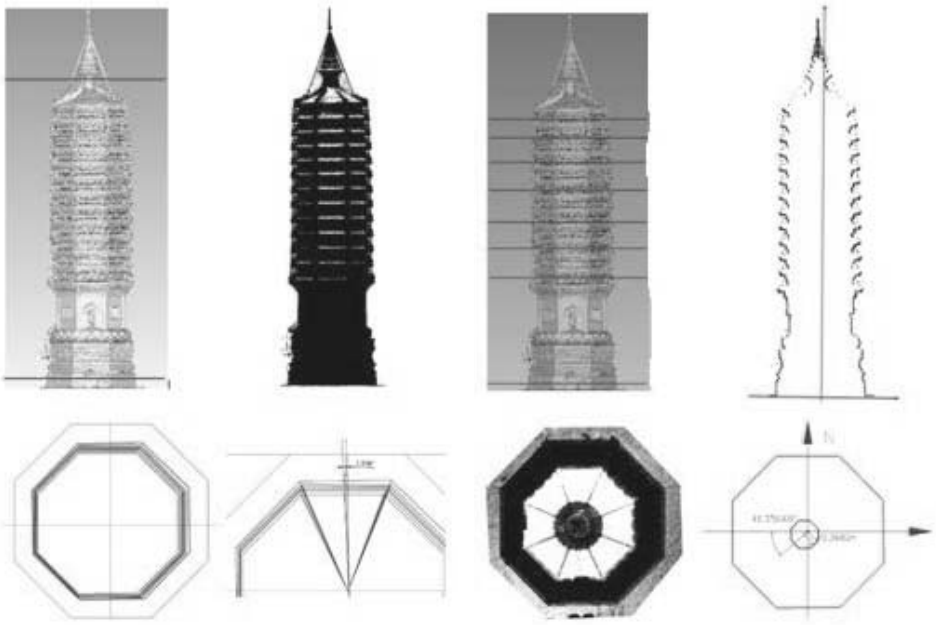

Fig.6 The twisting of the tower

Fig.7 The inclination of the tower

Fig.6 shows the layer structure error caused by second layer and the top layer relative to the maximum angle of torsion 1.578 °, and the remaining layers of the torsion angle in this range of random distribution.

Fig.7 shows that the center of the pyramidal center of the tower is 0.3601m away from the center of the base and the angle deviation is 41.3566 ° west.

4. GROUND PENETRATING RADAR DETECTION

4.1 . Introduction of Ground Penetrating Radar

Ground Penetrating Radar (GPR) is to detect underground targets by reflection of broadband high frequency electromagnetic waves in time domain. GPR profile measurement method used to measure the data analysis, according to the waveform similarity and in-phase characteristics to pick up the reflection layer, according to the amplitude, wavelength and shape characteristics to identify anomalies.

The characteristics of the technology are summarized as follows: ① ground penetrating radar is a non-destructive detection technology, the requirements of environmental conditions are more relaxed, strong adaptability; ② anti-vibration ability, can work in the city of various noise environment, Environmental impact of small; ③ have to meet the requirements of the detection depth and resolution, the maximum depth of 80 meters or more, the scene directly to provide real-time profile records, the image clear and intuitive; ④ high efficiency, portable host control data acquisition, recording , Storage and processing.

4.2. Data Collection

GPR data acquisition is divided into two categories: reflection detection and projection detection. Dipamkara stupa top view as shown in Fig.8 below, ① ② ③ represent the medial corridor, grass and lateral corridor. The Taki survey is divided into four survey lines, located in the side of the wall near the inner corridor, medial corridor midline, the middle of the grass and lateral corridor, the detection depth of 20m. Including the investigation of the bottom of the lighthouse masonry survey, including a total of five lines are from the tower northeast corner of the 0 position, along the clockwise direction, the detection mode for the point measurement, the data collected once every step.

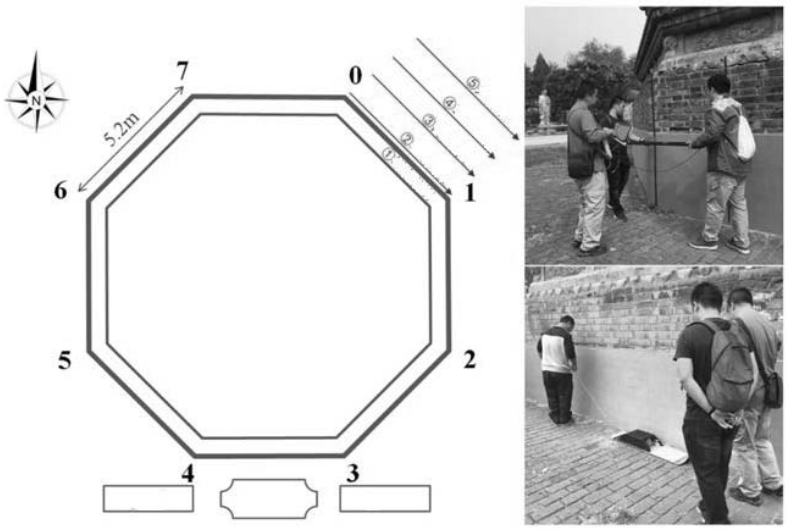

Fig.8 Dipamkara stupa and arrangement of surveying line

4.3 Data Processing and Analysis

Data processing is generally divided into editing, filtering, time gain, digital processing, graphics. Data acquisition process can be real-time data processing and display on a portable computer. GPR reflects the main differences in the electrical properties of the formation.

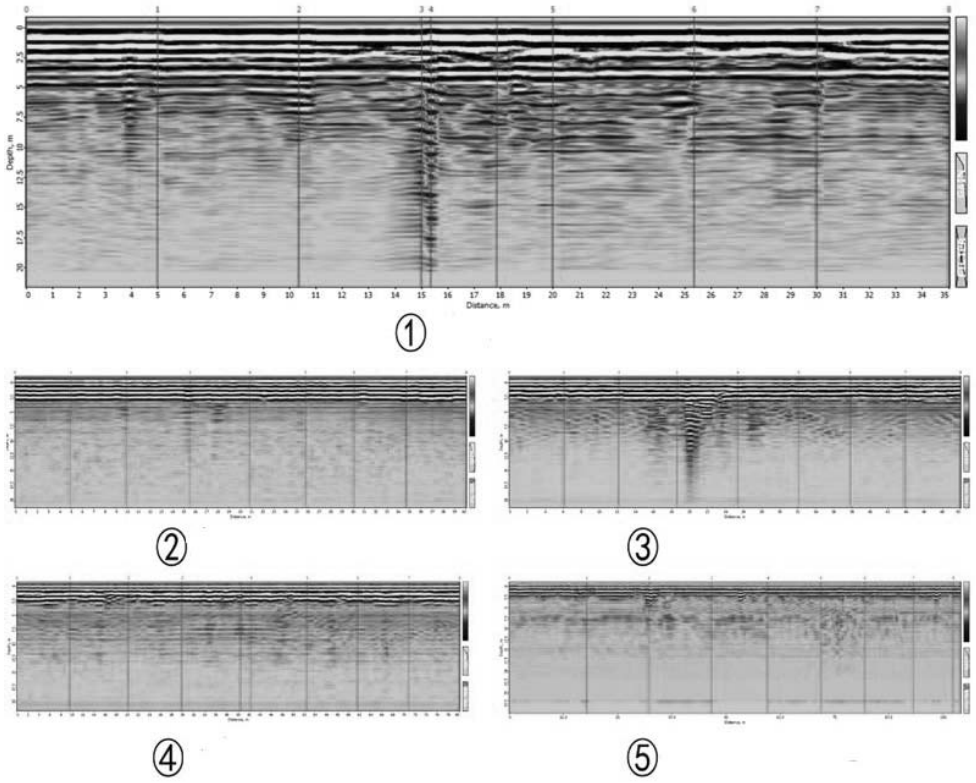

Fig.9 The position of the tower section

Analysis shows that the lower part of the lower part of the tower southwest of the internal structure of more broken, more water content; 5-6 between the band-like cracks, 1-2 there are more between the small cracks.

5. CONCLUSION

Ancient architecture is the precious cultural treasures left by our ancestors. It has many values such as history, culture, science and technology and art. A well-preserved ancient building is not only a study of a stage of historical and cultural important material information, but also social and cultural changes in the history of the witness. In recent years, the country gradually increased the development of national cultural soft power, such as Beijing, "13th Five-Year Plan" proposed to develop the protection and utilization of the eastern canal cultural planning and promote the development of tourism and cultural industries. Beijing Tongzhou Dipamkara stupa is located in the east of the Beijing-Hangzhou Grand Canal in the north of the Grand Canal, the Grand Canal of China is one of the four towers, one of eight Tongzhou, Beijing-Hangzhou Grand Canal Trinidad is the northern section of the flag, has been incorporated into the protection And the category of rehabilitation. In order to carry out a scientific, rigorous and efficient monitoring and maintenance of the ancient buildings, the comprehensive structural information is very important. The project will integrate multi-source data and obtain the omni-directional data of the lighthouse and its subsidiary buildings. , And the development of digital archives management system for future maintenance work greatly reduced manpower, material and financial resources, will become the future direction of the development of cultural relics protection, application prospects.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.169-171, February 16-18, 2017

Assistive Device for Gait Training

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ABSTRACT

Recently importance of the rehabilitation in an early stage is widely accepted for the patients suffered by cerebral infarction. For the walking rehabilitation for such patients knee ankle foot orthosis is often used. While knee ankle foot orthosis prevents the falling accidents, hemiplegic person can't achieve normal walk training since the knee joint is fixed to specified angle. In order to enable the natural walking, knee joint should be locked at the stance phase, and should be unlocked at the swing phase. In this paper we propose a knee ankle foot orthosis which has a braking function in the knee joint. The timing of the braking is determined by a controller to estimate the posture of the orthosis. Experimental results show that proposed mechanism enables natural walking.

1. INTRODUCTION

Why early rehabilitation for the patients suffered by cerebral infarction is required ? The reason is to prevent the he disuse syndrome such as muscle weakness, arthrosclerosis and internal organs function weakness. Rehabilitation in early stage leads to the early recovery to normal life without the onset of disuse syndrome. Gait training is of one effective rehabilitation technique to recover independent life. One of conventional gait training is walking along the parallel bars. Concerning to this gait training, it is important that excess training load should not given to the unsound leg and foot. In order to prevent the excess load on the unsound leg, the trainee is requested to adjust the load on his legs by supporting his weight by the parallel bars. If the load on the unsound leg is not enough, training result becomes unsatisfactory. This adjustment task is achieved intuitively by the trainee. Therefore, more quantitative training method is required. Before the gait training the trainee stands on the scale to memorize proper load specified by the trainer as shown in Fig.1.

Fig.1 Memorization of the

In this paper a new gait training technique is proposed, where the load on the leg can be monitored during gait training by a proposed device. Data about the load on the leg can be monitored and displayed on the display. Once excess training load on the leg is detected, alarm

signal is emitted by the system. Using this device a clinical test revealed the applicability of the training.

2. PROPOSED WALKING SCALE

In order to achieve the safe and proper gait training, the load on the leg during the training is important. Considering this aspect, the walking scale is proposed as shown in Fig.2. At the bottom of the shoes a walking scale board is mounted. Inside of the scale board four load cells are mounted. By processing output signal data the load on the scale board can be measured.

Wheatstone bridge technique to use four gauges is introduced and accurate data can be obtained. The data are transferred to computer via WiFi signals. Therefore, the data can be used to achieve safe and efficient gait training.

Fig.2 Walking scale with four load cells

3. Walking Experiment

Data obtained by the walking experiments are shown in Fig.3. The data was obtained with 2Kg accuracy.

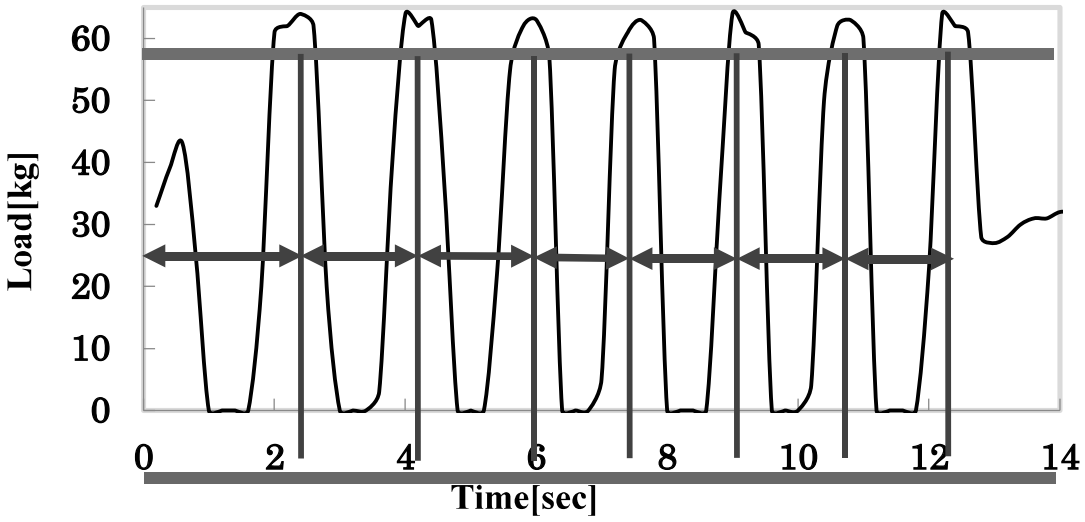

Fig.3 Data obtained during walking

3. Conclusions

The device was tested by an elderly woman, who is suffered by spinal canal stenosis. The trainer analyzed and it is recovered that the load on her left leg is too small. The

trainer requested the elderly to walk so that the load on the left leg increases less than 25Kg. The trainee had gait training for a couple of months with increased safety and efficiency. Fig.4 shows how the gait training was achieved.

Fig.4　Gait training using parallel bars

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Session-6

ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.172-177, February 16-18, 2017

Analysis of Identification Ability Based on Spatial Resolution of Aerial Image

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ABSTRACT: In order to prevent the disorderly spread of a city and to preserve the natural environment around the city, the local governments carry out administrative duties such as the management of the development restricted area and the crackdown on illegal buildings, and use aerial photographs for this purpose. This study analyzed the ability of identify terrain and natural features according to the spatial resolution of aerial photographs used in these administrative affairs qualitatively and quantitatively. For this purpose, we compared 7cm, 12cm, and 25cm aerial photographs and found that 12cm spatial resolution images are effective for local government interpretation tasks.

1. Introduction

Aerial photographs are photos of objects on the ground taken in the air, and they are mainly used to interpret land use conditions and changes in facilities etc. The National Geographic Information Institute (NGII) has taken aerial photographs of 25cm in spatial resolution across the country for about two years and supplied them to local governments. (Architecture Planning Division, Seoul, 2012).

The local governments conduct the interpretation work using 25cm aerial photographs provided by the NGII, but they are having difficulty in interpreting the changes of small buildings in the urban area or the change of the characteristics of the land using by using these images (Architecture Planning Division, Seoul, 2014).

Thus, this study was to analyze the effect of the spatial resolution of aerial photographs on terrain and object identification. To this end, qualitative and quantitative analysis was performed by using images with spatial resolution of 7cm, 12cm, and 25cm.

2. Interpretation Using Aerial Photographs

2.1 Qualitative Interpretation Elements

Aerial photographs are used as basic data for the making of national basic maps or various thematic maps as well as for the purpose of identifying the current status of cities or interpreting unauthorized buildings. The qualitative resolution interpretation of aerial photographs is to visually understand the terrain as well as pattern, color, shadow, shape, positional relationship among objects.

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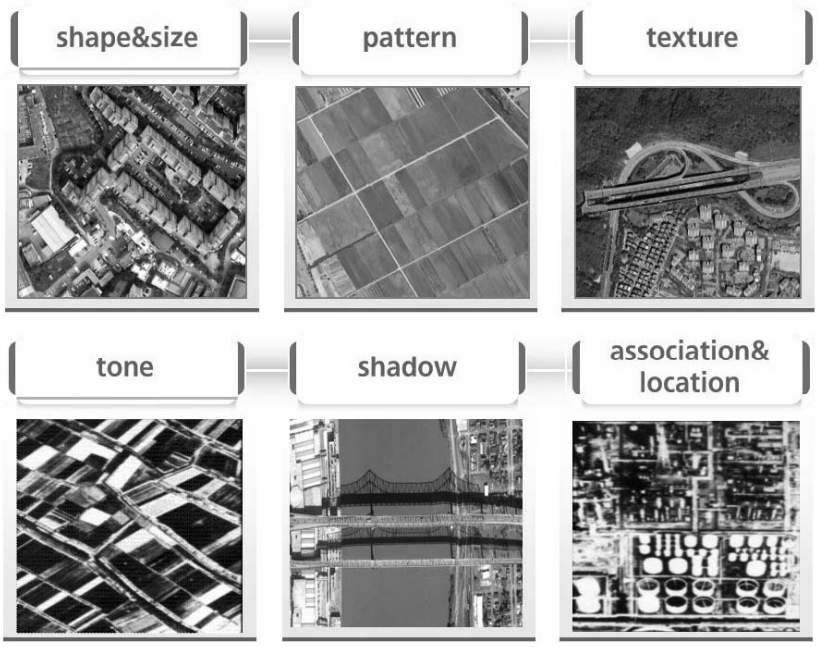


Figure 1. Qualitative Elements of Aerial Photographs

2.2 Quantitative Interpretation Elements

The quantitative interpretation of aerial photographs is to interpret an object by measuring an accurate numerical value such as length and area according to resolution of the aerial photograph. For quantitative interpretation, accurate boundary measurement is performed for the object according to the scale, size, pattern, and shape, and then the length and area of the object are calculated based on the pixel value according to the resolution and compared.

3. Experiment

Qualitative and quantitative analysis were performed by using aerial photographs with spatial resolutions of 7cm, 12cm, and 25 cm, respectively

3.1 Qualitative Interpretation

The qualitative resolution interpretation of aerial photographs is to visually interpret shape, size, pattern, tone & color, texture, shadow and association & location among objects.

Figure 2 is an analysis of the ability to identify images according to spatial resolution with a focus on shape, pattern, and shadow.

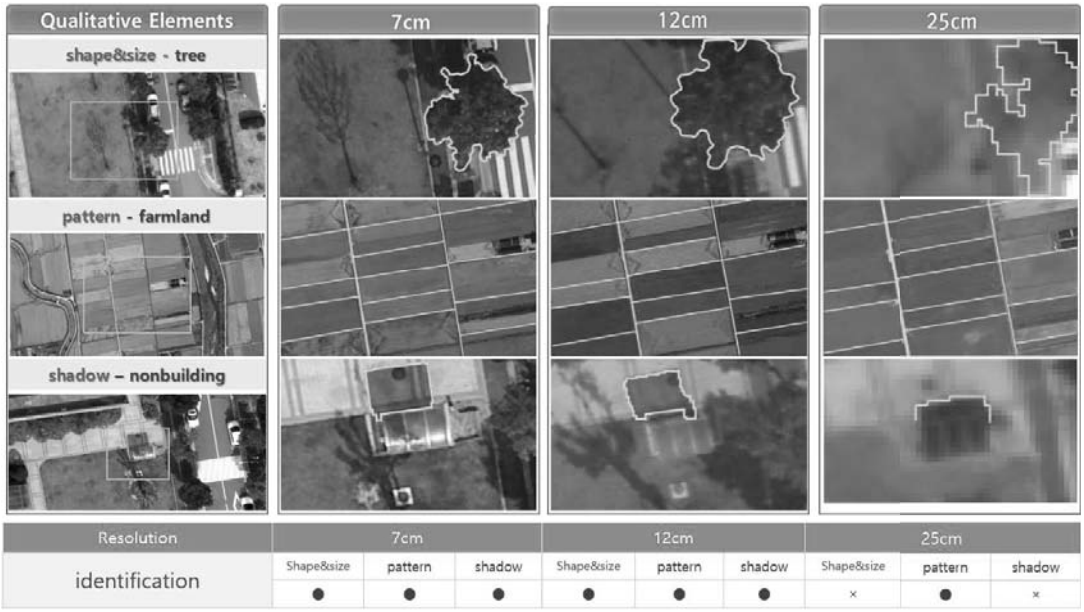
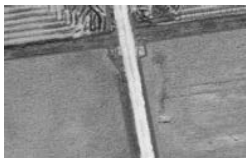
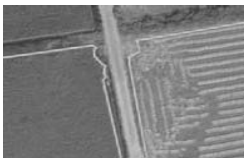
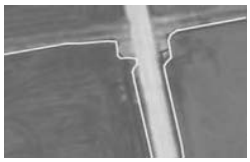
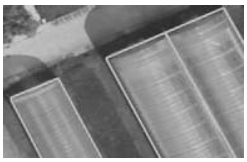
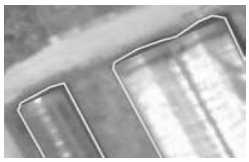


Figure 2. Qualitative Analysis Using Interpretation Elements

Table 1. Qualitative Analysis Using Terrain and Natural Features

Category \ Resolution	7cm	12cm	25cm
Building Rooftop			
	○	○	×
Change of the Characteristics of Land			
	○	○	×
Greenhouse			
	○	○	×

As can be seen in Figure 2, patterns can be interpreted qualitatively at 7cm, 12cm, and 25cm, but shape and shadow are difficult to interpret when the spatial resolution is 25cm.

Table 1 shows the result of qualitative analysis based on the terrain and natural features to be interpreted using aerial photographs.

As can be seen in Table 1, it was possible to interpret qualitatively irrespective of the terrain and the size of the object at 7cm and 12cm resolution but at 25cm resolution, the boundary between terrain and object is blurred, making it difficult to interpret.

3.2 Quantitative Interpretation

The quantitative interpretation compared the length and area of the object based on the pixel values according to the resolution of aerial photographs.

Figure 3 shows the result of comparative analysis according to spatial resolution based on length. In the case of a Greenhouse, the resolution was lowered from 12cm to 25cm based on the 7cm image, so that the boundary of the Greenhouse was blurred, making it difficult to find the exact boundary. This resulted in a difference of about 1 meter in length compared to the 7 cm image with high resolution.

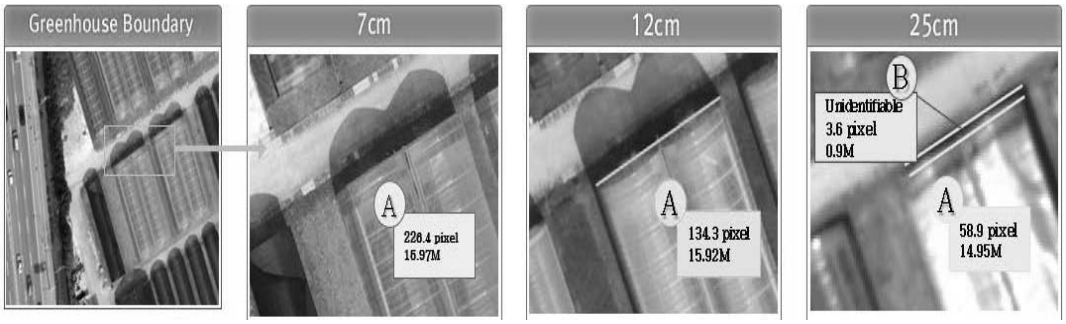


Figure 3. Comparison of Length of Boundary of the GreenHouse

Table 2. Comparison of Object Lengths according to Image Resolution

Category	7cm	12cm	25cm
Parking Lots	4.66 m	4.62 m	4.53 m
Roof Structures	2.35 m	2.38 m	2.15 m
GreenHouse Boundary	15.97 m	15.92 m	14.95 m
Building Rooftop	29.85 m	29.85 m	26.98 m
Characteristics	Boundary of terrain and features are very clear and accurate. Interpretation is possible.	Length measurement is relatively accurate compared to the 25cm resolution image.	Ability to identify depends on the size of the features. Precise boundary measurements are not possible.

