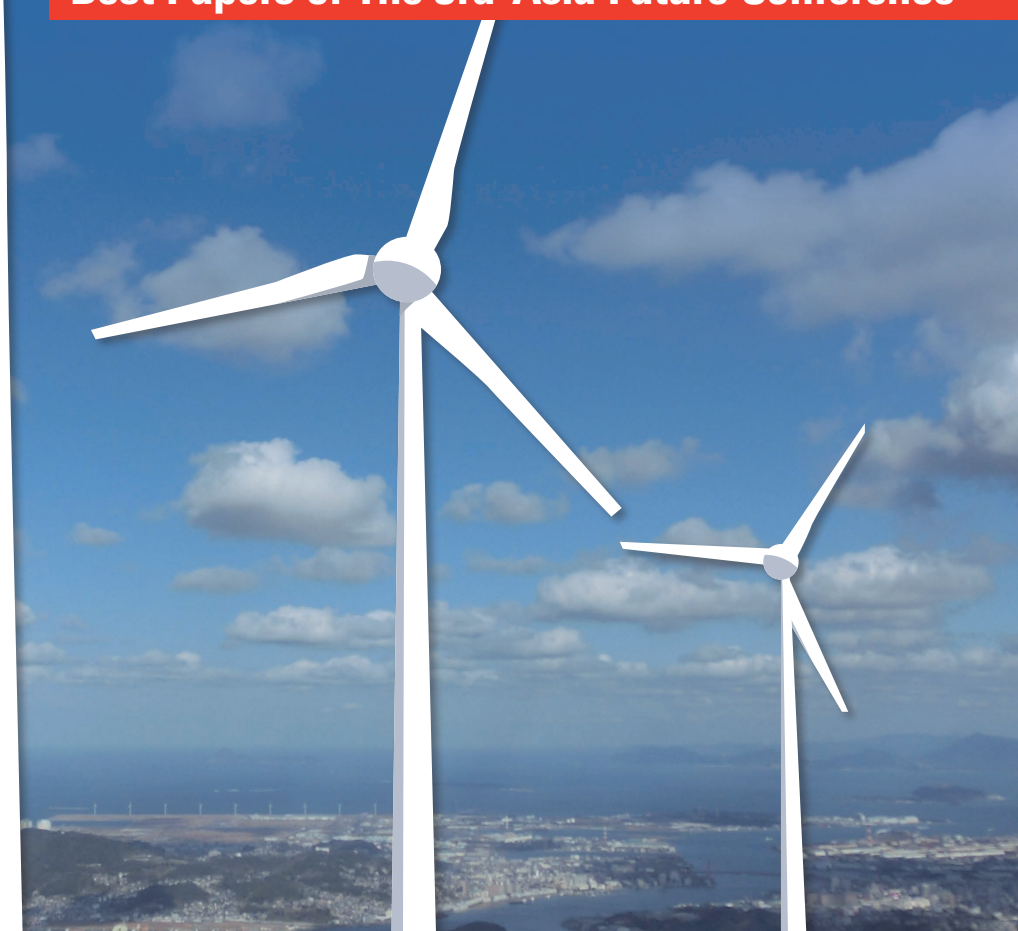
AFC
ASIA FUTURE CONFERENCE

第３回
アジア未来会議
優秀論文集

アジアの未来へ
―私の提案 Vol.3

TOWARD THE FUTURE OF ASIA: MY PROPOSAL

Best Papers of The 3rd Asia Future Conference



今西淳子【編】
EDITED BY *Imanishi Junko*

公益財団法人
渥美国際交流財団
関口グローバル研究会
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Japan Book