Similarly, parking lots, roof structures, and building rooftops were also compared and the result is summarized in Table 2.

Figure 4 compares the area of terrain, natural features depending on the resolution of the aerial photographs. The results for the building rooftop show that the area of 7cm resolution is 354.42 ㎡ and that of 12cm is 357.19 ㎡, showing almost similar area values and the area of 25cm resolution is difficult to determine the boundary, so a low value of 239.8 ㎡ was measured.

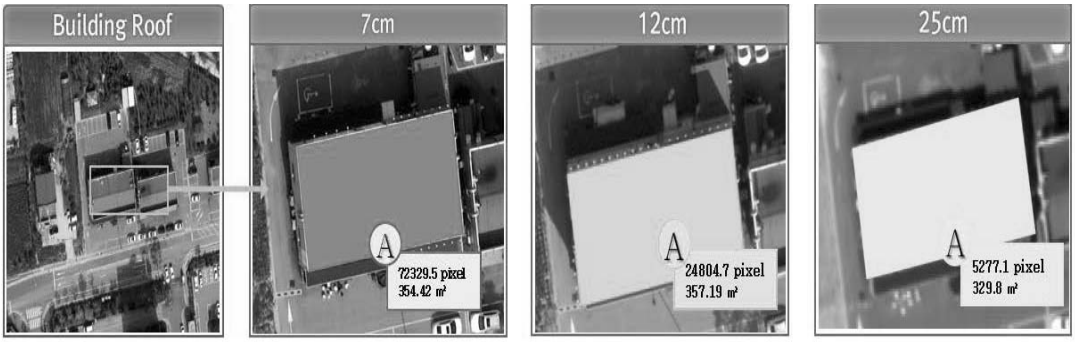


Figure 4. Comparison of Area of the Building Roof according to Image Resolution

Rooftop structures were also analyzed in a similar way, and the analyzed results are shown in Table 3.

Table 3. Comparison of Areas according to Image Resolution

Category	7cm	12cm	25cm
Building Rooftop	354.42 ㎡	357.19 ㎡	329.8 ㎡
Roof Structures	22.18 ㎡	22.35 ㎡	16.6 ㎡
Characteristics	Boundary and shape are very distinct. Accurate interpretation possible.	Similar to the measurement values in 7cm resolution. Appropriate as identification and interpretation.	Highly influenced by the feature size. Inappropriate as interpretation for small objects..

The results of qualitative and quantitative comparative analysis according to the resolution of aerial photographs showed that there was no problem in performing qualitative and quantitative interpretation in 7cm and 12cm images.

On the other hand, the 25cm resolution image was difficult to distinguish shape and shadow from the qualitative point of view, and showed a large difference in length and area compared to the 7cm and 12cm images from the quantitative viewpoint.

4. Conclusion

This study conducted the qualitative and quantitative analysis to examine the spatial resolution suitable for interpretation tasks performed by aerial photographs in municipalities and obtained the following conclusions.

Qualitative analysis based on the pattern, shape and shadow of the interpreting elements of the aerial photographs showed that the pattern could be identified even though the spatial resolution of the image decreased from 7cm to 25cm. On the contrary, it was found that shape and shadow could be qualitatively identified at 7cm and 15cm, but it was difficult to interpret if the resolution is lowered to 25cm.

For the quantitative analysis according to the resolution of aerial photographs, the length and area of the parking lot boundary, roof structure, Greenhouse boundary and rooftop were analyzed. When the spatial resolution was lowered to 25cm compared to the image at 7cm and 12cm, it was difficult to determine the exact boundary and this made it difficult to accurately measure the length and area of the object.

This showed that it is possible to use a 25cm image to determine the approximate pattern, length, and area in the local government interpretation task but 12 cm image with a spatial resolution higher than 25 cm is preferred to utilize shape and shadow, length and area.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.178-190, February 16-18, 2017

A Study on Airborne LiDAR Calibration and Operation Techniques for Bathymetric Survey

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ABSTRACT : The necessity of maritime sector for continuous management, accurate and update location information such as seabed shape and location, research on airborne LiDAR bathymetry surveying techniques are accelerating. Airborne LiDAR systems consist of a scanner and GPS/INS. The location accuracy of 3D point data obtained by a LiDAR system is determined by external orientation parameters. However, there are problems in the synchronization between sensors should be performed due to a variety of sensor combinations and arrangement. To solve this issue, system calibration should be conducted. Therefore, this study evaluates the system verification methods, processes, and operation techniques.

Keywords : Airborne LiDAR, LiDAR Calibration, Bathymetric Survey, GPS/INS

1. Introduction

In Korea, currently multi beam, single beam, and side scan sonar measurements are being used to obtain data for the purpose of determining sea bed shapes and locations. In mixed areas of coastal landward boundaries with many rivers, wetlands, coral reefs, and fringing reefs and waters, surveying is impossible due to the difficulty of operating data collection vessels. In areas where fishing activities are performed, bathymetry surveying is limited. Hence, advanced countries are using airborne LiDAR bathymetry surveying tools for depth-sounding to prevent marine disasters coupled with maritime safety, marine territory management, and climate change considerations.

Airborne LiDAR is equipment designed to obtain 3D location data from the ground and the ocean floor rapidly and accurately using aircrafts equipped with GPS/INS and laser scanners (Choi et al.,

2005). The advantage is possibility to obtain data regardless of climate or time of day. Additionally, high precision 3D location information can be obtained rapidly and accurately, as it is possible to calculate the exact distance to the ground. In particular, it can be used effectively to obtain 3D location information and marine charts for submarine topology in locations that are difficult for vessels to approach.

The location accuracy of 3D point data obtained by airborne LiDAR systems is determined by the external orientation parameters of the equipped scanners and GPS/INS. Therefore, prior to the use of a LiDAR system, system calibration to identify and resolve factors that can cause errors in GPS/INS and laser scanner data should be performed.

This study examined airborne LiDAR calibration related theoretical backgrounds and operation plans in bathymetry surveying with airborne LiDAR.

2. Calibration Method

Table 1. Factors that cause errors in airborne LiDAR systems

Mechanical errors	Accidental errors
Laser scanner mechanical error	Detection of pulse
Delay of laser pulse	Point jitter
INS misalignment and gyro drift	INS
GPS baseline distance (when baseline distance is more than 30km)	GPS
Delay effect of GPS signal in troposphere	tough terrain
Terrain gradient and plant species	reflectivity

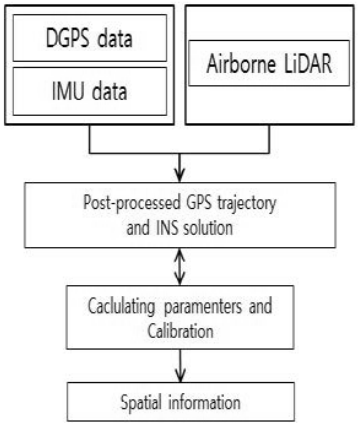

Figure 1. Flow chart for the airborne LiDAR Calibration method

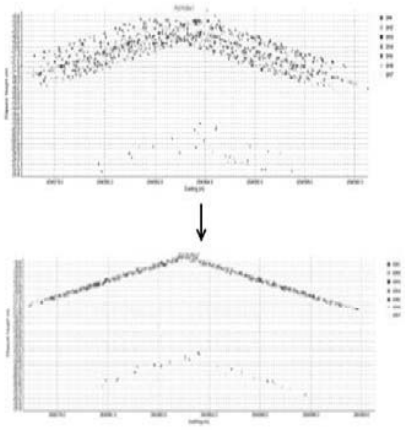

Figure 2. Data before and after calibration

Airborne LiDAR scanning is a surveying technique used to calculate location at reflection points and extract geographic information on the surface of the earth. This is accomplished by mounting a LIDAR system on an aircraft, with the laser pulse directed toward the ground. The time of arrival for the reflected laser pulse is measured. The flow chart for the airborne LiDAR calibration method is shown in Fig 1. To use an airborne LiDAR system, a calibration process to identify and remove factors that can lead to errors in the GPS/INS and laser scanner data should be performed. Here, calibration is the process of comparing a certain equipment or measuring instrument with a standard equipment or instrument whose accuracy has been verified, to determine the differences in accuracy, correlation, and recording, and to eliminate the identified differences (Dictionary of Defense Scientific and Technical Terms, 2011). In other words, it can be termed an essential process to correct errors in equipment, minimizing the errors, and increasing the accuracy of data. The advantages of calibration lie in obtaining reliable measuring equipment and results, determining and correcting systematic errors in the equipment used, calculating necessary factor coefficients for data correction, predicting the accuracy of a theory, and confirming the operating functions in equipment specifications. The factors that cause errors in airborne LiDAR systems are largely divided into mechanical errors and accidental errors (Table 1). Among mechanical errors, major causes originate from the GPS/INS system. The location determination accuracy of a laser scanner equipped with GPS/INS has a large influence on the final measurement accuracy (Choi et al, 2005). Therefore, it can be said that the largest error factor is a difference in rotation between the laser scanner and the INS in a coordinate system. Mostly, calibration is conducted in various 3D planimetric features with a combination of wide flat roofed buildings, large parking lots, valleys, forests, roads, and small buildings (National Geographic Information Institute, 2002). In Fig 2, the top figure presents the data obtained before calibration while the bottom one presents data after calibration. Data without calibration cannot be used. If calibrations were corrected in the three-dimensional X, Y, or Z axis, exact results can be obtained. Calibration can largely be divided into system calibration and field calibration. System calibration is a self-discrimination and correction process within a system, for example, the arrangement of the laser, correction of the scanner angle, correction of the signal delay, and correction of the absolute range. Field calibration is the process of correcting Roll, Pitch, and Heading errors that occur when the equipment is mounted on a new aircraft.

2.1 Geometrical Theory

2.1.1 Difference in Amount of Rotation between INS and LiDAR

In airborne LiDAR systems, navigation equipment such as GPS antennas and INS sensors are separate. The GPS antenna is located at the upper part of the aircraft, whereas the INS sensor is located within the lower LiDAR system. The relationship between the two should be highly accurate and maintaining this relationship is very important. If the geometrical structure of the sensors

changes, general errors will occur in the system model, The position of the lasers determines the position and vector of orientation. The coordinates are nonlinear. In particular, the adjustment process for each factor is very complex. The relational expression is shown in Eq. (1).

$$P_{Loc} = R_{Att} \cdot (R_{mis} \cdot R_{sca} \cdot r_{las} + \triangle f_{lev}) + APC_{loc} \quad (1)$$

$P_{loc(Local)}$ is 3D coordinates of a laser point in the local mapping frame;

$R_{At(Attitude)}$ is the rotation matrix between the INS frame and mapping frame, measured by GPS and INS;

$R_{mis(misalignemnt)}$ is boresight matrix between the laser frame and INS frame;

$R_{scan(scanangle)}$ is the transformation matrix from laser range to laser frame with scan angle;

$r_{las(laserrange)}$ is the laser range from fired point to target;

$\Delta f_{lev(levelarm)}$ is offset between laser fire point and GPS antenna phase center in body frame;

$APC_{loc(loclocal)}$ is the 3D coordinates of GPS Antenna Phase Center in the local mapping frame.

2.1.2 Influences of Roll

Errors in the Roll are shown in Fig. 3. If the laser pulse in a horizontal plane is directed left and right orthogonal to the flying direction at a certain width, the three-dimensional location of the laser pulse is greatly influenced by changes in the rotation in the X-axis. In other words, the actual location of a building and the LiDAR data can change at regular intervals orthogonal to the flying direction. This phenomenon indicates that errors exist in X-axis.

The relational expression of Roll is expressed as shown in Eq. (2). Here, is the difference between the height of the right-most point coordinate and the height of the left-most point coordinate in a horizontal plane. is the average flying height and is the maximum look angle of the scan system.

Table 2. Rolling angle deflect the horizontal surface

H(m)	200				
θ_{max}(°)	30				
$Z_L - Z_R$(m)	0	2.02	4.03	6.05	8.06
$\triangle R$	0	0.5	1	1.5	2.0

Table 2 represents errors in the Roll depending on the difference in height at both ends of the horizontal plane at a certain altitude. Each time the heights of both ends differ by about 2 meter, increases by 0.5 unit.

$$Z_L - Z_R = 2H\tan\theta_{\max} \cdot \quad \triangle R \quad ; \triangle R = \frac{(Z_L - Z_R)}{2H\tan\theta_{\max}} \tag{2}$$

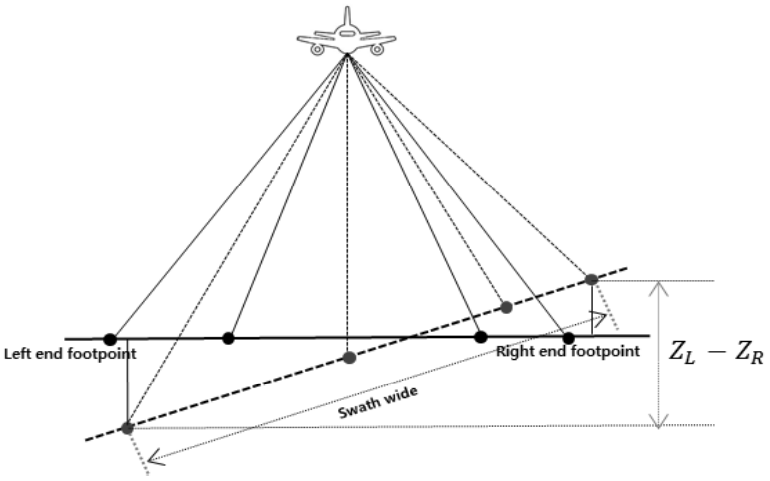

Figure 3. Rolling misalignment deflects the horizontal flat surface and shifts the feature position simultaneously

2.1.3 Influences of Pitch

Errors in pitch are shown in Fig. 4. Although the laser data reflected by the building and the laser data reflected by the ground should be exactly identical to the outline of the building obtained by actual measurement, the real data obtained are expressed twice in terms of the angle of the building measured in the field and the airborne LiDAR data. The relational expression of Pitch is expressed as shown in Eq. (3). $D$is the distance between points by normal direction flying vs. by reverse direction flying, $H$is the average flying height, and $\theta_{\max}$is the maximum look angle of a scan system.

Table 3. Pitching angle shift the horizontal position along the flight direction

H(m)	200				
θ_{max}(°)	30				
D(m)	0	2.02	4.03	6.05	8.06
$\triangle F$	0	0.5	1	1.5	2.0

Table 3 presents errors in Pitch depending on the distance between points in normal direction flying vs. in reverse direction flying. Each time the difference in distance from the center in the normal direction flying vs in the reverse direction flying differs by about 4 meters, ΔFincreases by 1 unit.

$$D = 2H\tan\theta_{max} \cdot \quad \Delta P \quad ; \quad \Delta P = \frac{D}{2H\tan\theta_{max}}$$

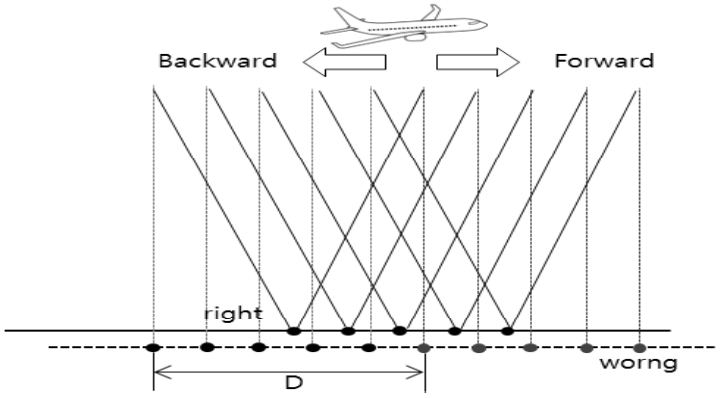

Figure 4. Pitching misalignment shifts the feature position mainly along the flight direction

2.1.4 Influences of Heading

Errors in heading are shown in Fig. 5. If the rotation angle of axis Z in the INS coordinate is not identical to that in the laser equipment coordinate, the location of a building is not identical at the point where the flying directions cross. To make the location identical, the heading should be corrected. Heading can be drawn by comparing it with airborne LiDAR data at the point where flying directions cross.

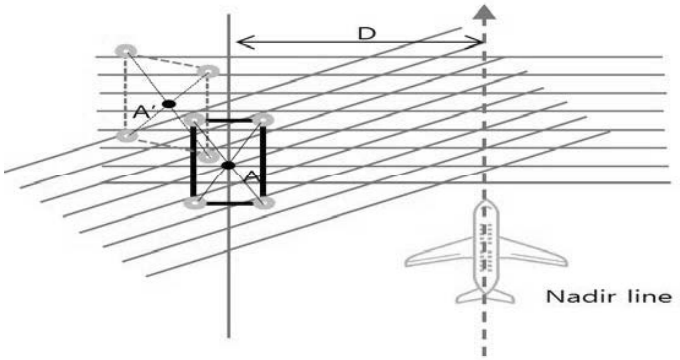

Figure 5. Positioning error from heading misalignment in both along and across flight direction

The relational expression of Heading is shown in Eq. (4). S is the mean distance between building point groups in normal direction flying vs. in the reverse direction flying, $H$is the average flying height, and $D$is the distance between vertical lines of the building and aircraft.

$$S = D \cdot \triangle H \quad ; \quad \triangle H = \frac{S}{D} \tag{4}$$

Table 4 presents errors in Heading depending on the mean distance between point groups in the flying direction. Each time Sincreases by about 1.7 meter, $\triangle H$increases by 1 unit.

Table 4. Heading angle shifts the horizontal position

D(m)	100				
S(m)	0	0.873	1.745	2.619	3.492
$\triangle H$	0	0.5	1	1.5	2

3. Data Acquisition and Adjustment Factor Calculation

3.1 Area of Study, Equipment and Data

For calculation of the airborne LiDAR bathymetry surveying calibration adjustment factor, Muan International airport was selected as the inland calibration area. The flight was divided into two parts: inland and sea. In the inland test station, an area with a wide area containing buildings was selected and the flight occurred lengthwise and breadthwise. CZMIL has a laser pulse scanning rate of 70kHz inland and 10kHz at sea, with a point density of 2m×2m(0.25pt/㎡)(table 5). In particular, it has a nonhomogenous scan pattern as a circular scanner. In both ends of the aircraft, the laser scanning results are relatively richer than SHOALS 3000, with an arc-shaped scan pattern. This pattern influences the point density, and the point density of CZMIL is higher than that of SHOALS at the same altitude.

3.2 Adjustment Factor Calculation

As shown in Fig. 6, to extract Pitch, Roll, and Heading factors from the selected site for calibration (Muan International Airport), cross shooting was executed and the test station flight trajectory (.sbet), shooting plan (.xml) file, and LiDAR source data (RAW) were used. To check correction values, blocks were set in the parts where each course was overlapped as shown in Fig. 7 and then the test was conducted.

Figure 6. Area of study and route of calibration

Figure 7. Calibration source data extraction

It was found that when data were extracted as primitive parameter values, 3-dimensional coordinates were incorrect as shown in Fig. 8.

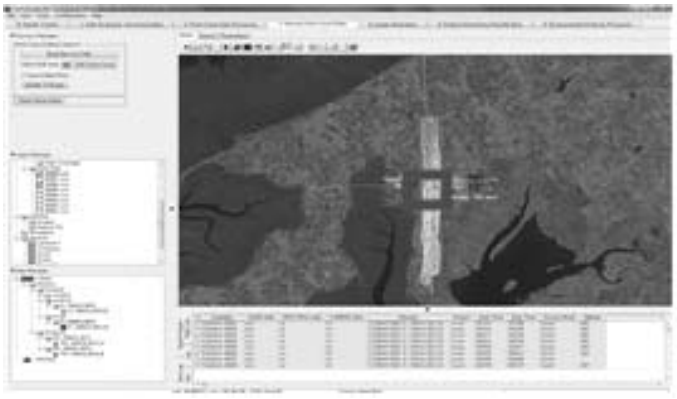

Figure 8. Pitch, Roll, and Heading adjustment factor verification

The final results were observed in profile by adjusting the calibration adjustment factor values (Parameter) and the parameters were obtained before correction (Figure 9). The parameters were applied and after checking the profile, the difference in data performance between the imported las files were analyzed in Table 6.

Table 5. CZMIL specification

Equipment	Item	Specification
	Manufacturer	Optech
	Standard	CZMIL
	Altitude	400m
	Underwater laser repetition rate	10 kHz
	Inland laser repetition rate	70 kHz
	Resolution	2m×2m nominal
	Angle of scan	20°
	Scanning range	291m nominal
	Classification of laser	Class 4 laser product

4. Planning and measurement of calibration site for each sea

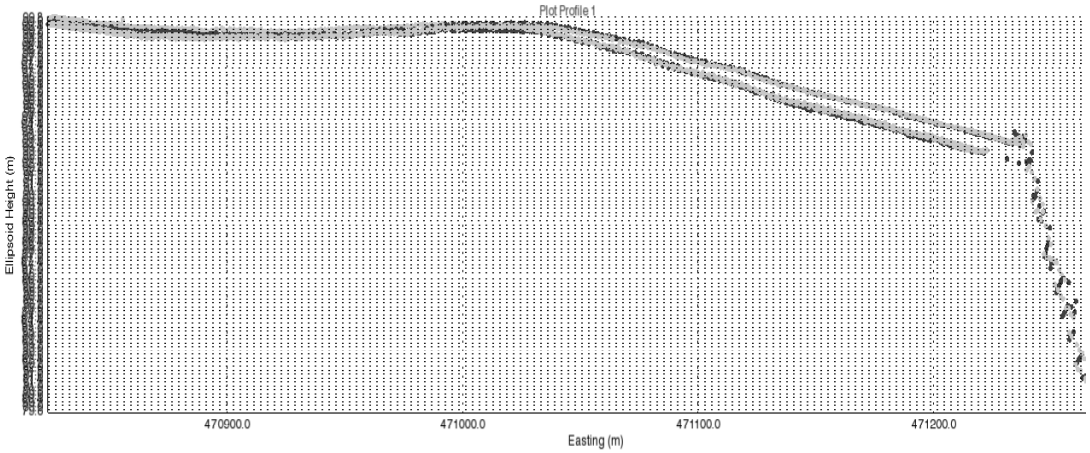

Figure 9. Overlap course Roll adjustment factor verification

Airborne LiDAR bathymetry surveying employs different calibration methods depending on equipment specification, turbidity of seawater, tidal current, tidal conditions, and climatic result of Secchi depth, it was found that calibration of the depth-of-water data was possible for depths greater than 3m (Baltsavias, 1999). Therefore, for airborne LiDAR bathymetry surveying in coastal areas,

calibration adjustment factors as mentioned in Section 2 should be checked in advance so that optimal depth-of-water data calibration can be executed.

Additionally, permanent calibration sites have not yet been installed according to sea sectors in Korea. This is why temporally installed reference points are used if necessary to test sensors for aircrafts, which leads to an economic burden and lack of consistency and reliability. Also, Korea has distinct characteristics according to the sea sector, specifically the sea surface in the East Sea, the South Sea, and the Yellow Sea and underwater turbidity. In particular, the underwater turbidity of the West Sea changes dynamically in real time. So, it is necessary to establish plans depending on the underwater environment according to the sea sector during airborne LiDAR bathymetry surveying.

4.1 How to Establish Calibration Sites by Sea Sector

The West Sea has a large tidal range and developed mud flat. The South Sea has a complex coastline. The East Sea has deep water and many rocks are covered and uncovered along the coast. Therefore, it is necessary to install calibration sites at a representative area by each sea sector and establish calibration sites that satisfy various conditions. This is why in Korea, various aircraft sensors are increasingly introduced and generalized. At this point in time, plans for standardization of the methodology for establishing test fields at the national level, system verification, data processing, and result calculation are required.

Table 6. Comparison of calibration parameters

Correction factor	Before correction		After correction	
SBF-IMU Misalignment(X)	0.000000		-0.01000	
SBF-IMU Misalignment(Y)	0.000000		-0.02600	
SBF-IMU Misalignment(Z)	0.000000		0.00000	
angular_misalignment_scanner_fresnel_x	0.000000		0.00000	
angular_misalignment_scanner_fresnel_y	0.000000		0.00000	
Scanner Angle Origin Offset	0.000000		2.5000	
Fresnel Element Slope	39.1500		39.15000	
Range Offset	CH1	0.0000	CH1	-0.35000
	CH2	0.0000	CH2	-0.50000
	CH3	0.0000	CH3	-0.43000
	CH4	0.0000	CH4	-0.47000
	CH5	0.0000	CH5	-0.47000
	CH6	0.0000	CH6	-0.35000
	CH7	0.0000	CH7	-0.35000
	IR	0.0000	IR	-1.58000
	DeeP	0.0000	DeeP	-0.41000

Table. 7 Considerations in establishing calibration sites

Class	Conditions	
Installation of calibration sites	Location	- Areas that are adjacent to operating agencies for operation and management - Places where there are no variations in topography/planimetric features - Government owned lands or public institution owned lands to avoid land disputes - Places where there is no GPS data reception failure - Places where there is no hindrance to flying
	Size	- Consider distance to reference point, distribution, and redundancy, etc - Considering foreign cases, 3km x 3km is an appropriate size.
	Distribution and installation of standard point	- Analogue and digital data can be combined. - Scale and resolution power should be considered before manufacturing at the size of the reference point for multiple purposes with one target. - Reference point that can be verified by both airborne sensor and satellite sensor should be installed. - Should be implemented according to current aerial internal rules.

The most important considerations before establishing calibration sites in Korea are optimal locations and size. In foreign countries, calibration sites are above 6km×6km. However, in Korea, considering domestic topographic conditions and social conditions, a 3km×3km, 1/4 area seems appropriate. Also, selecting areas that are adjacent to operating agencies (National Geographic Information Institute, public institution, etc) for operation and management would be ideal. Currently, the Korea Ocean Research Association is analyzing optimal sites for field calibration with multi beam and single beam and drawing up measures for multi beam calibration sites. Finally, it is necessary to establish actual sea sector calibration sites and install artificial structures to enable verification in various environments.

4.2 Measurement according to Underwater Environment by Sea Sector

Airborne LiDAR bathymetry surveying is a laser-based surveying method and due to the nature of lasers, its reflectance depends on the materials reflected. The results of measurement should be based on the reflectance of sand, mud flats, and rocks. In particular, aerial surveys need to be conducted for the existing single beam sea areas to improve precision. CZMIL survey results including depth-of-water and height are considered to provide precise information on rocks, bathing resorts, fish farms, and fishing area, which is lacking currently, and to help alleviate safety issues related to vessels and close surveying.

However, CZMIL is based on a circular laser scanning method. Thus, it is impossible to measure if there is water in a breaking wave zone. Error in CZMIL is ±5cm. To satisfy IHO-1(a) and improve accuracy, it is necessary to shoot simultaneously with a digital camera, compare and verify the obtained data, continuously upgrade the equipment and constantly monitor domestic coastal environments.

5. Conclusion

Calibration work is essential for performing airborne LiDAR measurement. Among the factors that cause errors, the largest is the difference in rotation between INS and LiDAR. Therefore, when testing LiDAR systems, the test should be conducted in structures with large relief displacement, like floating structures or roofs on a building. This study examined the calibration methods for airborne LiDAR bathymetry surveying and derived the following conclusions.

First, it was found that whenever the error in Roll depending on differences in the height in both ends of a horizontal plane differs by about 2 meter, ΔRincreases by 0.5 unit. Additionally, whenever the distance for normal direction flying and reverse direction flying differs by about 4 meter, ΔFincreases by 1 unit. Finally, whenever the mean distance between building point groups in normal direction flying vs. in reverse direction flying increases by about 1.7 meter, ΔHincreases by 1 unit.

Second, bathymetry surveying by using airborne LiDAR, enables the establishment and utilization of coastal management based on scientific data. And also, a systematic management of disasters and accidents in coastal areas is considered to be possible. To this end, it seems to be necessary to install fixed calibration sites suitable for each of the Yellow Sea, the South Sea, and the East Sea in Korea. It also seems necessary to carry out further research on how to obtain data appropriate for the domestic environment, with utilization and management plans for the data obtained. Also, rules regarding airborne LiDAR bathymetry surveying wroks need to be made by analyzing the maximum depth of water acquired according to the turbidity of the sea surface according to the sea sector, tidal current, tidal conditions, and weather conditions.

Acknowledgement

This research was a part of the project titled 'Development of Airborne LiDAR Bathymetry equipment localization technology', funded by the Ministry of Oceans and Fisheries, Korea (No. 20140555).

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.191-197, February 16-18, 2017

The Effects of Landscape Analysis and Simulation of Repairs in a Preservation District for Groups of Historic Buildings: A Case Study in Kojiro-kuji District of Unzen City, Nagasaki Prefecture

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Abstract: The qualitative impressions of buildings, gardens, walls, and other factors were evaluated by using the SD (Semantic Difference) method in Kojiro-kuji District of Unzen City, Nagasaki Prefecture. The impression of objects and the relationship between each object were analyzed quantitatively by applying type 3 qualification theory and cluster analysis. The total impression scores with the weight of the whole area were calculated by introducing the weights of the impressions of all objects into the calculations. The effect of hiding objects that were evaluated at a low level was simulated. Consequently, the validity of the results of the evaluation of the impressions was confirmed.
Keywords: preservation district for groups of historic buildings, landscape analysis, simulation of effect of repairs

1. INTRODUCTION

This study was conducted in Kojiro-kuji District of Unzen City, Nagasaki Prefecture. Kojiro-kuji is located on the sea coast of Ariake, on the northern part of the Shimabara Peninsula in western Kyushu. The Nabeshima house, moved to Kojiro-kuji from Saga, has been planned as part of the reclamation into the samurai district. It is an area surrounded by Kojirogawa (northern side), Minoturugawa (eastern side), and Kojiro Castle (western side). It measures 450 m from north to south and 240 m from east to west. A moat, mound, and homestead woodland are in place at the location, there enacted specific to the samurai land closed space and landscape, and has been reported until the present day. No other such examples can be seen, and these features and landscape, with their significant history, are evaluated highly by historians. Consequently, the area (9.8 ha), which is almost the entire region of Kojiro-kuji, was designated as Preservation District for Groups of Historic Buildings in 2004; further, it was selected as an Important Preservation District for Groups of Historic Buildings in 2005. Though the area designated as a preservation district is small, it is possible to feel a breath of the Edo Period throughout the whole area of the district.[1)]

In the evaluation of landscape, the statistically processed psychometric evaluation method, which is subjective, is often used on many people of the area. Although it is common for the evaluation to be conducted directly in the field, because of the difficult nature of the evaluation (as many people are to be evaluated), research using experiments of psychological evaluation through photos and images from videos ave been implemented.

Many studies have been conducted using an SD qualitative evaluation method to study street landscape. Factor analysis,[2)-4)] principal component analysis,[5)] and multiple regression analysis[6)] are used in the conventional analytical methods. In studies that evaluate the overall street landscape, the relationships between the individual subjects are rarely observed. On the other hand, Kinoshita and Sugiyama have conducted a study on the relationship of individual objects and sounds that form the landscape and sound landscape.[7)] In addition, Kim applied the qualification theory of impressions to evaluate the results using the SD method to objectively indicate the relationship of each object and sound.[8)]

In this study, the relationship between the objects forming the landscape is worthy enough to be examined. In other words, first, the impression of the individual object forming the landscape was evaluated in order to clarify the relationship between each of the objects. Then, the average total impression score with the weight of the whole area is shown by adding the weight of the samples. In addition, the effect of hiding objects that were evaluated at a low level was simulated.

2. METHODOLOGY

2-1The subject of landscape evaluation

The arrangement of the buildings in Kojiri-kuji is indicated in Figure 1. As shown in Table 1, the buildings that exist in this area are classified into three groups: traditional buildings, non-traditional buildings, and traditional features.

2-2 Landscape evaluation using SD method

The landscape impression evaluation form with the SD method is shown in Figure 2. In this study, first, 13 pairs of adjectives, such as "comfortable–uncomfortable" and "bad–good," were set up. Then, an impression score, namely from −3 to 3, was given as an adverb to each pair of the adjectives: "very," "quite," "slightly," "neither," "slightly," "quite," and "very," respectively. The mean and standard deviation of the data were calculated. The data were adjusted supposing a normal distribution.

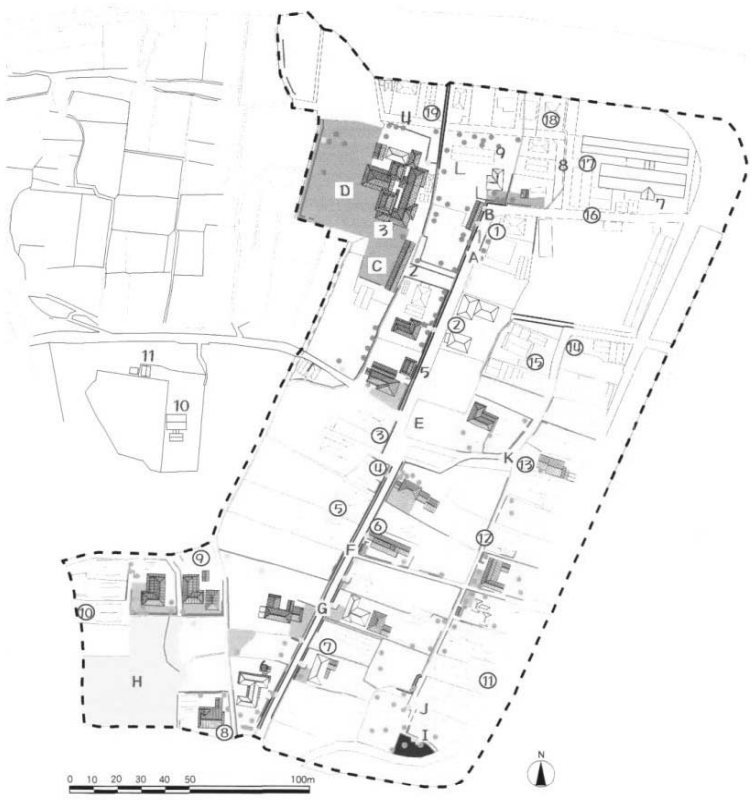

Figure 1. The arranged objects in Kojiri-kuji[9)]

Table 1. The classification of objects

Traditional buildings		Non-traditional buildings		Traditional work pieces etc.	
1	Nagayamon gate of Hoashi house	①	Private house 1	A	Channel
2	Nagayamon gate of Nabeshima house	②	Private house 2	B	Tree of Hoashi House
3	Nabeshima Jinya	③	Private house 3	C	Garden 1 of Nabeshima Jinya
4	Nabeshima Jinya Thatched roof	④	Private house 4	D	Garden 2 of Nabeshima Jinya
5	Kadokura	⑤	Private house 5	E	Sasatake hedge
6	Thatched roof	⑥	Private house 6	F	Stone fence
7	History museum	⑦	Private house 7	G	Gate and stone fence
8	MinoTsuru museum	⑧	Private house 8	H	Hill at the back and rice paddy
9	Hoashi House Residence	⑨	Private house 9	I	Nabeshima family graveyard
10	Kojiro shrine	⑩	Private house 10	J	Ten house well
11	Uehara Inari Shrine	⑪	Private house 11	K	Kobodaishido Hall
		⑫	Private house 12	L	Hoashi house Garden
		⑬	Private house 13		
		⑭	Maison path		
		⑮	Private house 14		
		⑯	Espokurukunimi		
		⑰	Old schoolhouse		
		⑱	Private house 15		
		⑲	Private house 16		

2-3 Landscape analytical method

Type 3 qualification theory and cluster analyses were applied and landscape analysis was conducted. The total evaluation score for each object (buildings and features) was calculated with a category score using type 3 qualification theory. An impression ranking was set up. In addition, the classification of such buildings and features was conducted through a cluster analyses.

2-3-1 Total evaluated impression scores and impression rankings

Categorical scores were calculated by using type 3 qualification theory and all categories were classified into groups. In other words, the adjective pair "bad–good" was set as a standard item, and groups to which each category of standard item belonged were prepared. Next, multi-dimensional Euclidean distances between categories of standard item and other categories were calculated, and all categories were collected into the group to which the distance was the shortest. Impression scores were given to all categories, and the total evaluated impression score was calculated by aggregating the total scores for the categories. We drew a histogram of impression scores and set impression rankings form "A" to "E."

2-3-2 The groups of sample groups

Cluster analysis was applied to sample scores, and all objects were classified into groups. It is shown as a tree diagram Finally, we performed a χ^2 test to check the validity of the groups and ranks by Cramer's coefficient of association.

2-3-3 The average total impression score with the weight of the whole area

In order to quantify the impressions of the whole district, the average total impression score with the weight of the whole area (Atpw) was shown by adding the weight of the sample (Ws). The evaluation of the strength of the impression of the object was also conducted using the SD method, evaluated in steps from 1 to 7. The Atpw is calculated using equation

$$\mathrm{Atpw} = \frac{\sum \mathrm{Tpw}}{n} = \frac{\sum(\mathrm{Tep}\cdot\mathrm{Ws})}{n}$$

Tep: Total evaluated impression score
Ws: Weight of sample
n: Number of samples
Tpw: Total impression score with weight
Atpw: Average total impression score with the weight of the whole area

2-3-4 Effect of the Simulation of Repairs

It is clearly shown to what degree the Atpw can change in the Tep, subtracting hiding for vegetation.

3. EVALUATION RESULT

We conducted a field survey on September 08, 2015, took pictures of buildings, gardens, walls, and other factors in Kojiro-kuji, and determined the location of the area. Next, impression values and the weight of the impression were estimated using the SD method for a total of 20 Japanese students on November 05 and December 02, 2015.

3-1 Results of total evaluated impression scores and impression rank

The category scores were calculated by applying type 3 qualification theory. Next, the classification of each category into groups was performed. The Tep were categorized by summing the impression evaluation scores for each category (Ep). The frequency distribution is shown in Figure 2. In addition, the calculated impression evaluation section of the highest and lowest points of the total score is broken into five equal parts to set an impression rank (Ri) of A through E in descending order. These results are summarized in Table 2.

Table 2 shows that traditional buildings and traditional features generally received high impression evaluations, and conversely private houses, which are non-traditional buildings, received low impression evaluations. About half of the private houses that are not designated as traditional buildings are below the degree of Ri D or even lower. However, the maintenance of the building is not in a good condition; so, even the traditional features have a relatively low rating.

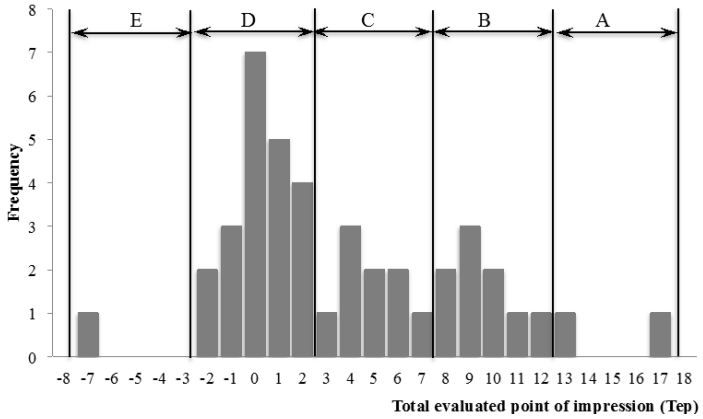

Figure 2. The frequency distribution of total evaluated impression scores

Table 2. Results of the landscape

Objects		Tep	Ri	Group
Number	Name of Sample			
38	Hill at the back and rice paddy	17	A	a
33	Garden 1 of Nabeshima Jinya	13		b
34	Garden 2 of Nabeshima Jinya	12	B	b
9	Hoashi House Residence	11		b
3	Nabeshima Jinya	10		b
32	Tree of Hoashi House	10		b
12	Private house 1	9		b
26	Private house 14	9		b
35	Sasatake hedge	9		b
42	Private house 12	8		b
23	Hoashi house Garden	8		c
31	Channel	7	C	c
1	Nagayamon gate of Hoashi house	6		c
14	Private house 3	6		c
13	Private house 2	5		c
29	Private house 15	5		c
2	Nagayamon gate of Nabeshima house	4		c
4	Nabeshima Jinya Thatched roof	4		c
11	Uehara Inari Shrine	4		c
16	Private house 5	3		d
8	MinoTsuru museum	2	D	c
19	Private house 8	2		d
28	Old schoolhouse	2		d
37	Gate and stone fence	2		c
5	Kadokura	1		c
6	Thatched roof	1		d
10	Kojiro shrine	1		c
17	Private house 6	1		d
27	Espokurukunimi	1		d
7	History museum	0		d
15	Private house 4	0		d
18	Private house 7	0		d
20	Private house 9	0		d
21	Private house 10	0		d
22	Private house 11	0		d
30	Private house 16	0		d
25	Maison path	-1		d
36	Stone fence	-1		d
41	Kobodaishido Hall	-1		d
39	Nabeshima family graveyard	-2		d
40	Ten house well	-2		d
24	Private house 13	-7	E	e

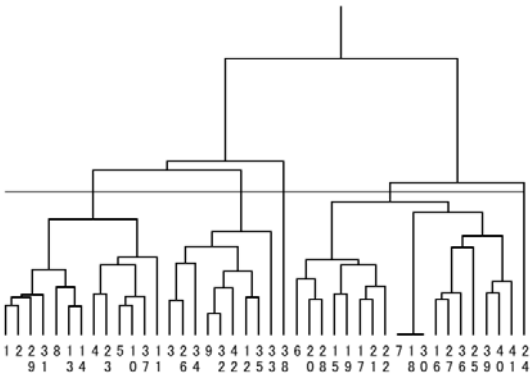

Figure 3. Tree diagram through cluster analysis

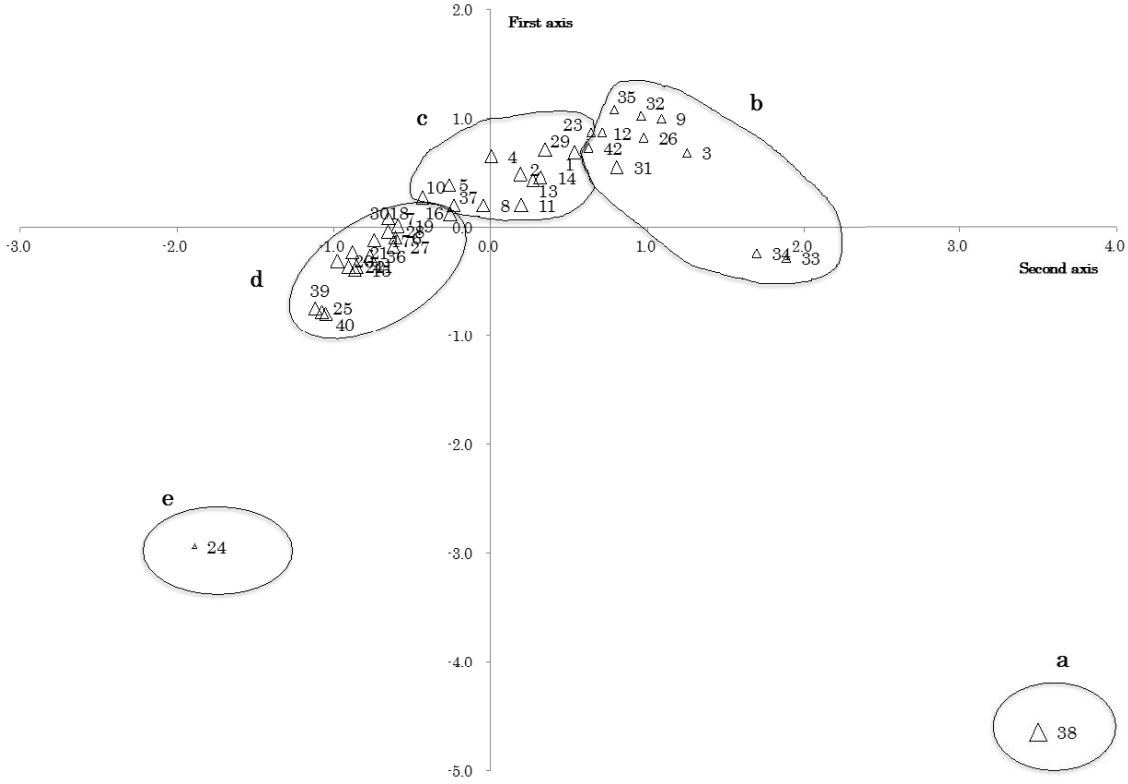

Figure 4. The distribution of the samples

3-2 Classification results for each object

Cluster analyses were applied to the sample score calculated using type 3 qualification theory and the tree diagram indicated in Figure 3. The number in the figure shows the sample (each object) number. The distribution of the sample is shown in Figure 4. The numerical value of the first axis is the sample score that belongs to the largest eigenvalue, and the numerical value of the second axis is the sample score that belongs to the second largest eigenvalue. Further the size of sample, which belongs to the third axis (the third largest eigenvalue), is indicated using △.

The results of classification and the impression ranks for each object are summarized in Table 2. It is clear from Table 2 that the Ri and the results of group classification are generally consistent.

In this study, thinking about the validity of the results, possible links between the rank from the category score and the classification group from the cluster analyses were checked. Cross tabulation was performed, and Cramer's coefficient of association was calculated at V = 0.83. It was indicated that both results have a strong link, and the validity of the results of analysis became clear.

3-3 Results of the average total impression scores with weight of the whole area

Tep, Ws, and Atpw are summarized and shown in Table 3. The Ws is rated with the descending order of the Tep. It is known that Ws changes with the difference between the scale and style of the building. The Ws is large in the large-scale Hoashi House Residence and Nabeshima Jinya; here, the weight of the sample is 5. On the other hand, the Ws is small in the small-scale Private House 7 and 11. Therefore, when Tep is added to the Ws, the difference in total impression scores with Tpw will increase. After the average total impression score with Atpw was calculated, its result was 17.88.

3-4 Results of simulation on effect of repairs

The case where Tep hid the targets that received a minus score by vegetation was assumed, and the effect of landscaping was simulated. Tep of targets that are negative points are assumed to be 0. Consequently, the average total impression score with the Atpw will be 19.14, increasing by 7.06%.

The purpose of the simulation in this study, conducting the impression evaluation of the entire district, is to determine to what extent changes, such as performing repairs, effect Atpw. The simulation method is very simple and is considered to be effective as a method for understanding impression evaluation and the effect of repairs on the entire district.

Table 3. Result of simulation of the effect of repairs

Objects		Tep	ws	Tpw	
Number	Name of Sample			Before	After
38	Hill at the back and rice paddy	17	5	85	85
33	Garden 1 of Nabeshima Jinya	13	6	78	78
34	Garden 2 of Nabeshima Jinya	12	6	72	72
9	Hoashi House Residence	11	5	55	55
3	Nabeshima Jinya	10	5	50	50
32	Tree of Hoashi House	10	4	40	40
12	Private house 1	9	5	45	45
26	Private house 14	9	4	36	36
35	Sasatake hedge	9	4	36	36
42	Private house 12	8	5	40	40
23	Hoashi house Garden	8	4	32	32
31	Channel	7	4	28	28
1	Nagayamon gate of Hoashi house	6	5	30	30
14	Private house 3	6	4	24	24
13	Private house 2	5	3	15	15
29	Private house 15	5	4	20	20
2	Nagayamon gate of Nabeshima house	4	5	20	20
4	Nabeshima Jinya Thatched roof	4	4	16	16
11	Uehara Inari Shrine	4	5	20	20
16	Private house 5	3	3	9	9
8	MinoTsuru museum	2	4	8	8
19	Private house 8	2	4	8	8
28	Old schoolhouse	2	5	10	10
37	Gate and stone fence	2	4	8	8
5	Kadokura	1	4	4	4
6	Thatched roof	1	3	3	3
10	Kojiro shrine	1	5	5	5
17	Private house 6	1	3	3	3
27	Espokurukunimi	1	4	4	4
7	History museum	0	4	0	0
15	Private house 4	0	3	0	0
18	Private house 7	0	3	0	0
20	Private house 9	0	4	0	0
21	Private house 10	0	4	0	0
22	Private house 11	0	3	0	0
30	Private house 16	0	3	0	0
25	Maison path	-1	3	-3	0
36	Stone fence	-1	4	-4	0
41	Kobodaishido Hall	-1	4	-4	0
39	Nabeshima family graveyard	-2	4	-8	0
40	Ten house well	-2	3	-6	0
24	Private house 13	-7	4	-28	0
Atpw				17.88	19.14

4. CONCLUSION

In this study, the impression of each object of those that formed a landscape was evaluated. Next, the relationship of each object to the impression was clearly made. The Tpw and Atpw were also calculated. Then, a simulation of the effect of repairs

effect was performed. The results are summarized as follows.

1. The general consent of the impression evaluation for each target was determined from the category score. A frequency distribution chart of the general consent of impression evaluation was created and the degree of impression for each target rank (A–E) was established on the basis of the results. Consequently, private houses, which are non-traditional buildings, received the low impression values, as contrasted with traditional buildings and traditional features, for which high impression evaluations were generally received. One private house received a high impression evaluation.
2. The relationship of everyone's impression of each target was clarified by classifying the target into a sample score using cluster analysis. The degree of impression rank determined from the category score and the results into which a target object was classified directly using the sample score were compared. Consequently, both classifications were identical for the most part; this indicates the validity of the analysis results.
3. The general consent of the impression evaluations with the Tpw and the Atpw was calculated by introducing the strength of the impression of each target object. In this way, it was possible to digitize the impression of the whole area. The scale according to which the value of the strength of the impression of each target correlates with the styles of buildings, gardens, walls, and other factors was quite large.
4. The case where the vegetation hid the target of which a negative impression was assumed and the effect of landscaping was simulated. Consequently, even if this target was just hidden, I determined that it is quite effective. This method of simulation is handy, and it is effective for the impression value of the whole town. It is a technique to grasp the effect of landscaping.

From the overall evaluation results of Tep, private houses that received high scores have hedges and stone walls, and those private houses without hedges and stone walls received lower scores. Therefore, it is obvious that these play an even greater role in the landscape. For example, Private House 1 received the highest evaluation among private houses. It is in a modern style, but a stone fence which remains from the Edo Period surrounds it. Private House 3, which was surrounded with a beautiful hedge, received high scores. In other words, the landscape of Kojiro-kuji would be greatly improved if the old stone walls and hedges were to be reproduced.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.198-203, February 16-18, 2017

Measurements of Weather and Air Conditioning Energy in Kumamoto City Urban Area

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ABSTRACT: Measurement instruments of weather and air conditioning electric power were installed in a building in the center of Kumamoto city urban district and long term measurement was performed. Based on these records, the relation between atmospheric phenomenon and air conditioning electric power of the objective district was analyzed as follows. (1) The characteristics of the atmospheric phenomenon and the characteristics of air conditioning electric power of the district through one year were analyzed. (2) The relation between daily mean temperature and daily electric energy through year was analyzed. As a result, for example, the mean temperature was 4.3℃ and electric energy was 54.0 kWh on January 15, 2014, and the mean temperature was 28.2℃ and electric energy was 39.2 kWh on August 1, 2014. In comparison with 17.1℃ and 14.5 kWh of April 17, 2014, those were 3.7 times and 2.7 times large, respectively.
Keywords: meteorological measurement; air conditioning energy; urban climate

1. Introduction

As for the rise in air temperature in urban area in summer, countermeasures are demanded from health and an environmental viewpoint. Practically, it is realistic what we improve from the space where many people use. As a result, the air conditioning load reduction is also expected with heat environmental improvement of the city space. The authors investigated heat environment by moving weather observation for the central urban district of Kumamoto city, and examined air conditioning load based on this result [1)-4)]. The result of the weather observation shows that a temporal difference of the air temperature occurs in the same block. From this, improvement of the heat environment is possible enough by taking precise measures between the limited space and time. In addition, we installed a weather observation system and a measurement device of the air conditioning electric power in one building of the urban district center in Kumamoto city and recorded it. In this study, we analyzed atmospheric phenomenon of the target block and relations with the air conditioning electric power based on this record. At first, based on a weather observation result and the data of Automated Meteorological Data Acquisition System (AMeDAS), we examined a meteorological

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characteristic through the year of the Kumamoto city center urban district and a characteristic of the air conditioning electricity usage of the target building. Next, we examined the relations of the atmospheric phenomenon of the block and the air conditioning electric energy in this building through one year.

2. Outline of weather observation and the air conditioning electric energy measurement

Fig. 1 shows Kumamoto city center urban district and the measurement spot. The ■ mark in Fig. 1 is a spot of the building which installed a weather observation system (LUFFT: WS-501) on the roof. The ● mark are observation points of the mobile weather observation that we carried out by previous study. The observation elements are air temperature, relative humidity, wind direction and velocity, intensity of solar radiation. We measured air conditioning electric power for every ten minutes of the building first floor (Green Technology: Electric power monitoring system). The floor space of first floor part for the measurements is 321.00m^2. The measurement started from August 21, 2012. In this study, we extracted two data from each month from the record of from January to December in 2014 and analyzed it.

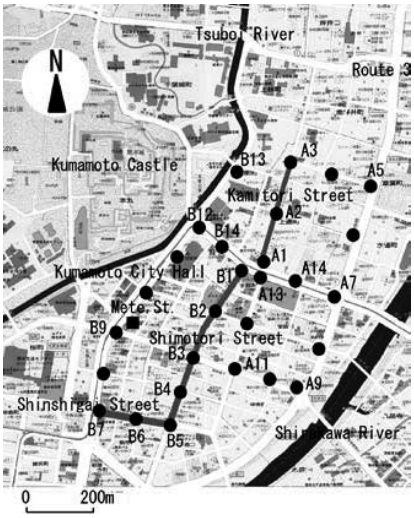
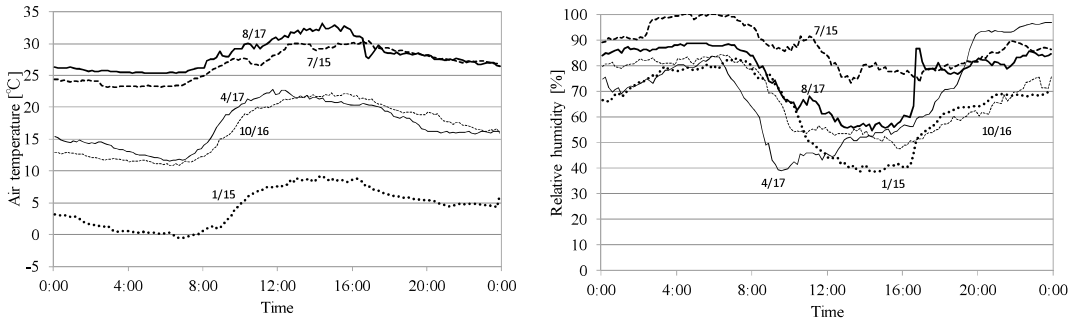


Fig. 1 Kumamoto city block observation point (”Ground Machizu” by Fukuoka Jinbunsha).
■：Weather observation and air conditioning electric power measurement, ●：Moving observation spot (previous study).

3. Results and considerations

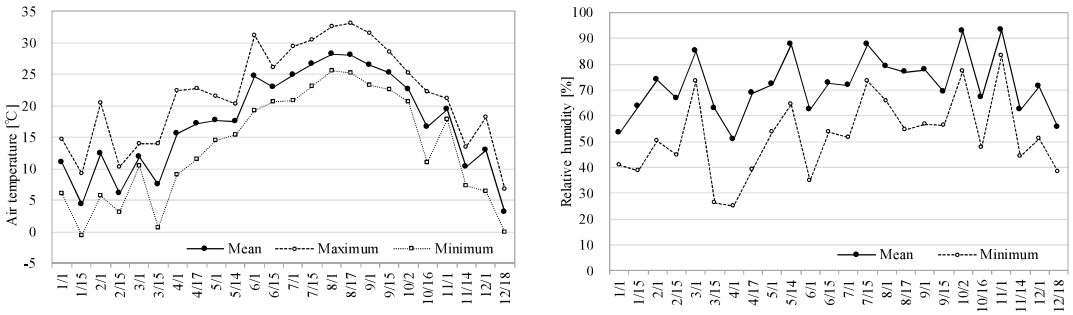
3.1 Weather observation results

Fig. 2 shows the weathers of the seasonal typical days from the measurement records with the weather observation system. August 17 was a hot day when it was reached 33.2℃ at 14:00, and was over 25℃ during the night. On January 15, air temperature fell below the freezing point by night. Fig. 3 shows the daily mean, maximum and minimum temperature, and the daily mean and minimum relative humidity, which were extracted two data from each month in 2014. Fig. 4 shows AMeDAS data at Kumamoto weather central [5)] which was located approximately 1.5 km north of the weather observation spot. From Fig. 3 and Fig. 4, the both observation data corresponded well.



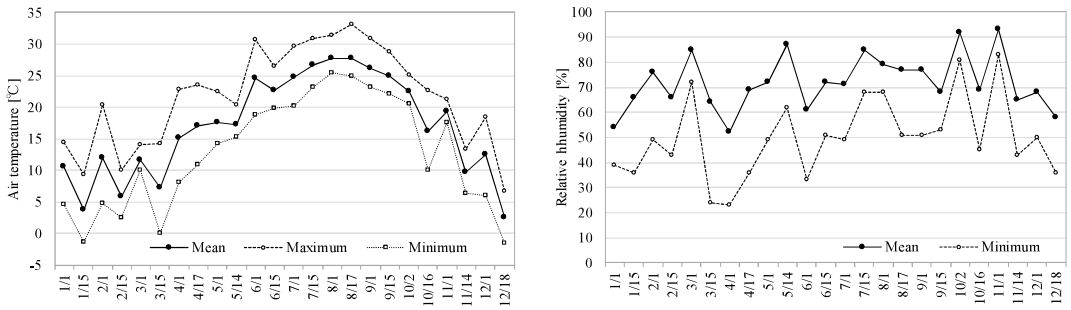
(a) Air temperature (b) Relative humidity

Fig. 2 The measurement results of typical days for every season.



(a) Air temperature (b) Relative humidity

Fig. 3 The daily mean data by observation (two days of each month in 2014).

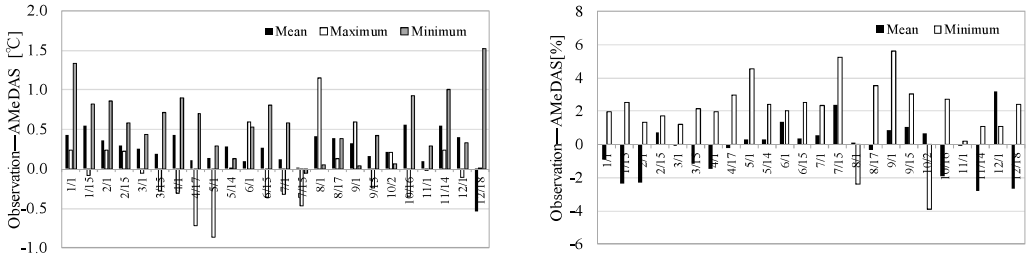


(a) Air temperature (b) Relative humidity

Fig. 4 The daily mean data by AMeDAS (two days of each month in 2014) [5].

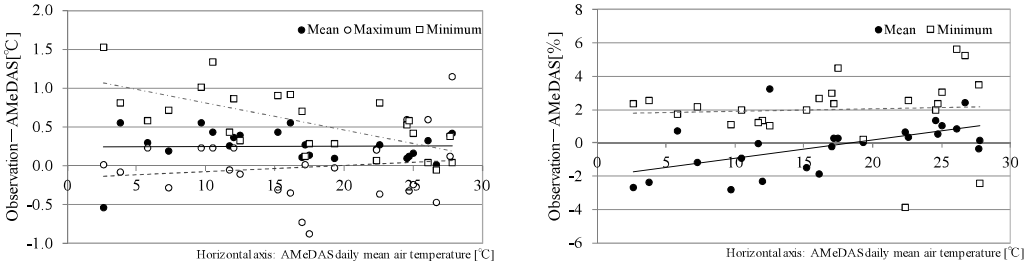
Fig. 5 showed the differences of daily mean values between meteorological observation and of AMeDAS. About mean temperature, around 0.2 to 0.3℃ is high in the observation values generally in comparison with AMeDAS values. About maximum temperature, there were the days when around 1.2℃ is high in the summer, and about minimum temperature, around 0.5 to 1.5℃ is high generally. In the winter, there were the day when 0.8 to 1.5℃ is high. Mean values of relative humidity were 1 to 2 % high in summer, 1 to 2 % low in winter, and minimum values were 2 to 5 % high. Fig. 6 shows the correlation between AMeDAS daily mean values, horizontal axis, and the difference of observation values and AMeDAS values, vertical axis. To see mean temperatures, the differences by the air temperature were not recognized so much and were around 0 to 0.5℃ high generally. About maximum temperature, there were the days when the values were 1.2℃ high in

25℃ or more. About minimum temperatures, 0.5 to 1.5℃ high when it was cold, and 0 to 0.5℃ high when it was hot. To see relative humidity, mean values became －3 to 2 % high in maximum humidity, and 1 to 5% high generally in minimum humidity.



(a) Air temperature (b) Relative humidity

Fig. 5 The difference of observation and AMeDAS (two days of each month in 2014).

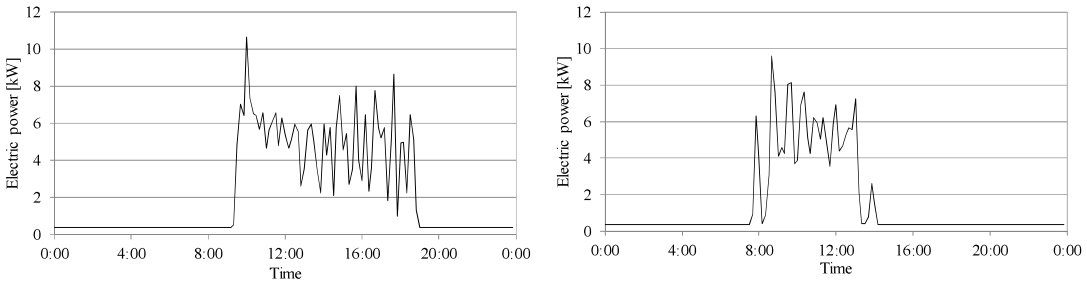


(a) Air temperature (b) Relative humidity

Fig. 6 Correlation between AMeDAS and the difference of observation and AMeDAS (two days of each month in 2014).

3.2 Measurement result of the air conditioning electric power

Fig. 7 shows the example of the results of the air conditioning electric power. On January 15, the maximum was 10.623 kW, the minimum was 0.372 kW and the average was 2.251 kW, and on August 17, 9.950 kW, 0.353 kW, 1.505 kW, respectively. Fig. 8 shows the daily electric energy which were chosen each two of a month through the year. Quantity of electricity inwinter was highest, and the electric energy, for example on January 15 when the mean temperature was 4.4℃, was 54.031 kW and it exceeds 5 times in comparison with around 10 kWh of spring and autumn. In summer, for example on August 1 when the mean temperature was 28.2℃, the electric energy was 39.228 kWh and it was approximately 4 times of a value of spring and autumn.



(a) January 15, 2014 (b) August 17, 2014

Fig. 7 Example of air conditioning energy measurements.

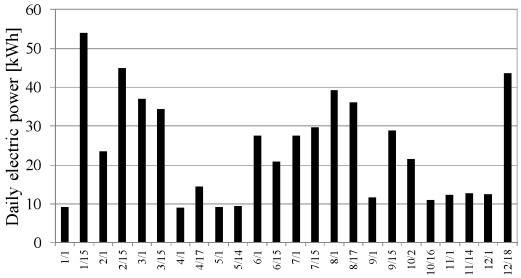


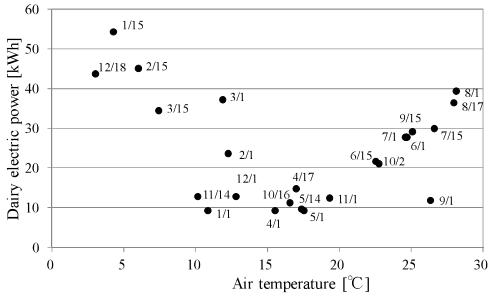
Fig. 8 Daily electronic energy of each month (two days of each month in 2014).

3.3 Relations of meteorological observation and the air conditioning electric energy

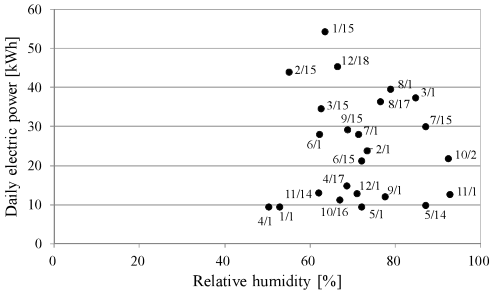
Fig. 9 shows the relations of the mean values of temperature and relative humidity and the daily electric energy. In winter, the electric energy was proportional to the difference of air temperature compared with spring and autumn. It was similar in summer. On the other hand, the clear correlation was not seen about the relations with relative humidity. Fig. 10 shows the daily electric energy in vertical axis and the absolute value of the differences with the observation air temperature on the basis of 18℃ in horizontal axis. The relations of both were given in the next expression:

$$W = 2.693 \mid T - 18.0 \mid + 6.559 \qquad (1)$$

where W is daily electric energy [kWh], T is the daily mean temperature by observation [℃] . The coefficient of correlation was 0.822.



(a) Dairy electric energy and daily mean temperature



(b) Dairy electric energy and daily mean relative humidity

Fig. 9 Dairy electric energy and daily mean temperature and relative humidity.

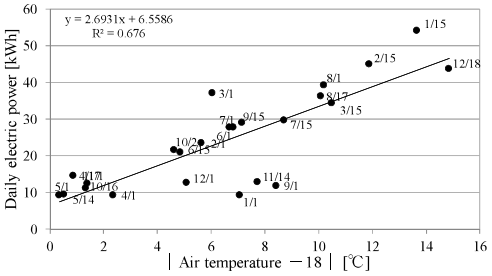


Fig. 10 Daily electric energy and the absolute value of the differences with the observation air temperature on the basis of 18℃.

4. Conclusion

This study examined urban district atmospheric phenomenon and relations with the air conditioning electric power quantitatively about one room of one building. The main result of this study is as follows.

1) Meteorological observations of the target building corresponded well with AMeDAS.

2) The daily electric energies in winter and summer were proportional to the differences of air temperature compared with spring and autumn.

3) Regardless of an air conditioner or heating, the air conditioning electric powers increased in proportion to temperature differences on the basis of 18℃.

Acknowledgement

This work was supported by JSPS, KAKENHI 24560672.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.204-211, February 16-18, 2017

Personality of small scale school's children of Nagasaki, Japan

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ABSTRACT: This paper is related to the personal nature of the children in the small scale elementary school. In order to investigate the children`s character of small-scale school, the authors carried out the questionnaire with the personality test simultaneously to the small-scale school and the ordinary school for the comparison. This personality survey is used by the main 5 factor personality examination handbook. Through this research, we can easily understand a basic personality by checking the proposed five elements. Five factors are extroversion, agreeableness, conscientiousness, emotional stability, and intellect. As a result, a child of the small school has a low extroversion and intellect. Conversely, the emotion stability turned out high.

1. INTRODUCTION

First author went to elementary school at two schools. One was a small scale schools and the other one was a ordinary school. In these two elementary schools, she had many opportunities for school's experience engaging with the same grade children. From the first day of elementary school, ordinary school children of attempted to engage with her positively. However of small scale school the children never spoke to her from themselves. She felt that there was a difference in response in the two elementary schools children. The small number of children at a small scale school had produced a difference in the responses of the two schools. It seems that if there is a few member in a class, it is difficult to build a new human relationship and to live in a human relationship with new friend.

From these experiences authors assumed that the size of the school had some influence on the personality of the child. And we decided to study the personality trait of small scale school children.

2. RESEARCH METHOD

In order to know the personality of small scale school children, we conducted a questionnaire on personality examination for 47 children from 4th grade to 6th grade at 3

small scale schools in Nagasaki city. In addition, we observed the same questionnaire for children of 4th grade to 6th grade at ordinary school, as a comparison target for understanding the personality trait of small scale school children. The questionnaire used "The main 5 factor personality examination for elementary school children" proposed by "The main 5 factor personality examination handbook". Lastly, we showed the results of the questionnaire with comparing the data between the small scale school and the ordinary school. Finally, we concluded that the personality trait of the small scale school children.

The main 5 factors of personality examination was created to efficiently measure the basic personality of human beings. Basic characteristics of human personality can be determined by examining 5 main factors of extroversion, agreeableness, conscientiousness, emotional stability and intellect. The main 5 factors of personality examination used in this study is based on Goldberg's Big Five hypothesis.

3. RESULT

In this research, compared university school and ordinary school, before comparing small school and ordinary school. As the result, ordinary school has a higher average score of agreeableness, conscientiousness, and emotional stability, it has a lower average of extroversion and intellect.

(1) Extroversion

Table 1 Average of comparison Extroversion

	Standard average	Small scale school average	Ordinary school average
Value of the extroversion	3.44	2.96	3.143

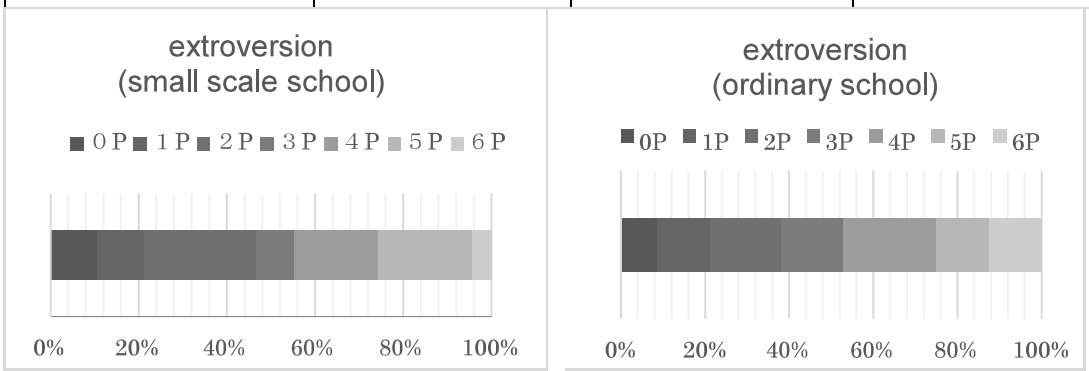

Figure 1 extroversion and distribution of the mark

The average of small scale elementary school was lower than ordinary school about personality

domains. It means that children of small scale elementary school have a quiet personality. Focusing for the high score like 6 points, small scale elementary school has 4.3% and ordinary school has 12.4%. As a result, the children of small scale elementary school does not have a range to a high score. This result teaches us that there are few aggressive children of small scale elementary school.

(2) Agreeableness

Table 2 Average of comparison（agreeableness）

	Standard average	Small scale school average	Ordinary school average
Value of the agreeableness	3.87	4.17	4.29

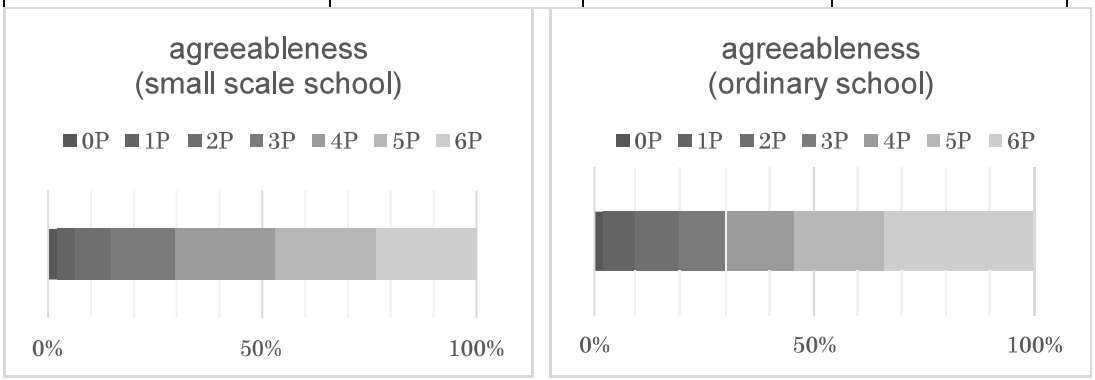

Figure 2 Agreeable and distribution of the mark

The average small scale elementary school was lower a little than ordinary school. There are almost no differences as much as the agreeableness of the small scale school and ordinary school. Focusing for the high scores like 4 and 5 and 6 points, small scale school has 70.2%, ordinary school has 69.9%. And then, focusing for the low scores like 0 and 1 and 2 points, small scale school has 14.9%, ordinary school has 18.9%. Thereby, small scale school have unevenness of high score and low score. Consequently, there are variation types with cooperative child and not cooperative child in extroversion term.

(3) Conscientiousness

Table 3 Average of comparison（conscientiousness）

	Standard average	Small scale school average	Ordinary school average
Value of conscientiousness	3.59	3.68	3.914

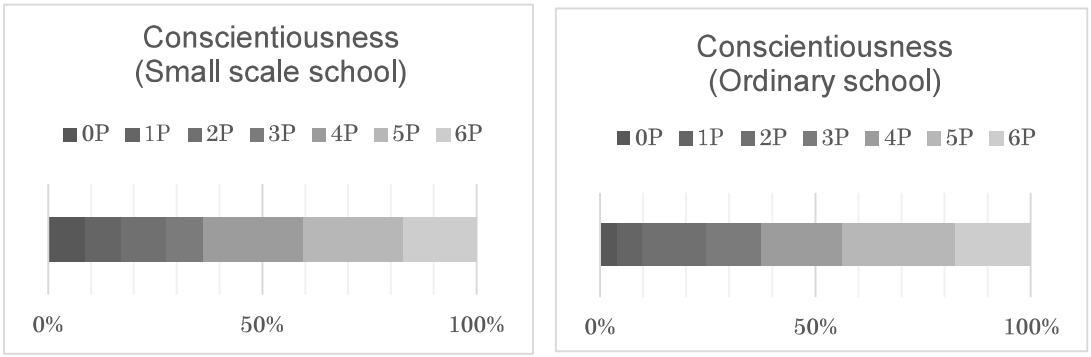

Figure 3 conscientiousness and distribution of the mark

In table 3, the average value of small schools was lower a little than the average value of ordinary school. But the average value of small scale school was almost the same as the average value of personality domains test. It is considered that the scale of the school does not influence the conscientiousness of the child.

(4) Emotional stability

Table 4 Average of comparison（emotional stability）

	Standard average	Small scale school average	Ordinary school average
Value of emotional stability	3.79	3.55	3.522

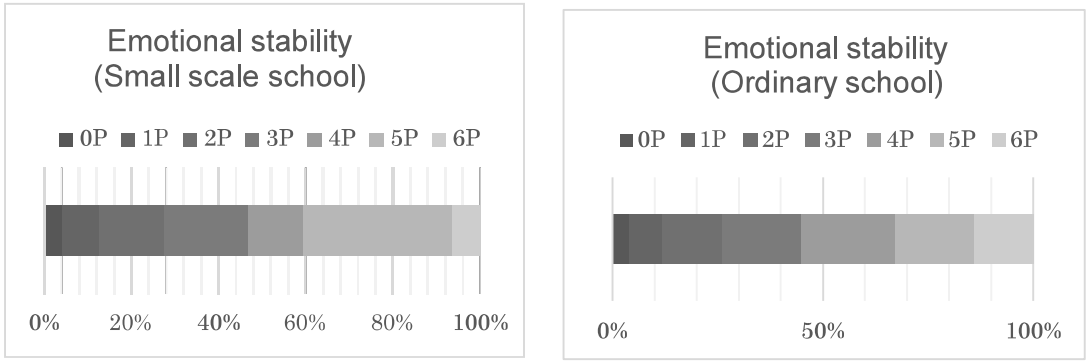

Figure 4 emotional stability and distribution graph of the mark

In table 4, the average small scale elementary school was higher a little than ordinary school, but was lower a little than personality domains test. Emotional stability can be said to be the same on average.

Although there was hardly any difference in average value, focusing for the high scores like 5 and 6 points, small scale school has 40.4%, ordinary school has 32.8%. As a result, small school children have a range to a high score. Accordingly, it may be said that there are a lot of children with the emotional stability at small scale school. It means that the children of small scale school may be a stable in the emotion. And, it can be said that children of small scale school do not envy.

(5) Intellect

Table 5 Average of Comparison（intellect）

	Personality test average	Small scale school average	Ordinary school average
Value of intellect	2.167	1.723	2.116

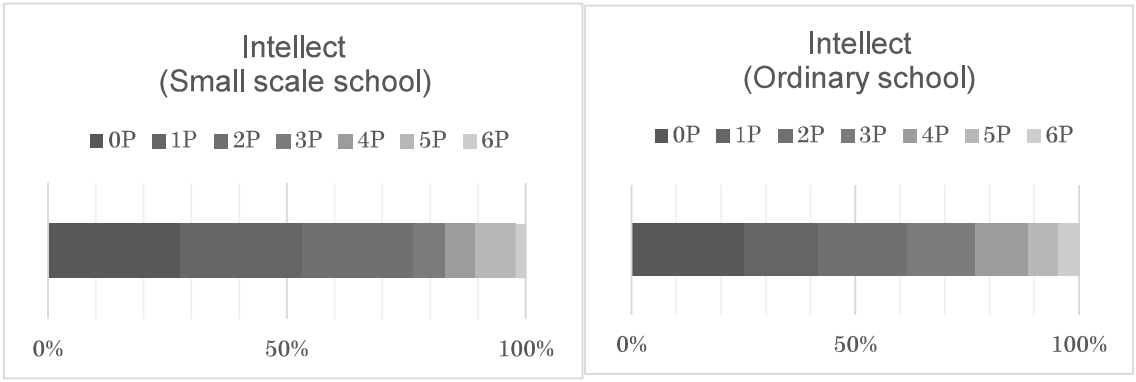

Figure 5 Intellect and distribution of the mark

Small scale school average was lower than ordinary school about personality domains test. It may be said that the children of small scale school children have intellect personality lower than ordinary school. Focusing for the low scores like 0 and 1 points, small scale school has 53.2% and ordinary school has 41.7%. As a result, small scale school children have a range to a low score. It said that there are few children with intelligent and analytical children of the small scale school.

(6) Personality type

Through this research, the personality type was classified the person into 50 kinds. The result are like table 6.

Table 6 Personality type classification result (unit is percentage(%))

Personality type	Feature of 5 factors	Ordinary school	Small scale school	Attached school
Extroverted personality	extraversion＋	1.2	2.1	3.7
Introverted personality	extraversion－	3.7	4.3	4.1
Gentle personality	agreeableness＋	4.6	6.4	5.3
Unemotional personality	agreeableness－	3.7	2.1	4.1
Diligent personality	conscientiousness＋	2.1	2.1	2.4
Lazy personality	conscientiousness－	2.4	2.1	2.8
At ease personality	emotional stability＋	5.0	2.1	4.5
Nervous personality	emotional stability－	0.4	2.1	0.4
Reflective personality	intellect＋	2.1	4.3	2.0
Unreflective personality	intellect－	3.3	4.3	2.8
Zestful personality	extraversion＋ agreeableness＋	2.9	0	1.2
Unsociable personality	extraversion－ agreeableness－	1.2	0	0.8
Rough personality	extraversion＋ agreeableness－	0.8	0	2.0
Modest personality	extraversion－ agreeableness＋	2.1	0	1.6
Ambitious personality	extraversion＋ conscientiousness＋	0	0	0
Unambitious personality	extraversion－ conscientiousness－	1.7	0	0
Mischievous personality	extraversion＋ conscientiousness－	0.8	0	2.0
Punctual personality	extraversion－ conscientiousness＋	2.9	2.1	1.6
Confident personality	extraversion＋ emotional stability＋	1.2	0	4.1
Insecure personality	extraversion－ emotional stability－	0.4	2.1	0
Impulsive personality	extraversion＋ emotional stability－	0.4	0	0
Placid personality	extraversion－ emotional stability＋	3.7	10.6	1.2
Witty personality	extraversion＋ intellect＋	2.1	0	3.7
Unadventurous personality	extraversion－ intellect－	2.1	0	0.8
Verbose personality	extraversion＋ intellect－	1.2	0	0.4
Meditative personality	extraversion－ intellect＋	2.4	2.1	1.2
Dependable personality	agreeableness＋ conscientiousness＋	1.7	0	2.0
Selfish personality	agreeableness－ conscientiousness－	1.2	6.4	2.4
Easy going personality	agreeableness＋ conscientiousness－	0.8	0	1.2

(To be continued)

Rigid personality	agreeableness－ conscientiousness＋	0.4	0	1.2
Tolerant personality	agreeableness＋ emotional stability＋	3.7	6	0.8
Intolerant personality	Agreeableness－ emotional stability－	0	0	0
Sentimental personality	agreeableness＋ emotional stability－	0	0	0
Masculine personality	agreeableness－ emotional stability＋	2.4	2	1.2
Tactful personality	agreeableness＋ intellect＋	2.9	2	2.0
Ruthless personality	agreeableness－ intellect－	1.2	2	1.2
Lenient personality	agreeableness＋ intellect－	0.8	0	0.8
Cynical personality	agreeableness－ intellect＋	3.3	0	2.4
Forward-looking personality	conscientiousness＋ emotional stability＋	4.1	4	2.8
Fickle personality	conscientiousness－ emotional stability－	0	0	0.8
Particular personality	conscientiousness＋ emotional stability－	0	0	0
Informal personality	conscientiousness－ emotional stability＋	1.7	6	1.2
Polished personality	conscientiousness＋ intellect＋	1.2	4	2.4
Haphazard personality	conscientiousness－ intellect－	0.8	2	1.2
Conventional personality	conscientiousness＋ intellect－	1.2	2	0.8
Rule-avoiding personality	conscientiousness－ intellect＋	0	0	2.0
Brilliant personality	emotional stability＋ intellect＋	3.7	4	4.9
Inartistic personality	emotional stability－ intellect－	0.4	0	0.4
Imperturbable personality	emotional stability＋ intellect－	5.0	4	2.8
Sensual personality	emotional stability－ intellect＋	0	0	0
The person gets balance	There is not a characteristic element and gets balance	9.1	4	7.3

As the tablet6, the most common type of personality in small school children is a placid person (extroversion－emotional stability＋). Placid personality are smooth, confident and emotionally very stable. Through this result with placid personality, we can find that small scale school has 10.6%, and ordinary school has 3.7%. This percentage and results explain us that the difference of small scale school and ordinary school is clear.

Secondly, much personality types in small scale school are Selfish personality(agreeableness－ conscientiousness－), Tolerant personality(agreeableness＋ emotional stability＋), and Informal personality(conscientiousness－ emotional stability＋). Consequently, the personality type of small scale school children have much personality type of emotion stable. In this investigation, the characteristics to children of the small scale school could be done clearly by the number value by Big Five personality.

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Session-7

ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.212-215, February 16-18, 2017

Human Interface to use Eye-ball Movement

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ABSTRACT

For patients with serious physical disability information about eyeball position is effective to operate the computer. Some technique to detect eye-ball position like eye-tracking and vision sensor are recognized as effective devices. However, these devices require skillful maintenance tasks. In this paper, a device to use multiple reflective sensors is proposed. A feature of the device is that the skillful maintenance and setting of the device is not required. In addition, the device is low-cost. Experiments of the device revealed the applicability of the device.

1. Introduction

Recently vision interface devices for people with physical disability were developed. They focused on the slight body movement of the eyeball, lips and eyebrow. One typical technique is an eye tracking technique developed at Tobii Technology Ltd. Computer control devices based on this technique is often used by ALS patients, whose remaining ability are restricted at the eye-ball movement. Another technique to measure eye-ball movement is based on the principle of EOG(Electro-Oculogram) signals. The human eye is an electrical dipole, where the eye retina is negatively charged and the corona is positively charged. During eye movements the dipole position changes. If two electrodes are placed on the temples, eye-ball movements can be measured as a voltage(EOG) difference of these two electrode. Of course, these devices are effective to detect eyeball movements. But maintenance of these devices requires some skill and knowledge. Based on the environments of the patients, more simple and low-cost device is required.

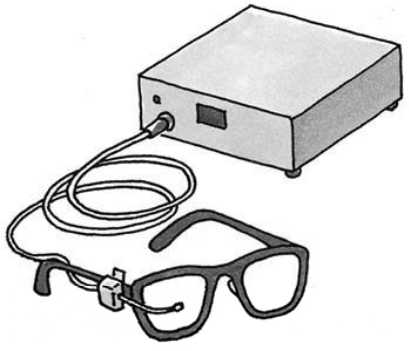

Fig.1 Blinking switch with reflective sensor

2. Blinking switch to use reflective sensor

One conventional device to use reflective sensor is shown in Fig.1. Infrared light is projected onto the eyeball and the reflected light is detected by the optical sensor. The principle of the blinking switch is based on the phenomenon that reflected light is effected by the posture of the eyeball. Device in Fig.1 leads the light by the optical fiber into the sensor box. This device can detect the blinking action. While the principle is simple, the user has to special attention to set the sensor to the proper position. Once the sensor moves slightly on the user's head, the sensor cannot detect blinking action properly.

(a) Three reflective sensors (b) Six reflective sensors

Fig.2 Glass with multipe deflective sensors

In Fig.2 our blinking sensing device is proposed. A feature of the device is the multiple compact flat-type reflective sensors are placed on the glass. Due to the multiple data obtained by these sensors, the positions of the reflective sensors are compensated. Therefore, the user needs to care about the position of the device on the head.

In order to calibrate the positions of the multiple sensors on the glass, the calibrating program is developed. The calibrating process is achieved as fillows:

(Step 1) User wares the glass on his head and starts calibrating process.

(Step 2) The user is requested to move his eyeball toward left, right, up, down, forward and at every eyeball position strength of reflected lights is stored in the device.

The data are Rij(where j is the number of the sensor, and j is the number of the measurement)

(Step 3) The user is requested to close his eyelid and strength of reflected light at every sensor is stored in the device.

(Step 4) By processing the all Rij data based on the pattern matching method, threshold range to discriminate the position of the eyeball position and to detect the blinking function are determined.

Experiments revealed that the glass with six reflective sensors is effective to detect the direction of the eyeball like up, down, left, right and left and also to detect the blinking action. The glass with three reflective sensors is effective to detect the blinking action.

3. Original screen text editor

Considering the performance of two devices proposed an original text editor is developed. For the device with six reflective sensors, the text editor developed is shown in Fig.3. On the monitor one part of screen keyboard is shown. A function of this screen text editor is that the screen keyboard on the monitor moves according the direction of the eyeball. Suppose the user gazes left, the screen keyboard moves leftward. Another function of this text editor is that the text in the center rectangle is selected by the blinking action of the user.

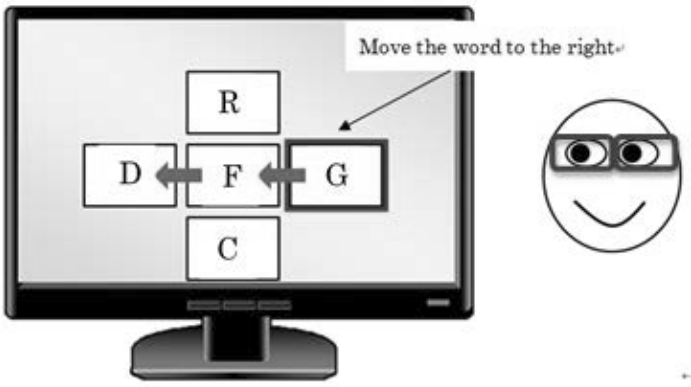

Fig.3 Original screen text editor

The device with three-reflective sensors is not applicable to the above text editor. But the device is applicable to conventional text editor with scanning function.

4. Coclusions

A device to use multiple reflective sensors is proposed. By employing multiple sensors the troublesome setting task of the device at the proper position is not necessary. Even if the device is moved with unintentional physical movement, the device can recover its ability to detect eyeball position. By introducing compact reflective sensors the applicability of the device can be improved.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.216-223, February 16-18, 2017

Analyzing Port Connectivity and Competitiveness among Kaohsiung and Southeast Asia Ports

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ABSTRACT: This study aims to analyze port connectivity and competitiveness among Kaohsiung and Southeast Asia ports using Annualized Slot Capacity approach. The financial crisis in 2001 had transferred the world economic center from the European and American regions to Pacific Ocean, specifically in Asia. Given that seaborne trade has increased rapidly in the past few years in the Asia region, the competition between container ports in the Asia has become more increasingly intense. Specifically, the raising of labor and production costs has forced multinational firms to extend or move their supply chain into the Southeast Asia regions. The Kaohsiung port, one of the top three container in 1999, is the biggest port in Taiwan and locates between the Transpacific route (T/P) and Far East-Europe (F/E) route. Facing the significant change of shipping marketplace and the development of container ports in the Southeast Asia region, the Kaohsiung port has lost its mega hub port position. Thus, it is imperative and worthy to evaluate the port competitiveness among Kaohsiung and Southeast Asia Ports by performing Annualized Slot Capacity approach.

1. Introduction

The globalization has accelerated the development of international trade and consequently increased the demand of international transportation. Typically, the international transportation is highly depending both on air and ocean transportation. Taiwan is an island economic nation where international trade accounts for a substantial proportion of economic activity. Thus, international transportation plays a critical role in the Taiwan. In particular, about 99% of the import/export cargo volumes were shipped by sea so it can know that sea transportation plays an important role in Taiwan's global trade and economic development.

The financial crisis in 2001 had transferred the world economic center from the European and American regions to Pacific Ocean region, specifically in Asia. According to the reported published

by Lloyd's List Containerisation International Yearbook (2016), nine of top 20 ports were in the mainland China in 2015. Kaohsiung port ranked thirteenth and Southwest Asia ports such as Singapore port, Port Klang and Tanjung Pelepas were all ranked in top 20 in 2015. In summary, fifteen of top 20 ports were located in the Asia region.

The mainland Chain had established many bonded areas along the coastal cities to attract foreign investors in the wake of political reform and economic opening. By providing a sound production and logistics environment, the mainland China has played the role of the world's factory. However, numerous corporations, recently, mindful of production costs and potential markets have been pondering moves to inland areas or expansion of their supply chains into Southwest Asia regions. So the center of global factory has gradually transferred to Southeast Asia countries which also derived the increasing demand of international transportation. The increasing demand of international transportation has accelerated the development of container ports in the Southwest Asia countries. Table 1 displays the throughput of major ports in the Southwest Asia region such as Singapore, Malaysia, Vietnam, and Thailand. It shows the throughput of each port is increasing in the past five years. In particular, the growth rates in Port Klang, Tanjung Pelepas, Laem Chabang, Ho Chi Minh, and Haiphong are more than 30%.

Table 1 2010-2015 Container port throughput Unit: million TEU

Ports	2010	2011	2012	2013	2014	2015	Growth rate (%)
Singapore	28.4	29.9	31.7	32.6	33.9	30.9	8.8
Port Klang	8.9	9.8	10.0	10.4	10.9	11.9	33.7
Kaohsiung	9.2	9.6	9.8	9.9	10.6	10.3	12.0
Tanjung Pelepas	6.3	7.3	7.5	7.4	8.2	8.8	39.7
Laem Chabang	5.2	5.7	5.9	6.0	6.6	6.8	30.8
Ho Chi Minh	4.4	4.7	5.1	5.5	5.4	5.9	34.1
Haiphong	0.9	1.0	0.9	3.02	3.5	3.9	33.3

Source: Containerisation International Yearbook (2011~2016)

The Association of Southeast Asian Nations (ASEAN) is a regional organization comprising ten Southeast Asia states which promotes intergovernmental cooperation and facilities economic integration among its members. The members of ASEAN include Indonesia, Malaysia, Philippines, Singapore, Thailand, Brunei, Cambodia, Laos, Myanmar and Vietnam. The totally population in the ASEAN is approximately 625 million and accounted 8.8% of the world's population. Notably,

Singapore has played an important role in transshipment port in the Asia-Pacific region.

Kaohsiung port located between T/P and F/E/ routes plays a vital transshipment hub for shipping cargos from Southwest Asia regions to North America. Recently, given the significant change of shipping marketplace and the development of container ports in the Southeast Asia region, the major ocean carriers has increasing their deployment of fleets in Malaysia, Philippines, Singapore, and Thailand rather than the Kaohsiung Port. Thus, the Kaohsiung port has lost its mega hub port position in the Pacific Ocean region. This study, therefore, aims to evaluate the container ports' competitiveness among the Southwest Asia regions by applying Annualized Slot Capacity approach. By calculating the port connectivity, this study can realize whether the Kaohsiung port has its vital role and competitiveness in shipping market among Southeast-Asia ports.

The objectives of this study are as follows:

- evaluating port connectivity and competitiveness between Kaohsiung port and major Southeast-Asia ports; and
- identifying the fleet deploy behaviors of ocean carriers and examines the change of network.

2. Literature Review

2.1 Port Competitiveness

The term competitiveness can be defined from different perspectives and levels. Porter (1998) pointed out that a nation's competitiveness depends on the capacity of its industry how to innovate and upgrade which to create an excellent business environment to let the industry gain the advantages to compete. So, a nation's competitiveness is gaining from nation resources such as labor and capital. In terms of organizational and individual perspectives, Barney (1991) indicated that an enterprise with key resources and capabilities had a competitive advantage compared to their major competitors. Thus, key resources and capabilities are critical determinants of superior performance and profitability.

Haezendonck and Notteboom (2002) pointed out that port competitiveness depends on the competitive advantages that port gains or creates over a period of time. Heaver (1995) argued that the port competitiveness is gained when a port can attract more shipping lines to call at. Institute of Transportation, MOTC (2015) noted that port competitiveness is a relative indicator that needs to be displayed in a competitive situation. Compared to the weaker port, a port with competitiveness has a greater chance to access shipping companies and shippers' flavor.

Verhoeff (1981) divided port competitiveness into four different types, competition among port enterprises, competition among ports, competition among port cluster (another ports cluster have the same geographical features near by a ports cluster) and competition among port scope (port and port located at the same coastline or hinterland). The factors affecting port competitiveness may not be the same; it may include labor, technology, capital, geographic location, port infrastructure, government policy or port operations performance and so on. Notteboom and Yap (2012) argued that a container

port competitiveness depended on shipper's choice, specific trade route, geographical locations and connections with other ports.

2.2 Port Connectivity

With the changing logistics strategies and the evolving role of ports in supply chains, the issue of port connectivity has received increasingly attention in port literature for improving hinterland accessibility. It is imperative for port operators or authorities to enhance port connectivity for the entire logistics chain of maritime transport, as well as the need to identify a cost-efficient way to facilitate international trade.

Jiang et al. (2015) defined port connectivity means how well one port connects to others in the maritime transportation network and its ability to be reached by regular liner services. This knowledge can help both port operators and ocean liners to formulate their strategies. Wang et al. (2016) pointed out that port connectivity is external links to other systems/ports within an area. If the port has a good degree of connectivity, the port's competitiveness will enhance (Lee et al., 2014) and can contribute to economic development of the network effect (Laird et al., 2005).

In general, the higher the connectivity level of a port, the more attractive it will be in terms of facilitating the transportation of cargo and reducing transportation cost and time, which will result in it being more competitive than others. Conversely, a port which is highly competitive makes it more attractive for liners to set up their transshipment operation at the port, which results in more port calls and therefore enhances its connectivity.

The importance of hinterland connections has been recognized as one of the most critical issues in port competitiveness and development in most ports around the world. Upgrading of facilities and equipment, privatization of port operations and increased sophistication of berth planning has resulted in drastic reduction of ship turnaround times over the past decade (Merk and Notteboom, 2015).

Recently, a large number of previous studies had addressed the topic of port connectivity. For example, Wilmsmeier et al. (2006) investigated maritime trade among 16 Latin-American countries and found that inter-port connectivity had a significant impact in international maritime transport costs. Wilmsmeier and Hoffmann (2008) evaluated the impacts of liner shipping connectivity on intra-Caribbean freight rates and the relationships between the structure of liner services, port infrastructure and liner shipping freight rates. Furthermore, Hoffmann (2005) combined nine factors of maritime transportation, including fleet assignment, liner services, vessel and fleet sizes and so on, to generate an overall Liner Shipping Connectivity Index (LSCI) for 162 coastal countries, which was published by the United Nations Conference on Trade and Development (UNCTAD).

In summary, the port connectivity and competitiveness basically could be evaluated by both questionnaire survey or quantity models. The factors influencing the competitiveness of a port included quantity of goods, shipping services, speed/time, efficiency, port facilities/infrastructure, port information system, location and so on. However, these indicators tend to be more tactical and some

sources are more subjective and it can't quantitatively analyze the actual impact of indicators on port competitiveness. Conversely, Annualized Slot Capacity (ASC) uses the average vessel capacity of shipping line, the number of calls of shipping line in a year and the number of shipping lines of a port analyzes port connectivity and competitiveness. The ASC method uses the objective data to measure the connectivity and competitiveness of a port. Hence, there are a few studies applying ASC to analyze port connectivity and competitiveness.

2.3 Slot Capacity Analysis

The slot capacity analysis is calculated by the following formula (1), Y_t is the total slot capacity of k shipping services for the time period t, deployed between port i and port j for k=1, 2, 3,…, n; and t can be donated by day, week, month or year, depending on the search question and research intent.

$$Y_t=\sum_{k=1}^{n} y_{ij}^{kt} \quad (1)$$

Therefore, slot capacity data are categorized by the shipping lines and trade routes connected to the two ports and the top trade routes served by the ports. The data can be used to analyze patterns of maritime supply chains by observing the ports (as nodes) and routes or lines (as links) that are embedded within the chai. And the analyses can to be scaled in terms of geographic coverage at the regional, inter-regional and global levels.

Lam (2011) used slot capacity analysis to evaluate the ports of Singapore and Hong Kong to illustrate the respective transshipment and gateway perspectives. Findings reveal that geographical location and changes in the constitution of players can have reverberations on the maritime supply chain dynamics that traverse the port. Lam and Yap (2008) analyzed the annual slot capacity to the evaluate competition for transshipment containers by major ports in Southeast Asia. The data were computed and categorized based on shipping trade routes. Computation of annualized slot capacity (ASC) for k services calling at a port can be obtained with the formula (2), V denotes average vessel capacity and F denotes the frequency of call in a year.

$$\sum_{i=1}^{k} ASC_i=\sum_{i=1}^{k} V_i F_i \quad (2)$$

The findings revealed that competition from Port Klang and Tanjung Pelepas had a negative impact on Singapore's transshipment performance. Although Singapore continued to possess a dominant position as the premier transshipment hub in the region in terms of market share by both transshipment throughput and annualized slot capacity.

Lam and Yap (2011) adapted annualized slot capacity to evaluate the calling patterns of container shipping services in order to understand the dynamics of port connectivity and inter-port relationships

in the supply chains. Empirical evidence is drawn from four major ports in East Asia, namely Shanghai, Busan, Kaohsiug and Ningbo. The study identified the shipping capacity, trade routes and geographical regions connected to the ports, shipping lines involved, and the extensity and intensity of inter-port relationships among the four container ports from liner shipping network's perspective. The findings showed that most of the shipping capacity employed on the major east-west trade routes became non-exclusive and involved calls at two or more of the four ports.

Based on literature review, port connectivity is one of critical factors determining the freight of goods and can affect the performance of port competitiveness. Improving the level of port connectivity can increase port's attractiveness and attract more liner shippers to allocate major shipping lines to berth port which in turn enhance port competitiveness. In the past, there have been many studies use questionnaire to analyze port competitiveness but less studies use quantitative method evaluate port competitiveness. Thus, this study will apply annualized slot capacity method proposed by scholars to quantitatively evaluate connectivity and competitiveness of ports.

3. Methodology

The aforementioned studies had demonstrated port connectivity is closely related to port competitiveness. When port connectivity level becomes higher, port competitiveness will enhance so as to increase more goods and attract larger shipping companies to deploy major shipping lines. This study thus adopts quantitative method by calculating port connectivity to assess port competitiveness. Following Yap's (2009) suggestion, a slot capacity analysis model was used in this study to analyze port connectivity and competitiveness of Kaohsiung port and Southeast-Asia ports.

Competitiveness and connectivity between container ports mentioned in this study depend on the growth or decline of Annualized Slot Capacity (ASC). Computation data for ASC can be obtained from the actual vessel capacity in the container shipping services and is for a single port service. This study will analyze the development of containerized shipping services at the annualized slot capacity of the port and various trade routes in which the container shipping services are called and the geographical areas to which the port is linked. Therefore, this study refers to Yap (2009) proposed annualized slot capacity formula and be modified as shown in equation (3) below:

$$ASC_{wt}=\sum_{s=1}^{h} T_{wt}^{s}=2\sum_{s=1}^{h} E_{wt}^{s}G_{wt}^{s}C_{wt}^{s} \quad (3)$$

Where T is the annualized slot capacity, measured in TEU that called at port W for a particular service h in time period t; E is the number of calls made at port W for the whole service loop; G is the frequency of call in a year; and C is the average capacity of vessels deployed. Annualized slot capacity of a port is be influenced by the number of calls at a port for the whole service loop, frequency of call in a year and the average capacity of vessels deployed. Multiplication by a factor of 2 presumes that

the vessels are fully loaded and that all the containers will be unloaded and the vessels subsequently reloaded to their maximum capacity.

This study aims to use ASC to analyze port connectivity and competitiveness among Kaohsiung port and Southeast-Asia ports. Beside Kaohsiung port, the major ports in Southwest Asia region such as port of Singapore, Port Klang, Tanjung Pelepas, Laem Chabang, Ho Chi Minh and Haiphong port were selected in this study to compare the port connectivity. The data related to the number of calls at a port for whole service, frequency of call in a year and average capacity of vessels from 2011 to 2016 Q2 were collected and further to calculate the index of port connectivity by performing annualized slot capacity approach

4. Expected Results

By collecting the related information of number of calls at a port, total slot capacity, and frequency of call in a year on Kaohsiung port and Southeast-Asia ports. This study conducts annualized slot capacity method to compute ASC of each port. The findings of ASC can evaluate the port competitiveness among these ports. Moreover, this study uses different shipping lines and different shipping companies who allocate major shipping lines to berth ports to analyze these ports' connectivity and competitiveness in these different contexts. Several practical implications on how to increase port connectivity and competitiveness for the port authorities or carriers were also provided according to the findings of ASC.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.224-234, February 16-18, 2017

Identifying the Key Success Factors of Taiwan's Maritime Express Services

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ABSTRACT:

Before the opening of direct shipping across Taiwan Strait, Mini-three-links was one of the common ways adopted by shippers to transfer goods between the China and Taiwan. Recently, the development of cross-border e-commerce has accelerated the growing of international trade. Given the fact that no space available in Hong Kong and Singapore airports to handle the express cargos. The Taiwan government had developed Taiwan's Maritime Express Zone to provide express services between the China and Taiwan. Unfortunately, the implementation so far is not as perfect as expectation. The study thus aims to identify the key success factors of Taiwan's Maritime Express services by applying Analytic Network Process (ANP) approach. Results will be useful for related authorities and logistics service providers to involve in cross-border e-commerce for improving their logistics operation environment.

1. INTRODUCTION

There was no trade between China and Taiwan after the civil war in 1979. With the wake of political reform and economic opening, the policies on foreign directly investment and visiting relatives between the mainland China and Taiwan were released. The economic trade between China and Taiwan thus showed a trend of sustained growth. A shown in Table 1, the total value of import and export was only 2.85 billion and 0.02 billion in the beginning of economic opening. Notably, the value of import and export had reached 187.4 billion and 377.6 billion, respectively in the period of 2009~2013. Before the opening of direct shipping across Taiwan Strait, the flow of goods between China and Taiwan were only transported by three kinds of modes, namely (1) Indirect

transportation; (2) Offshore shipping center; and (3) Mini-three-links (Chen et al., 2012).

Table 1 Taiwan's value of import and export to China

Unit: billion dollars

	Value of import	Value of export
1989-1993	2.85	0.02
1994-1998	16.03	2.60
1999-2003	35.64	45.07
2004-2008	121.07	261.10
2009-2013	187.46	377.64

Source: Bureau of Foreign Trade (2016)

Considering the cheaper labor cost and low product cost, a lot of foreign companies and Taiwan's factories have moved their production lines to China which is known for big consumer market and cheap labor. Accordingly, the need to transport the raw materials between two sides of Taiwan Strait rapidly increases the trade interaction. In addition to above reason, they also focus on cost and timeliness which makes industries prefer the Mini-three-links as top choice. Mini-three-links plays an important role which has lots of advantages, such as loose inspection of goods, preferential tax and excellent geographic location. Furthermore, globalization of trade and rapid development of network communication has made e-commerce increasingly important in the global trade. For example, China hold "11.11 Global Carnival" which was also called as Single's Day on November 11th. The total amount of transaction was as high as 468.3 billion Taiwan dollars (Business Next, 2015)

However, United Daily News (2015) pointed out that Hong Kong and Singapore airports had been no space because of large import and export cargo volume due to the growth of China's e-commerce. Moreover, there was no difference between Taiwan and Hong Kong in terms of operating efficiency of ports and airports (Chu et al., 2006). According to above reasons and business opportunities, Taiwan's government decided to set up Maritime Express zone in Taipei port and started the business in 2015. As time went by, the implementation of Maritime Express seemed not to bring the expected benefits. Therefore, the government should immediately consider whether to readjust the policy implementation and check which aspect of planning is not perfect. In fact, there is no research about Taiwan's Maritime Express services. For the sake of observing the key success factors of Taiwan's Maritime Express services, this study will be based on implementation of short sea shipping that is similar to Maritime Express. This study has four sections. Section 1 introduces motivation, background and purpose. Section 2

discusses the literature review of the Mini-three-links, Taiwan's Maritime Express and short sea shipping. Section 3 describes the Analytical Network Process used here. Section 4 presents the factors and criteria we find.

2. LITERATURE REVIEW

2.1 Mini-three-links

At present, the main ports of the Mini-three-links are Liaoluo Port in Kinmen and small-amount trade ports in Xiamen. The mode of transportation is given in Figure1. Firstly, Taiwan's freight forwarders transport the goods to each port via Liaoluo Port. After the custom clearance, they will be transported to the freight transfer center of Xiamen, then distribute to all parts of China. Types of goods are daily commodities and hardware products such as mails, furniture and fastener, etc. And the Mini-three-links route is divided into the South line (Kimen to Xiamen and Quanzhou) and the North line (Matsu to Fuzhou). For companies, it's a convenient and flexible mode due to daily services so that they can almost transport goods to China every day. However, the Mini-three-links are faced with many problems one after another. Kinmen Daily News (2015) pointed out that China enhanced the regulation especially for cosmetics and health food; EC Biz (2015) indicated that the Mini-three-links wasn't a formal mode of transportation, and the companies would get in trouble in getting license after China strengthen the control. Therefore, Taiwan government should try to negotiate with China and reinforce the cooperation of cross-strait trade.

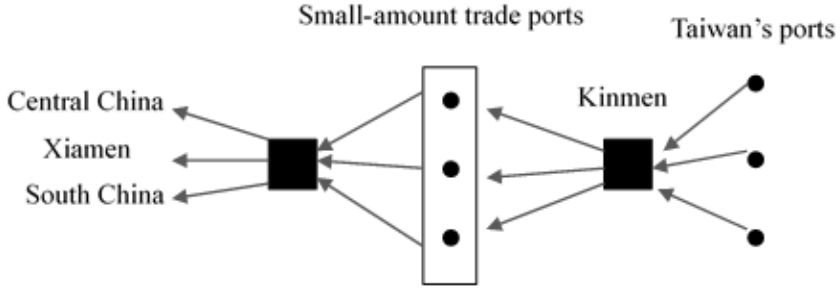

Figure 1 The mode of the Mini-three-links

Source: Yang and Shi (2015)

2.2 Taiwan's Maritime Express services

Taiwan's Maritime Express is based on the policy of the Mini-three-links, which adopts the routes originated from the Mini-three-links and promotes good flow of goods by using RO/RO ships. In the overall operating mode and laws, it's followed

by related practices and regulations of air express, which is characterized by the pursuit of delivery time and decrease of cost. On the other hand, this mode replicates some practices of air express which are helpful for goods transportation. For example, they offer 24-hour year-round custom clearance services, allowing low-value goods to take a simple declaration of clearance and prepaying taxes which these ways are important for speed and convenience of clearance.

Thanks to excellent location, our government decided to set up Maritime Express in Taipei Port in 2015 and also started the service in Anping Port next year (CT News, 2016). Related Maritime Express handling unit operator are divided into three types: (1) transport operator is responsible for shipping goods from and to cross-strait; (2) unit operator is an approved freight station operator that can provide enough space with any equipment necessary for customs clearance and inspection; (3) delivery enterprise is any profit-seeking enterprise that operates the business of forwarding and delivering maritime express consignments. The current route between Taipei and Pingtan is four flights each week and sails three hours.

2.3 Short sea shipping (SSS) in Europe and USA

The policies of SSS in European and USA, similar to Taiwan's Maritime Express in some form, were that ships sailed on the coastal river or sea to deliver goods (Anastassios and Athanasios, 2008). As the global trade come to maturity, efficient transportation networks are key elements for economic growth. But the rapid expansion of trucking or train as main modes has caused environmental and societal problems. Therefore, SSS is a sustainable mode of freight transportation that has lots of advantages over the other modes.

Although it's an environmentally friendly alternative, there are various administrative, legal and financial obstacles that delay the expansion of SSS. Anastassios and Athanasios (2008) indicated that there are four obstacles as follows: (1) additional handling costs; (2) Image problem; (3) Harbour Maintenance Tax; (4) Jones Act. Paixao and Marlow (2002) also pointed out that European SSS was lack of efficient port operation and required the amount of paperwork. Moreover, slow and unreliable image of SSS, identified by Government Accountability Office (2005) and Paixao and Marlow (2005), resulted in many shippers weren't willing to choose this mode. Consequently, the shipowners should change their corporate attitude and integrate their business to the modern just-in-time logistics as a way to improve the image of SSS.

Different approaches on the competitiveness of SSS are presented by many

scholars. Musso and Marchese (2002) proposed that the optimal trip distances and the corresponding costs can make SSS more competitive. And SSS competitiveness depended directly on the sea-let distances (Paixao and Marlow, 2002). Lombardo et al. (2005) considered that market size and transportation demand for SSS services were the most critical factors. According to European Commission APAS report (1996), it can be argued if SSS related cost can be less than 35% of the cost of road transportation, the additional logistics-related costs can be offset. In terms of time, SSS provided fewer days of flights, compared to the flexible departure time of road, it was clear that SSS was less competitive. Shippers' minimum requirements for the flights were fixed days of departure each week (Bolis and Maggi, 2003; Brooks, 1990; Brooks and Hodgson, 2006). According to above literature review, this study summarized five factors and 18 criterion for the success factors of Taiwan's Maritime Express services (See Table 2).

3. METHODOLOGY

3.1 ANP

Analytic Network Process (ANP) is a special case of AHP was developed by Saaty (1996). AHP maintains a unidirectional hierarchical relationship among decision level while ANP does not assume independence between elements of the model. In this case, each criteria may exist in relationship of dependence or feedback so that this study would choose ANP as main methodology. The steps of calculation of weight are followed by:

Step 1: Constructing a hierarchy

According to the objective of the problem, the experts in related fields are sought to obtain the elements and criteria of decision-making and find out the mutual influence between the sub-criteria and the criteria. Finally, construct the hierarchy of the study.

Step 2: Designing the questionnaire and surveying

Each level based on upper level should be compared with each other by 9 range scale. Consequently, it must design questionnaire to fill in for planning group to determine the relative importance.

Step 3: Developing a comparison matrix

Elements in each level are compared in pair with respect to their importance to an element in the next level. The first of the pairwise comparisons is made at the top of the hierarchy and can be reduced to a number of square matrices $A = \lfloor a_{ij} \rfloor$ as in the following matrix:

Table 2 Dimensions and descriptions of Taiwan's Maritime Express services

Factors	Criteria	Brooks (1990)	Transport research APAS (1996)	Commission of the European Communities(1999)	Paixao and Marlow (2002)	Musso and Marchese (2002)	Bolis and Maggi (2003)	Becker et al. (2004)	Paixao and Marlow (2005)	National Ports and Waterways Institue(2005)	Government Accountability Office(2005)	Beskovnik (2006)	Brooks and Hodgson (2006)	Anastassios and Athanasios (2008)	Douet and Cappuccilli (2011)	Suarez-Aleman et al. (2014)	Arof et al. (2016)
Policy and regulation	Speeding up custom clearance			○	○							○					
	Providing incentives								○	○				○			
	Smooth cargo clearance												○		○		
	Loose supervision												○				○
Financial cost	Reducing the cost of land leasing		○			○									○		
	Subsidy policy		○			○											
	Reducing management cost		○		○	○									○		
Speed and reliability	Goods are delivered on time				○		○		○		○		○	○			
	Reliability of transport time				○		○	○		○	○		○	○			
	Stable and high frequency flights	○			○		○	○	○		○		○	○	○		

Price	Flexible price																
	Competitive price				○				○			○					
	Additional handling cost								○					○			
	Cheap port loading and unloading cost											○			○		
Service and convenience	Efficient port loading and unloading service				○				○			○	○		○	○	○
	Professional service								○				○				
	Efficient system								○			○				○	
	Sufficient and good equipment							○	○			○					

$$A=[a_{ij}]=\begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ a_{21} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ a_{n1} & a_{n2} & \cdots & 1 \end{bmatrix}=\begin{bmatrix} w_1/w_1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \cdots & w_2/w_n \\ \vdots & \vdots & \cdots & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix} \quad (1)$$

Step 4: Calculating the consistency of judgement

Check the whole hierarchy with consistency due to the differences of importance in each level. Saaty (1980) suggested CR value should be about 0.1, so to get the consistency. The CR can be calculated using equation (2) & (3) as follows:

$$CR=\frac{CI}{RI} \quad (2)$$

$$CI=\frac{1}{n-1}(\lambda_{\max}-n) \quad (3)$$

Step5: Form a super-matrix by using criteria comparison in the system

The following is the general form of the super-matrix. The eigenvectors calculated by each matrix are taken as the weight of the matrices, and the weight of all the matrices are presented in matrix to form the final supermatrix.

$$W=\begin{array}{c} \\ C_1 \\ \\ \\ \\ C_2 \\ \\ \\ \\ C_3 \\ \\ \end{array}\begin{array}{c} \begin{array}{cccc} C_1 & C_2 & & C_3 \\ e_{11}\,e_{12}\cdots e_{1n_1} & e_{21}e_{22}\cdots e_{1n_2} & & e_{m1}e_{m2}\cdots e_{mn_m} \end{array} \\ \begin{bmatrix} W_{11} & W_{12} & \cdots & W_{1m} \\ W_{21} & W_{22} & \cdots & W_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ W_{m1} & W_{m2} & \cdots & W_{mm} \end{bmatrix} \end{array}$$

Finally, the relative weights and importance of each criterion are obtained according to the limit matrix, which can be used as the priority of the decision-making plan and the optimal alternative.

3.2 Questionnaire design and sampling target

Questionnaire design is divided into two sections. Section 1 is the survey of respondents and their basic data to understand the background. Section 2 is to establish the hierarchical structure. Then, use the Super decision software to carry out final results. Respondents of this study are from Taiwan International Port Co., TongLit Logistic, Wangon Group and customs who are familiar with the business of

Taiwan's Maritime Express,

4. EXPECTED OUTCOME

This study is based on above literature review to find out the success factors of Taiwan's Maritime Express services. As a result, we summarize five factors and 18 criterion. In the future, this study will be in accordance with experts in this field to select the more appropriate factors and criterion, which helps the results to achieve effective correctness. And the results will be useful for related authorities and logistics service providers to involve in cross-border e-commerce for improving their logistics operation environment.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.235-241, February 16-18, 2017

The Relationships among Perceptions of Corporate Social Responsibility, Job Satisfaction and Organizational Commitment - A Case of Employees in Taiwan International Ports Corporation

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ABSTRACT

This study aims to examine the relationships among employees' perceptions of corporate social responsibility (CSR), job satisfaction, and organizational commitment in Taiwan International Port Corporation. Data was collected by questionnaire survey and all statistics analyses were performed by the SPSS software. The multiple regression analysis method would be performed to test the research hypotheses in this study. The results of this study expect to demonstrate that: (1) Employees' Perceptions of CSR has significantly positive effect on Job Satisfaction; (2) Job Satisfaction has significantly positive effect on Organizational Commitment; (3) The employees' Perceptions of CSR has significant positive effect on Organizational Commitment, and (4) Job Satisfaction has mediation effect between employees' Perceptions of CSR and Organizational Commitment.

1. INTRODUCTION

The concept of sustainable development has forced the enterprises to involve the corporate social responsibility (CSR) into their operation strategy. The most basic business attitude includes the interdependence between existence of enterprises and social development, and the integrity and responsibility. According to the WBSCD, the CSR refers to a commitment to sustain through the contribution of business to economic development, while enhancing the quality of the labor, family, life and community and society. A large number of prior studies had demonstrated the positive impact of CSR activities on firm performance. By paying more attentions in CSR activities, a firm can increase their corporate image and which in turn increase their employees' commitments and firm

performance.

Taiwan is an island-based economic entity in the centre of the Asia-Pacific and the country is highly dependent on international trade for its prosperity. However, the emergence of large-scale container ships, the re-deployment of service routes; the emergence of daily frequency services and the reorganization of world shipping strategic alliances had forced Taiwan's container ports to face several critical issues, such as a decrease in the number of ports of call and a decrease in frequency of sailings. Accordingly, at the beginning of 2012, the Taiwanese government decreed an organisational change in the ownership of the ports, forming the TIPC (Taiwan International Port Co., Ltd.) to increase efficiency and competitiveness. The organizational change would result in uncertainties on employees' job, promotion, resources, and so on and had made employees feel uneasy and lacked of commitment to the company (Ding-Shiun Siao, 2013).

Kanter (1968) noted that organizational commitment is the willingness of employees to volunteer their organizations and their loyalty to the organization. The stronger the internal staff of the organization's identity is, the centripetal force will become higher and more willing to work for the organization. Also, the organizational commitment depends on the intensity of the attitude of staff tendencies. The prior studies had showed CSR had positive impact on organizational commitment. Thus, undergoing the organizational change, it is imperative for the TIPC to increase organizational commitment and employee loyalty. Specifically, CSR is one of the best ways to improve a firm's image and which in turn improve employees' job satisfaction and organizational commitment. This study, thus, aims to evaluate the relationships between employees' perception on CSR, job satisfaction and organizational commitment from the view of TIPC's employees. The purposes of this research are as follow:

1. Evaluating employees' perception of CSR and job satisfaction,
2. Evaluating the satisfaction of job and organizational commitment,
3. Examining the impact of employees' perception of CSR on organizational commitment, and
4. Examining the mediation effect of job satisfaction between the employees' cognition of CSR and organizational commitment.

2. LITERATURE REVIEW

2.1 Corporate Social Responsibility (CSR)

Corporation social responsibility (CSR) was proposed by Bowen (1953), the father of CSR, and defined CSR as all activities in which an entrepreneur has obligation to pursue policies, meeting social values and goals. Enterprise itself has to bear the economic, legal responsibilities. Using own resources and business strategy to operate and the voluntary of corporation contributing the social development responsibility (Fifka, 2009).

2.2 Job Satisfaction

Job satisfaction first originated from Mayo, Whitehead, Roethisberger and other scholars in 1927 to 1932, which co-sponsored by Hawthome Studies. This study indicates that work behavior is affected by workers' emotions, which leads to differences in job performance. The main reasons that affect job satisfaction and productivity are workers' social and psychological factors (Cian-Wen Yeh and Nien-Chi Liu , 2009). In addition, the individual in the course of their work can be satisfied with their inner satisfaction. When it meets the inner satisfaction, the job satisfaction will become higher; without meeting the inner satisfaction, the lower job satisfaction will be (Hsiang-Ying Wu, 2016).

2.3 Organizational Commitment

Organizational commitment is derived from the *Organization Man*, published by Whyte (1956), which describes "Organizational people not only work for the organization but also belongs to the organization." Becker (1960) noted that commitment is a mechanism for generating the sustainability of human professional behavior while individuals invest in related to interests and produce consistent activities. In addition, organizational commitment also refers to the organization's goals, values, beliefs, etc. These include a strong sense of identity, acceptance and willing to contribute to the organization of personal effort and talent. Meanwhile, it also hopes to last service attitude and behavior in the organization (Wen-cheng Chen, 2013).

2.4 CSR, Job Satisfaction and Organizational Commitment

A large number studies had examined the relationships among CSR, job satisfaction, and organizational commitment. For example, Lin (2011) evaluated the relationships among hotel employees of the ethical programs, perception of CSR, job satisfaction and organizational commitment; Chen (2014) assessed the relationship among CSR, job satisfaction and organizational identity of employees; Hsu (2014) examined the impact of CSR on employee organizational commitment - job characteristics as moderator variable; and Chen (2015) examined the relationships among job stress, job satisfaction and organizational commitment. The aforementioned studies all showed that CSR had a positive impact on job satisfaction and organizational commitment. Meanwhile, job satisfaction had a positive impact on organizational commitment. Moreover, job satisfaction was found to play a mediatory role between CSR and organizational commitment.

3. RESEARCH METHODOLOGY

3.1 Research framework and hypotheses

Based on literature review and aforementioned studies, corporate social responsibility is related to job satisfaction and organizational commitment, and the level of organizational commitment affects the degree of job satisfaction. Accordingly, this study proposes the following hypothesis:

H1：The employees' perceptions of CSR has positive effect on job satisfaction

H2：The employees' Perceptions of CSR has positive effect on organizational commitment
H3：Job Satisfaction has positive effect on organizational commitment
H4：Job Satisfaction has a mediating effect between employees' Perceptions of CSR and organizational commitment

3.2 Definition and Measurement of Operational Variables

Data for this study was collected by the questionnaire survey. This study specifically takes the TIPC as a case to examine the relationships among CSR, job satisfaction, and organizational commitment. The questionnaire would be distributed to the employees of Taiwan International Ports Corporation. The questionnaire contains four parts, namely, basic information of respondents, perception of CSR, job satisfaction and organizational commitment. The participants were asked for their response to all items using a five-point Likert scale, ranging from "1= strongly disagree" to "5=strongly agree".

3.2.1 Corporate Social Responsibility

The measurement items of CSR were adopted from the studies by Carroll (1979, 1991) and divided into four dimensions:

1. Economic responsibility: economic responsibility is regarded as the most basic responsibility of enterprises to provide goods and services to meet the needs of the community at a reasonable price to earn appropriate profits.
2. Legal responsibility: the operation of an enterprise shall comply with the law.
3. Ethic responsibility: ethic responsibility is difficult to define because it involves social expectations that are not expressly provided by law.
4. Philanthropic responsibility: the law is not civilized regulations and the enterprise is voluntary feedback on society.
5.

3.2.2 Job satisfaction

With regard to job satisfaction, the Minnesota Satisfaction Scale (MSQ) proposed by Weiss et al. (1967) was used in this study to measure the job satisfaction of TIPC employee:

1. Internal satisfaction: it refers to the degree of worker satisfaction with the work itself, or gets a sense of accomplishment in the work, sense of responsibility, etc.
2. External satisfaction: it refers to the degree of worker satisfaction and work itself has nothing to do, such as interpersonal relationships, praise and rewards.
3. General satisfaction: it refers to the sum of the internal satisfaction and external satisfaction as the overall job satisfaction.

3.2.3 Organizational Commitment

Finally, the measuring scale of organizational commitment was adopted from the Organizational Commitment Questionnaire (OCQ) which was proposed by Porter, Steers, and Mowday (1979). The measurement items and dimensions are as follows:

1. Value commitment: strong beliefs and acceptance of organizational goals and values.
2. Efforts commitment: voluntary working for the organization.
3. Retention commitment: strongly hope to continue stay in the organization.

3.3 Data analysis

All data analysis in this study was performed by the SPSS statistical software. The methods performed in this study are introduced as follows:

1. Descriptive Statistic Analysis

   Use the descriptive statistical analysis to research the object of personal information and the scale of the identity degree, and use Likert scale of five points scale to distinguish the degree of identity of the research object.

2. Factor Analysis

   Factor analysis is used to reduce the number of variables and its purpose is to select a small number of representative variables, this method can maintain the original data, and each other as independent variables.

3. Reliability and Validity Analysis

   The implication of reliability is to measure the consistency or stability of the results obtained by multiple replicates, or to estimate the number of measurement errors to actually reflect the true quantitative level of an indicator (Wu, 2011). Cronbach's α coefficient in the overall reliability of the total scale should be more than 0.7, the internal consistency of the various factors (Yang, 2014). Validity is refer to a test can measure the psychological or behavioral characteristics and distinguishes internal validity and external validity. The internal validity is the correctness and authenticity of the study's narration, and the external validity is to study the inference correctness (Wu, 2011).

4. Expected Result

The purpose of this study was to explore the relevance of CSR, job satisfaction and organizational commitment. By reviewing previous studies, this study identifies the indicators of CSR, job satisfaction and organizational commitment and proposes the network of the relationship between the three models. The data was collected by the questionnaire survey and several methods, namely, statistical analysis, factor analysis, reliability and validity analysis were performed to test the research hypotheses. The result of this study expects to demonstrate employees' perception of CSR has a

positive effect on job satisfaction, and job satisfaction has a positive effect on organizational commitment. Moreover, the job satisfaction plays an mediatory role between the employees' perception of CSR and organizational commitment.

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ISBN-978-4-9907633-3-6
GISUP 2017(International), No.19, pp.242-256, February 16-18, 2017

The policy of reverse logistics and method in electronic products recycling and reusing

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Abstract

The demand of the electronic products is getting huge continuously in this worldwide market. However, the life-cycle of electronic products come to be shorter, and it causes the trash getting more. From the recycling of the view, there are most having precious metals in these products. Therefore, if the technique of solving-recycle is established, all of them can be recycled and reused.

The research uses the secondary data method to realize the way of recycling in electronic products and propose the hypothesis questions from H1 to H4. Through the way of interview deeply with government the third party of recycling company and the companies of electronic products to discuss the issues of the policy in recycling reusing and reverse logistics.

Because of the shortage in the ability of executing in Taiwan and it causes that the electronic products cannot be used effectively after the recycling. Therefore, the government should control that the recycle industries stop to dismantle personally and teach the customers to realize the means of recycling. Owing the electronic products have relation with the issues of environment and the government should have long-term plan and solve them to enhance the performance of final recycling.

Keywords: electronic products, recycling, reuse, reverse logistics policy.

1.Introduction

1.1 Background and motivation

Nowadays the demand for electronic products grows continuously in global market. Moreover, many new electronic products appear and the life cycle of them are shorter and shorter. Therefore, the electronic waste become the most fast-growing trash. However, there are many hazardous chemicals in the components of electronic products and it will have serious problem for the recycling in the future.

According to the United Nations, the global production of e-waste reached to break the record to 41.8 million tons in 2014, of which the proper recycling of electrical waste is less than 1/6 (only 6.5 million tons), and only one-sixth recycling in accordance with the appropriate recovery and reuse. Most of the enterprises do not properly solve the electronic waste and are suffered severe punishment. (Industrial Development Bureau, MOEA, 2016) At present, the global annual number of abandoned mobile phones is about 400 million. In general terms we find that, in the waste mobile phones that have lead, cadmium, mercury and other harmful substances, if we directly discard them will seriously pollute the soil and groundwater. (Taiwan Environmental Information Association, 2012).

1.2 Research purposes

At present, there have obvious growth and improvement in the recovery in Taiwan. The government also formulates a clear approach and recycling method for recovery policies. It also

stipulates the recycling procedures for waste information products and waste electrical and electronic equipment. There have air conditioning, television sets, computers and other electronic products recycling, but does not include the entire electronics industry. Among them, the electronic products, batteries recycling have great effectiveness, but the mobile phone, tablet and other resources recycling and reuse is not clear practice, at present, Taiwan has not yet systematic management of waste for electronic products, and the discarded mobile phone recovery rate is only 3%. By referring to the national laws and policies, we can compare Taiwan's policy deficiencies and effectively implement it in society. We hope that the improvements promoted by the law will make people pay more attention to the importance of recycling electronic products, Together with the maintenance of the Earth's environment.

Therefore, this research aims to study this topic, and hope to achieve the following objectives:

(1) To discuss national policies and regulations, and understand the similarities, differences, advantages and disadvantages.

(2) To understand the situation of Taiwan's electronic product recycling and reuse.

(3) To understand the consumer for resource recovery, re-use attention and awareness.

(4) Put forward the standards and methods of implementation of recycling and reuse in Taiwan, and further improve Taiwan's deficiencies in resource recovery and recycling rate.

2. Literature review

In the situation of global environmental improvement and limited resources, how to make electronic products effective recycling, reuse to achieve the recycling of resources is an important issue. Therefore, this study will explore the 3C products, recycling, reuse, etc. for understanding and discussion.

2.1 Electronic product

According to the European Union Waste Electrical and Electrical Equipment (WEEE) for the definition of electrical and electronic products include temperature switching equipment, screens, monitors and screen (greater than 100cm2 equipment), lighting equipment, large equipment (any external size greater than 50cm) , Small equipment (no external dimensions greater than 50 cm), small information and communication equipment (no external dimensions greater than 50 cm) (European Commission, 2012). The data provided by the Ministry of Economic Affairs for the use of electronic products in Taiwan are shown in Table 1 below.

Table 1 Taiwan's Use of Electronic Products (Computers, Electronic Products and Optical Products)Unit:ton

Years	2007	2008	2009	2010	2011	2012	2013	2014	2015
Quantity	67.21	70.74	61.06	72.11	100	86.98	75.54	81.18	75.5

Source；Ministry of Economic Affairs,R.O.C. (2016)and collated by the research.

2.2 Recycling

Recycling is the process of collecting discarded products and disassembling to reconstitute a new product, or collecting the used product then clean and dispose to be sold. (EPA, 2016).

In accordance with Article 2 of the Regulation on the Management of Recycling and Disposal of Waste Electrical and Electronic Products, Taiwan disassembles waste electrical and electronic products, and extracts substances as raw materials or fuels, and reduces or eliminates its harmful components. (SME Green Information Network, 2016). EU is primarily a recycling point established

by local government recycling centers and responsible industry (European Environment Agency, 2016).

The United States established the R2 (Responsible Recycling) Recycling Regulatory Certification System to regulate the recycling of industrial waste and the export of electronic wastes to foreign countries by the industry or manufacturers to reduce toxic wastes in electronic waste (Zheng Zushou, Li Chunhui, 2013).

Japan has two groups of enterprises were dealing with all domestic waste household electrical appliances, and it has total of 46 professional home appliance recycling companies (Li Shiguang, 2014). Table 2 shows the statistical data provided by EPD for waste electronic recycling statistics in Taiwan.Table3 is the compare of the recycling method in four countries.

Table 2 Statistics on Waste Electronic Recycling in Taiwan in the Seven Years Unit:ton

Item \ Years	2009	2010	2011	2012	2013	2014	2015
Waste appliances	31,820,544	30,986,952	30,313,198	36,186,703	39,853,245	41,672,838	45,929,874
Waste batteries containing mercury (waste dry batteries)	7,377,540	5,894,997	5,626,365	7,096,710	6,865,725	6,312,977	5,663,407
Waste lead acid battery	7,520,472	7,579,692	6,830,411	6,873,686	8,793,726	9,470,549	9,610,161
Waste computer	12,597,050	13,474,251	12,830,978	13,457,377	11,863,555	12,574,977	12,354,073
Waste optical discs	1,506,751	1,737,653	1,726,317	2,237,052	2,174,985	2,619,986	3,463,071
Waste mobile phone	334,382	331,431	336,789	376,268	494,905	774,043	1,470,572

Source: EPD (2016) and collated by the research.

Table 3 The recycling method in Taiwan, the European Union, the United States, and Japan

Country	Method
Taiwan	Purchase new machines and recycle old machines same time. Clean team consultation. Give them to the recycling industry.
EU	Establishment of recycling points. Cleaning team. Provide free recycling of waste electrical and electronic equipment
USA	Establishment of R2 Recycling Certification System. Rigorous control of e-waste exports.
Japan	Construction of environmental technology center. 46 professional home appliances recycling business

Source: Collated by the research.

2.3 Ruse

The concept of re-use is the item you should reuse as much as possible before you replace them. A product is recovered and used, and it mean it can be used, and if necessary it or some parts will be re-promoted (Ministry of Economy, Trade and Industry 3R Policy, 2004).

Taiwan's waste information recycling process is the people will be discarded computer by the clean team, the recycler, that is sent to the resource recovery and processing plants, which can be valuable substances through the recycling process to be recovered, and the remaining cannot be reused, (The Environmental Protection Department, Executive Yuan, 2016).

Article 7 of the Waste Electrical and Electronic Equipment Directive (WEEE) of the European Union the recycling of waste electrical and electronic equipment is also subject to the "re-use priority". In addition, Article 4 of the EU Directive on Waste Structures adopted on 17 June this year by the European Parliament also stipulates that the prevention and management of wastes should be adopted in the form of reduction, re-use, material recycling, energy recovery and proper disposal. 5, but specific life-cycle analysis of specific waste, follow the order of the environmental impact is higher, do not follow the order (Ma Xiaokang, Xu Jingxiang, 2015).

The main US recycling methods are handled by third-party providers: Computers for Classrooms is for the non-profit secondary computer recycling donation organization. The main task is to recycle the discarded or donated computers, rearranging, cleaning and repairing into basic E-Recycling of California was originally a waste recycling industry, and is now a member of the California E-Waste Recycling Program. The company's core business is in the recycling of used electronics Products, the use of artificial and mechanical combination process, careful dismantling of electronic waste, into a variety of materials (Zushou,Zheng, Chunhui,Li, 2013).

In 1991, Japan enacted the Law on the Promotion of the Effective Use of Resources. This Act was the original bill to establish a recycling society, which was revised in May 2000 and fully implemented in April 2001. (A) To strengthen the recycling of products by the producer (recycle); (b) product manufacturing resources and extend the service life, inhibition of waste output (reduce); (3) reuse the Product from the recovery (reuse) (Ministry of Economy, Trade and Industry, 2016).

Table4 the method of reuse in Taiwan, EU, USA and Japan.

Country	Method
Taiwan	Recycling to the treatment plant processing, and if it cannot be reused, it will be sent to the qualified generation of processing industry.
EU	The rule of WEEE.
USA	By third-party non-profit industry.
Japan	Producer and import industry should control self-made and imported products of computer.

Source: Collated by the research.

2.4 Policy

(1) Policy in Taiwan

In Taiwan, the "four-in-one" system is adopted for the recycling of resources. The "community residents" will use their household waste to sort out the small-sized resource wastes from their own households, combined with the local government clean-up teams, Recycling Fund "to be recycled. Taiwan's current environmental laws are mainly divided into the Waste Disposal Act, the Recycling Law and other environmental laws. In order to solve the problem of discarding large-scale household electrical appliances such as waste TV sets, waste washing machines, waste refrigerators, waste heaters and waste heaters, etc., the EPD, July 1, 100 years officially implemented the "four-machine reverse recycling policy", mainly to clearly regulate the trafficking industry should be responsible for the recovery, reduce the dispute between the public and traffickers. Through this policy, to ensure that resources and materials are indeed recycled or properly disposed of, and strengthen the waste after the four-machine flow control, to avoid pollution of the environment. (Environmental Protection Agency, Executive Yuan, 2016).

(2) Policy in EU

Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96 / EC) Waste Electrical and Electronic Equipment (WEEE) requires the manufacture / supplier of 10 categories of electrical and electronic products in the European Union market to take responsibility for the recycling and reuse of e-waste products. Waste electrical and electronic equipment collection, recovery, regeneration of the target (European Commission, 2003).

(3) Policy in USA

The US federal government, the state and local governments are based on the "Resource Conservation and Recovery Act" and "National Computer Recycling Law" to prohibit the landfill of waste household appliances and mandatory recovery of hazardous substances, and promote e-waste recycling plan. The Resource Conservation and Recycling Act was enacted in 1976 to deal primarily with the disposal of solid waste and hazardous waste in US federal law.

The National Computer Recycling Act's main program of work is to help federal agencies set targets and implement green electronic product procurement to manage their electronic products (including procurement, use and disposal) in an

environmentally friendly manner, to assist in improving their existing electronic products Use practices and conduct national recognition of their achievements. The United States currently has 25 states have e-waste recycling laws and regulations, the main recycling projects include computers, monitors, computer peripherals, televisions, printers, fax machines, photocopiers and mobile phones and other electronic products, different regions State e-waste control will be different (Zushou,Zheng, Li Chunhui, 2013).

(4) Policy in Japan

Japan advocates the establishment of a recycling-oriented society, from a variety of point of view, such as reuse (1R) policy to promote the reduction, reuse and reuse (3R) penetration, for waste reduction and reuse management policy for Japan's waste electrical and electronic The regulations governing the use of information products include the Law on the Promotion of the Effective Use of Resources, the Re-Commercialization of Specific Household Machinery (Appliance Recycling Law) and the Law on the Promotion of Recycling of Small Household Electrical Appliances (Ministry of Economic Affairs and Small and Medium- 2013).

The "Law for the Promotion of Effective Utilization of Resources" mainly targets seven designated industries or products, including resource-specific industries, specific re-use industries, designated resource-based products, designated reuse products, designated marking products, designated re-resources Products and designated by-products, for the specified seven industries and product-related regulatory content.

The Recycling of Specific Household Machinery Act (Appliance Recycling Act) stipulates that manufacturers and importers of household appliances have to recycle and implement re-commoditization for specific household electrical appliances (the term "re-commoditization" is hereinafter referred to as " Household appliances products such as refrigerators, televisions, washing machines and air conditioners, and proposes to deal with the recycling of waste household electrical appliances in order to build a recycling economy and society.

From April 1, 2013 Japan started the implementation of a new law, that is, "waste of small electronic products and other resources to promote the Act" (referred to as small appliances recycling Act). The purpose of this law is to promote the recycling of small electronic products such as digital cameras and game consoles, so as to facilitate the recycling, transportation and re-use of used small electronic products. Recycling is a product that can be efficiently collected and transported and used to reduce the cost of recycling the household electrical appliances used in the consumer's home.

2.5 The situation of reuse and recycling

2.5.1 Situation

(1) Situation in Taiwan

The recycling of waste electrical and electronic equipment in Taiwan is promoted in a systematic way through a combination of community recycling, recycling, local government and recycling funds. Taiwan waste electrical and electronic recycling pipeline is generally convenient and high for the recycling of waste electrical and electronic appliances in the waste TV, waste washing machines, waste refrigerators and waste cold, heating (referred to as waste four) recovery, considering its size, weight When consumers purchase new machines, some operators have to collect the cost of recycling the old ones. At the same time, there is still no way to enter the current recycling system. (Chen Hongyi, 2013)

However, the key to the recovery and recycling market is the size of the market. There is a wide range of e-waste. A single type of e-waste may not reach the market scale. Often, the e-waste resources Recycling market is not easy to establish a complete recycling channel, coupled with the e-waste recycling market and the end of its pipeline to the channel is not complete, not easy to enhance the value of its renewable resources. (Ma Xiaokang, Xu Jingxiang, 2015)

(2) Situation in EU

EU goes through long-term practice; circular economy has become more robust legal and social,

and its established mechanism and member countries of the success stories, and worthy of our future development of circular economy society. Germany is one of the earliest countries in the world to develop a recycling economy. The government goes through the legislation on legislation, has established a cooperative mechanism between the government, enterprises and the public through the Circular Economy Law (Kreislaufwirtschaftsgesetz, KrWG) Enterprises have the responsibility to create products that comply with regulations, the people have the obligation to dispose of private waste.

Depth understanding of its circular economy development process and the representative of the circular economy laws and regulations, renewable energy law and packaging regulations, enhance international cooperation and accelerate the establishment of a sound national policy system to assess the existing industry links and possibilities of cooperation , Select the appropriate development of circular economy model, the government policy, standardize the responsibility of enterprises and the public through innovative business model and industrial symbiosis, and ultimately the establishment of a zero waste society.

(3) Situation in USA

The US federal said it will strengthen the recycling of electronic products, re-use and final disposal measures. As the government's primary procurement arm, the US General Services Administration has set a new mandate for the government's environmental commitment to strengthening e-waste management. The core of the new regulations is to prohibit burning or landfill e-waste, and to re-use. Government departments should send unnecessary electronic equipment to the department in need, and the remaining electronic products to the local government, schools or non-governmental organizations. This will not reduce the Government's debt, it can reverse the government's image of inefficiency and waste. In addition, the government can sell these devices to encourage buyers to support the government for electronic equipment for recycling and recycling behavior.

However, those electronic products that cannot be reused will be recycled. The US General Services Administration will be strict checks and recovery procedures, the product can only be sent to the R2 and e-Stewards certified companies, and the two are the only US, through the US Environmental Protection Agency audit certification standards. In order to make the process public, the General Services Administration also said it would formulate a policy to require government agencies to submit all the idle electronic product information, and published in the Data.gov website.

Although many electronics manufacturers, retailers and users are improving e-waste disposal methods, the overall statistical data is still not ideal. Cell phone recovery rate is still less than 8%, while 62% of the waste computer or into the landfill. With the popularity of electronic products, the global connection is closer; the need to continue to meet the needs and rules, in this regard, the US government needs to lead by example (People's Network, 2015).

(4) Situation in Japan

Japan has a systematic approach in the area of e-recycling, where Japanese waste is broadly classified as industrial and non-industrial waste, and e-waste is recognized as a "non-industrial waste" in large-scale waste for the treatment of different types of garbage. Recycling is to achieve the material recycling society, and waste management. Public cleanliness and effective use of resources to promote the law to achieve this goal .In the electronics industry has a large household appliances law and Small household appliances law, and Japan has also adopted a home appliance recycling voucher system, the system is to ensure that the relevant people and organizations, such as consumers, retailers and manufacturers, will be top-down smooth recovery of home appliances recycling system. (Kayoko Yamamoto, 2010) Until April 2015, the large-scale appliance law designated by the collection station has 369 (including the collection of goods), the collection of goods and services to the consumer, There are 49 recovery plants, 22 recovery sites, and 35 facilities for processing and refurbishing small household appliances, which together with the recycling voucher system for e-waste.(Shunichi Honda, 2015)

2.5.2Problems

(1)Problems in Taiwan

In 1984, Taiwan's home appliance manufacturers set up a "four-machine, one-brain waste appliance recycling and clearing promotion society" through the "Taiwan Electrical and Electronic Manufacturers' Association" to show positive attitude towards domestic waste electrical and electronic follow-up. In 1987, the EPD established the Management Committee of the Recycling Management Fund (hereinafter referred to as the Fund Management Committee). The EPD announced the "Recycling and Disposal of Electrical and Electronic Articles and Information Items" and the "Recycling of Waste Electrical and Electronic Equipment" Management fund management committee merged business, the domestic public waste electrical and electronic recycling system officially on the road, but also declared the determination of Taiwan's effective management of e-waste.

"Zero waste" is the ultimate goal of resource recovery and reuse. In fact, resource management and environmental issues are two sides. However, "waste" and "secondary materials" can differ widely in terms of definition. The recycling of electronic waste contained in the rare earth and materials, renewable resources in the context of sustainable environmental framework under the price more expensive. Taiwan waste electrical and electronic waste materials recycling policy implementation of the results are quite good, if the future can effectively enhance the secondary material recycling technology, and the extraction of rare metals resources related industries closely linked to the domestic industry to lead the international trend of environmental protection will be (Council of Environmental Protection Administration, Recycling Management Fund Management Committee, 2012).

(2) Problems in EU

Waste as a resource in 2020, is the main target roadmap for high resource efficiency in EU. The roadmap also emphasizes high-quality recycling, eliminating landfills, limiting energy recovery to non-recyclable materials and stopping illegal transport of waste. And it is possible to achieve these things. In many countries, kitchen and horticultural waste constitute the largest portion of municipal solid waste. This type of garbage, when separately recovered can be converted into energy or fertilizer. Anaerobic digestion is a waste treatment method, but under controlled conditions, the process involves biotransformation to a biodegradable process similar to that in the heap. Anaerobic digestion produces biogas and surplus material, which in turn can be used as a fertilizer, such as compost.

From 2011, they look at better management of the potential benefits of municipal waste generation in European Economic Area. The result is staggering. Improvements in urban waste management between 1995 and 2008 resulted in significant reductions in greenhouse gas emissions, mainly due to the reduction in avoided methane emissions and emissions from landfills through recycling. If by 2020, all countries fully comply with the Landfill Directive's landfill transfer target, would be able to cut carbon dioxide equivalent emissions from life-cycle GHG emissions by an additional 62 million tones, which would be a significant contribution to the EU's climate change mitigation efforts.

The potential benefits of waste are enormous and can contribute to the EU's economic cycle with little waste. The use of environmentally friendly 3R provides environmental benefits even for high recycling and recovery rates in the country. Unfortunately, our current production and consumption systems do not provide incentives to prevent and reduce waste. From product design and packaging material selection, the entire value chain needs to be redesigned to prevent waste, and then a process can be made into the remaining input. The use of environmentally friendly 3R requires the concerted efforts of all concerned parties: consumers, producers, policy makers, local governments and waste treatment plants. If the collection of garbage sorting infrastructure arrives, consumers are only willing to classify household waste recycling. The opposite is also true; only when the family for garbage classification, the city can increase recycling. Ultimately, either waste will pose a problem or

resources depend on how we manage it. (European Environment Agency, 2016)

(3) Problems in USA

EPA's mission is to protect human health and the environment; and the goal is to ensure that all people are able to protect the environment and good health. The state's efforts to reduce environmental risks based on the best available scientific knowledge, federal laws protect human health, impartial and effective implementation of environmental protection. Environmental protection is about natural resources, human health, economic growth, energy, transportation, agriculture, industry and international trade, and these factors in the development of environmental policy should also be considered. Communities, individuals, businesses, national, local and state governments to effectively obtain adequate and accurate information on health and environmental risks that contribute to the diversity, sustainability and sustainability of our communities and ecosystems. Economic production, the United States and other countries to cooperate to protect the global environment play a leading role.

Environmental protection is everyone's responsibility, and from the beginning to understand the problem. The basics include reducing energy use materials and recycling as much as possible. Moreover, educating more about environmental protection from schoolchildren is important. Other federal, tribal, state, or local agency issues are sometimes handled by the US Environmental Protection Agency. In practice, local agencies deal with problems faster and more correctly because the EPA may not be able to pinpoint the state of affairs in each state or region. Such as: addressing nuclear waste at the Environmental Management Energy Agency (USEPA, 2016).

(4) Problems in Japan

The Ministry of the Environment of Japan has established a comprehensive proposal to improve the measures and provide guidance in the enterprise also has some norms and publicity measures, and provide complete information on recycling. And other management systems are provided to ensure that certain household trash is properly delivered to the processing pipeline of the manufacturer or a similar retailer.

The enactment of a decree on the promotion of recycling of small household electrical appliances in Japan can effectively promote the use of resources and the proper disposal of waste through the enforcement of the Act. This is mainly due to the increase in demand for resources and market exclusivity in the emerging countries The Government expects that all waste electrical and electronic equipment and information items may have final disposal sites and establish appropriate environmental management policies.

In the case of Japanese policy to regulate retailers and municipalities to recycle small household electrical appliances, their personal data should be stored in the equipment. In order to protect the personal data, it is necessary to ensure that the personal data in the equipment has been forcibly removed. Referring to the privacy right granted by the government According to the laws and regulations, according to the provisions of the laws and regulations of the counties and cities to implement appropriate measures, according to the notice should be recycled small household electrical appliances project, mobile phone the project personal data has not been deleted the most likely, the research data contained in the chip and analogy message Terminal personal data is not deleted the highest probability, in the recovery of personal information can be manually deleted before, to avoid leakage. Japan in this regard to do quite well, it is worth Taiwan's reference (Lin Yubei, 2013).

3. Research Methods and Design

This study is mainly based on literature analysis and in-depth interviews with the study and analysis. First, confirm the research theme, collect relevant materials and cases, form research structure and proposition design, do analysis by literature analysis, interview depth interviews with government units, third-party recycling companies and related electronics companies, to come to the final in conclusion.

3.1 Subjects

The main research object of this study is the recycling of electronic products, mainly to discuss the national electronic product recycling policies and methods, re-use policies and methods, and national enterprises how to respond to government policies and related e-recycling industry, and understand the current number of countries recycling . As waste electronic products have a great impact on the environment, so all countries are hoping to have a sound domestic system for this issue to improve, and enterprises for their own products should also be given to corporate responsibility, and the general public It is important to address this issue as well, whether it is through government advocacy or ethical responsibility. It is important to understand the environmental impact of this issue, and it is important for the general recycling industry to pay attention to make environmental improvement. It is hoped that Taiwan will be able to improve its recommendations and improve its policies.

3.2 Definition of research variables

(1) Electronic products: electronic motor products, including refrigerators, televisions, computers, lighting, mobile phones and so on.

(2) Recovery: refers to the collection of materials to be discarded, decomposition and then into a new product before the process, or the collection of used products, cleaning, disposal and then sold. (EPA, 2016).

Recycling changes include still tend to upgrade recycling, which involves adding value and reusing a project with the decomposition of a project or substance into new elements for reuse. Recycling, another approach, involves avoiding unnecessary acquisitions that will eventually have to be recycled or disposed of as waste (Margaret, 2012).

(3) re-use: refers to the change of the original material form or combined with other substances for use as material, fuel, fertilizer, feed, fillers, soil improvement or other purposes by the central authorities recognized the purpose of the use of renewable resources, (Environmental Protection Agency, Executive Yuan, 2005).

Reuse represents a few things that means a project can be used as a reusable investment to find ways to reuse used items, especially those that cannot be recycled and will eventually sit in a landfill for centuries. Consider repairing the project instead of throwing it away. If you upgrade a device or gadget, see if you can donate it to people you can use. If the product achieves its purpose, looking for alternative uses. (Sfgate, 2016)

(4) Reverse logistics: Logistics-related activities such as reduction of production, regeneration, substitution, material recycling and waste disposal in a broad sense, and play in the logistics process of recycling of goods, waste cleaning and hazardous substances management. (Council of Logistics Management, 1998)

(5) Policy: Policy is a program designed for a certain target value and event. The policy process includes the declaration, determination and declaration of needs and expectations, and implementation. (Lasswell and Kaplan, 1950)

3.3 Research methods

3.3.1 Content analysis

Content analysis is a process of systematically searching for and organizing interviews with verbatim transcripts, field notes, and other materials collected in research to increase the researcher's understanding of the data and present the main findings of the researcher to other readers. Analysis involves the processing of data, organization of information; the data is divided into easy to deal with the unit, to be integrated, looking for group type, in order to find the importance of the group type, and the importance of learning to inform the reader. In most research projects, the end result is a paper, a book, a report, a paper publication, or a planning action (Robert C. Bogdan, Biklen Sari Knopp, Translator Huang Guangxiong, 2001).

Data analysis has two important characteristics, namely, to analyze the information in a timely manner, that is to collect information in the field at the same time, to collate and analyze the data; the use of inductive methods to analyze the information collected from the process of development and induction Concepts, theories, rather than collecting data or evidence to evaluate or validate the patterns, assumptions or theories envisioned before the study

(Knight, 2014). Although the methods of collecting, extracting and sorting documents are different, it is necessary to follow the following principles, systematically, selectively and objectively for the whole document investigation process. The process of document analysis and implementation is the same as that of other social survey. It is necessary to follow the procedure as follows to determine the problem, to formulate the hypothesis, to prepare the front, to collect the data, to analyze the data, to critique the data and to summarize the data. (Ye Zhicheng, 2011)

3.3.2 In-depth interview

The interview of qualitative research is a purposeful, face-to-face dialogue process in which researchers and research participants are equally interactive. Through the process of dialogue and the principle of maintaining openness and flexibility, researchers learn about the participant Experience, feelings, and opinions on a topic. (Niu, 2014) The differences between interviews and observations suggest that interviews can collect information about past and present, while observation can only collect current information. Interviews can gain people's thoughts, views and attitudes, and learn more about the motivation behind them. Only to see the action taken by people, and the context in which this action takes place; interviews with information by way of inquiry, exploration and listening, and observation by way of observation to obtain information. The advantage of the interview is that it not only collects past and present information, but also collects the views of the study participants about the future. (Lincoln & Guba, 1985; Erlandson et al., 1993)

Access method is divided into two types: the "structural" access method, also known as standardized access, guided access or controlled access. This method is characterized by the standardization of the problem, and then by the respondents to answer or choose to answer, all respondents are agreed to answer the structure of the problem. There are two ways to structure the type of access, the first is the interviewer to control the outline of the question, for each interviewee asked almost the same question; the second is the question and possible answers printed on the questionnaire by the respondents free The "unstructured" access method refers to the standard procedure of not pre-booking forms, questionnaires or orientation. The interviewer and the interviewee can freely talk about certain issues. The interviewees can freely express their opinions. What is the depth of the interview: I hope through the interview found that some important factors, these factors are not observed with the surface and the general access can be obtained. Respondents must describe the matter in detail and explain its meaning and its relevance to other events, step by step and pursue it in depth. (Zhang Chunxing, Yang Guoshu and Wen Chongyi, 1991)

3.5 Research proposition

Proposition 1: Differences in national laws and policies have a significant impact on the recovery rate of enterprise self-recovery.

The European Union implements the Restriction of Hazardous Substances in Electrical and Electronic Equipment Directive (RoHS) and the Waste Electrical and Electronic Equipment Directive, which stipulates that all manufacturers of electronic and electrical products that have sales activities in Europe must assume the legal responsibility to pay for their own discarded products (Zeng Jianyuan, 2010). Therefore, this study assumes that if Taiwan enacts related laws to stipulate the implementation of enterprises, it will improve the self-recovery rate of Taiwan enterprises' e-waste.

Proposition 2: Differences in national laws and policies have a significant impact on the recovery rate of consumer self-recovery.

Japan promulgated the "Specific Household Machinery Recycling Law" (Act on Household Appliances Recycling), which stipulates that household appliances manufacturers and importers are obligated to collect waste materials for household electrical appliances and implement the obligation to deal with recycling rates. Including the manufacturers, importers, sellers, county and municipal governments and consumers, and to provide a simple and clear people and a complete system and recycling processes to enhance the people's willingness to self-recovery; in Europe, the public recycling pipeline for the local government Recycling centers

and responsible industry set up the recovery point, the domestic recycling pipeline, including cleaning teams, pickers, second-hand dealers and distributors, the public recycling of a variety of pipeline facilities to the Netherlands, for example, the Netherlands Waste Electrical and Electronic Equipment Directive in 2004 April 19 by the Netherlands Ministry of Environmental Protection proposed to provide collection, processing, recycling and disposal of waste electrical and electronic equipment, waste disposal costs are borne by the producers, and mark the latest information in the market for each type of equipment, so that each consumption Understand the importance of recycling (Zhang, Jin, 2014), so this study assumes that if the implementation of policies in Taiwan similar to the relevant laws and systems to allow people a clear understanding of the recovery process, will enhance the people's own recovery.

Proposition 3: Different recovery methods have a significant impact on recovery rates

In Japan, there are a total of 46 professional home appliance recycling companies (Shunichi Honda, 2015); in Finland, each community (in Japan, Japan, Japan, Japan and other countries) Have a recycling center, you can waste recycling of electronic equipment, the respective Recycle Bin is also responsible for the recovery of a variety of electronic waste, pre-classification plant first in the removal of harmful substances in the waste, and then a variety of electronic equipment disassembly, according to different materials Classification.(Li Shiguang, 2014) If the recycling industry expands in Taiwan, the recycling rate will have a significant impact.

Proposition 4: Reuse of different countries have a significant impact on the recycling rate.

In US, recycling of electronic products is by non-profit second-hand computer recycling donation organization, the main task is to discard the old people discarded or donated computers, rearranged, cleaned and repaired for basic operational status, then donate To the local schools for teachers and students to use, the total number of US re-use up to 2,440,000 Dayton. Taiwan's waste information recycling process is the people will be discarded computer by the clean team, the recycler, that is sent to the resource recovery and processing plants, which can be valuable substances through the recycling process to be recovered, and the remaining cannot be reused, It shall be properly disposed of by the qualified generation cleaners. (Zheng Zushou, Li Chunhui, 2013) Therefore, this study assumes that the recycling of electronic waste in different countries, can improve the recycling rate of e-waste.

4. Research analysis and results

4.1 Information of respondents

In this study, a series of structural questions were pre-set. In the interview process, semi-structured interviews were conducted to interact with the interviewees. The interviewees were selected from government agencies, recycling companies, electronics manufacturers and academics. A total of six interviewees , The interview period: October 2016 to November 7, the average time for each interview is 30 minutes to one and a half hours.

In this study, six respondents were summarized in Table 3.

4.2 Interview Record

During the interview process, the interviewees responded according to the semi-structured interviews conducted by the interviewers. The semi-structured interviews were conducted throughout the interviews. In order to make the interviewers speak freely, the interviews were not based on the order of the interviews. Interviews with the current situation, the flexibility to adjust the interview questions, so that respondents in the interview process less vulnerable to restrictions, and to give their own experience to answer their content integrity by the interviewer. In the interview before the consent of the consent of the respondents to the entire process with a mobile phone recording, and in the interview process for the purpose of paper-based records in order to carry out after the word-by-word analysis and finishing to avoid oversights.

Table 3 Data sheets of respondents

Code	Gender	Positions	Company name	Seniority (year)	Interview Date	Interview time
A	Male	Manager	Perfect recycling company	10	2016.10.19	86 minute
B	Male	Deputy director	Liuh-jian company	11	2016.10.20	101 minute
C	Female	Environmental protection administrator	Liuh-jian company	11	2016.10.20	101 minute
D	Male	Team leader	Kaohsiung Environmental Protection Bureau	10	2016.10.24	90 minute
E	Male	Associate Professor	Department of Marketing and Distribution, National Pingtung University	11	2016.10.26	50 minute
F	Female	Assistant Manager	Total source of computer Ltd.	1	2016.10.24	29 minute
G	Male	Professor	Depaertment of Marine Environmental Engineering, National Kaohsiung Marine University	23	2016.11.07	77 minute

Source: Collated by the research.

After the interview, the data of the sound recordings will be written verbatim, and the manuscript will be encoded and analyzed. The verbatim portion of the verbatim manuscript refers to the content of the respondent's response, summarizes and analyzes the verbatim manuscript, fully responds to the interviewee's comments, analyzes the information objectively without adding personal comments, C, D, E, F, G are the names of the six respondents, respectively, based on the identification of a convenient interview. Depth analysis of the depth of interviews with the collection, in order to obtain all the respondents to the real unit of electronic product recycling, reuse of the contents of the impact. Restricted length requirement, verbatim manuscript and code content omitted.

4.3 Hypothesis Analysis and Validation

In this study, four major research propositions, such as enterprise self-recovery rate, self-recovery rate, overall recovery rate and reuse rate, are collected and analyzed to verify the impact level of each proposition.

(1) Hypothesis 1: Different laws and policies of different countries have a significant impact on the recovery rate of enterprises' independent recovery.

At present, the European Union, the United States, Japan and other advanced countries and enterprises have actively promote the concept of independent recycling. Taiwan should strongly urge enterprises to self-recovery and require a certain recovery ratio policy and appropriate adjustments to Taiwan's environmental changes and corrections. It will be able to achieve a certain performance.

Based on the results of the analysis of the present study interview, hypothesis 1 established.

(2) Hypothesis 2: Different laws and policies of different countries have significant impact on the recovery rate of consumers' self-recovery

Because the situation of Taiwan and education system and the European Union, Japan and other advanced countries have great differences, if the Japanese and other national policies applied to Taiwan, the recovery rate will be difficult to improve. If we can adjust the policy applied to Taiwan, and to meet the convenience of consumers and interests, it will enable consumers to self-recovery performance.

Based on the results of the interviews with this study, hypothesis 2 established.

(3) Hypothesis 3: Different recovery methods have significant effects on recovery rate

If Taiwan follows the example of Finland, Japan and other countries of the recovery, it may be due to national quality, geographical conditions, consumer policy with different degrees have different results. Moreover, if the recovery of other

countries to modify the way to meet the localization applied to Taiwan, the rate will be performance.

According to the results of the analysis of this study interview, hypothesis 3is established.

(4) Hypothesis 4: Reuse of different countries has a significant impact on the recycling rate

From the interview results, the lack of Taiwan's re-use of the reasons for the number of front-end e-waste is less able to extract a large number of rare and precious metals and precious metals. Moreover, the market is small and the introduction of new technology does not meet cost considerations. Therefore, if Taiwan adopts foreign policies, such as opening up imported waste electronic products, the government will provide funds to introduce new technologies, and economic interests will encourage the industry to deal with them, which will enhance Taiwan's re-use performance.

According to the results of the interviews with this study, Hypothesis 4 established.

5. Conclusion and suggestion

5.1 Conclusion

In recent years, the increasing number of e-waste in various countries, resulting in environmental pollution is very serious. Compared to the European Union, the United States, Japan and other advanced countries, Taiwan is still need to improve e-waste recycling mechanism. After the whole interview, we get the following conclusions:

(1) Since the EU and Japan actively promote e-waste laws and regulations, and they also pay attention to the voluntary recovery obligations of enterprises, enhance their own recovery rate, it can produce performance by referring to these countries' systems and considering the Taiwan environment.

(2) In Japan, the European Union and other countries will enact laws and regulations, such as the Japanese Home Appliances Act, requiring consumers in the waste of electronic recycling must contact their own recyclers to recycle, and must pay the cost of Taiwan if the reference to these countries, In line with Taiwan's convenience and economic conditions, will be able to produce performance.

(3) Since the EU countries such as Finland, Germany and other countries will set up recycling points in the community points, consumers can take their own e-waste recycling base to enhance the recovery rate, Taiwan if the reference to Taiwan's national conditions and economic conditions such as convenience , Feedback to be applied to these countries the way, can produce performance.

(4) The United States and Japan and other countries because of electronic waste in the heavy metal refining has advanced technology, can be extracted from the metal species is also quite diverse, increase resource recycling, if the system for Taiwan to amend and enhance the amount of waste front , And the introduction of advanced refining technology, will be able to improve the waste recycling rate.

5.2 Suggestion

(1) Enterprises should be social responsibility, in addition to enhance corporate image and reputation. They should be self-produced products to do a certain rate of recovery, it will be sent to the professional handling agencies, a complete recovery mechanism.

(2) The recycler should abide by the laws and regulations regulated by the government, and should not conduct dismantling in private. The waste electronic products should be sent to the professional handling organization in a complete manner to prevent environmental pollution.

(3) Government agencies should strictly regulate the laws and regulations, mandatory enterprises should be a certain rate of self-recovery and in the production process should limit the application of its material, so that the back-end can do the perfect disposal.

(4) Government agencies should strictly stipulate that recyclers should not engage in private dismantling activities and strictly prohibit illegal recycling plants. They should not be banned by the processing enterprises. EPDs should be

regularly deployed to carry out inspections to prevent illegal acts. .

(5) In the light of the policies and practices of waste electronic recycling and reuse in advanced countries, we should revise the system applicable to Taiwan. In terms of policy, the Government should carefully consider the effectiveness of implementation to enhance the recovery performance.

(6)The Government should strengthen consumer awareness and awareness of education and advocacy, the Government can be combined with the enforcement of laws and regulations and subsidies to force consumers to correct the recovery behavior, and give consumers incentives, subsidies, incentives to attract consumers to take the initiative to recover.

(7)The Government can assist the industry in setting up industrial alliances. Funds will introduce new technologies to assist enterprises in the development of this industry. They must also give enterprises a certain degree of environmental awareness and awareness. This will strike a balance between economic and environmental protection.

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