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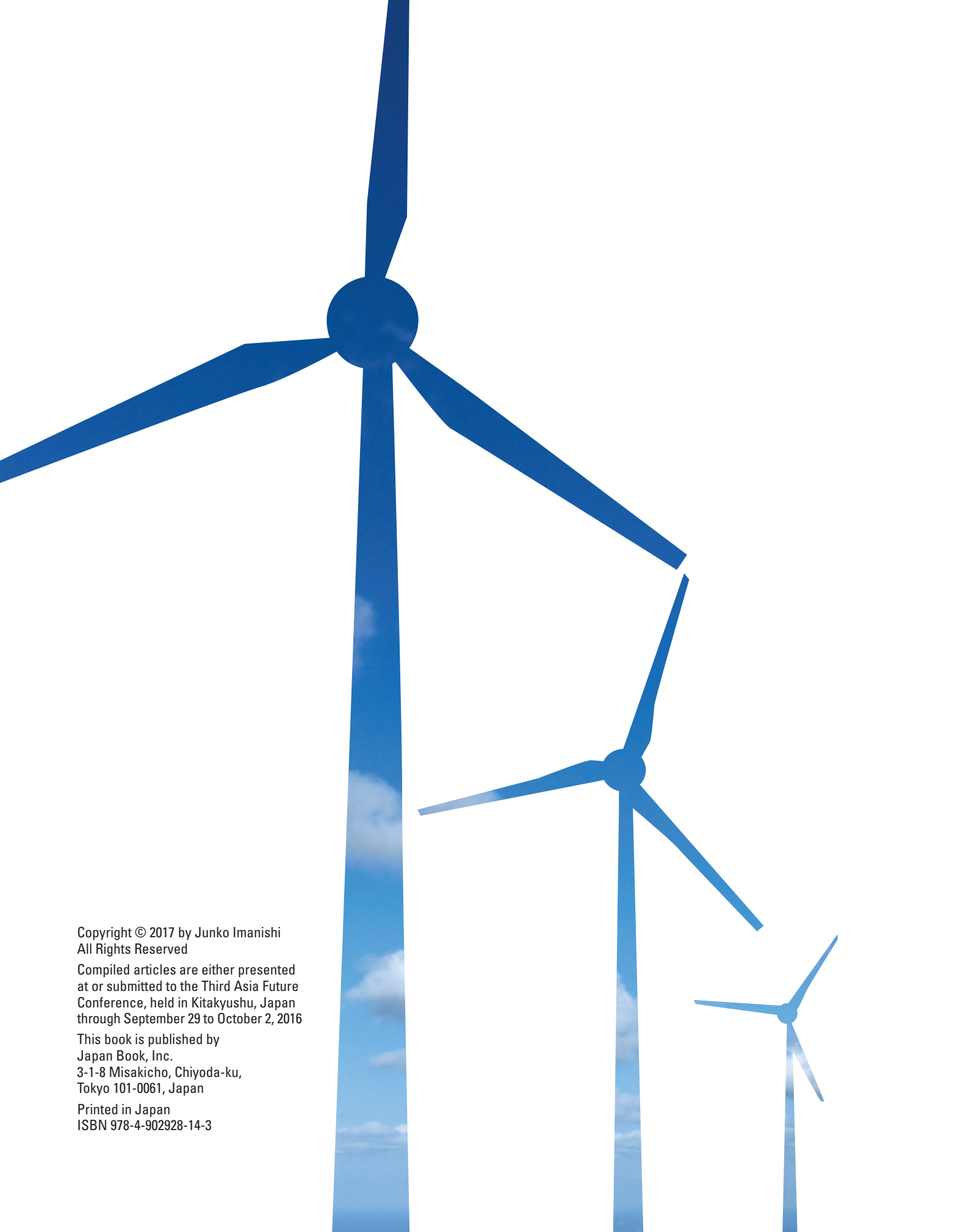

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EDITED BY *Junko Imanishi*

Theme of The 3rd Asia Future Conference:
Environment & Coexistence
第３回アジア未来会議テーマ：
「環境と共生」

公益財団法人
渥美国際交流財団関口グローバル研究会
Sekiguchi Global Research Association Atsumi International Foundation

AFC
ASIA FUTURE CONFERENCE

About the Aim of the Conference and about This Book

アジア未来会議の趣旨とこの『論文集』について

Junko Imanishi
今西淳子
Representative, Sekiguchi Global Research Association, Atsumi International Foundation
渥美国際交流財団関口グローバル研究会代表

The twenty-first century has seen the world thrust into a maelstrom of change and unpredictability. We remain hopeful in the face of rapid technological advancements, but many of us struggle to regain our bearings as longstanding social structures become upended. Internationalization and globalization have long been heralded as the keys for the future, yet a truly global path forward remains elusive, serving only to heighten the sense of uncertainty. As global citizens in this era of change, we are called anew to reexamine our world and our collective future and to seek new multidimensional and inclusive perspectives on myriad global issues.

The achievement of rapid economic development has also led to dramatic changes in Asia. At the same time, a complex set of transnational problems have been brought about by global environmental issues and increased socioeconomic globalization. In the midst of an ever-expanding understanding of "society," the global citizenry—individuals, governments, and the business community—must adopt policies that not only allow for the pursuit of individual interests but also respond to concerns for the peace and happiness of society as a whole. Solving these problems requires the development of multifaceted

21 世紀にはいって世界全体に変革の嵐が渦巻き、人々は新しい技術に大きな期待を抱く一方、社会構造の激しい変化にとまどっています。国際化・グローバル化が唱えられて久しいのに、世界中で共有できる新しい方向性を見出すことができず、混乱は増すばかりです。このような時代においては、物事を新しい視点から複合的に分析し判断していくことが必要なのではないでしょうか。しっかりした理念を持ち、それを如何に実践していくか、一人一人の意識の改革と行動が問われているのではないでしょうか。

近年、アジアの各国は急激な経済発展を遂げていますが、地球環境問題の発生や社会経済のグローバル化の進展とともに、国境という枠組みを越えた問題が生じています。さらには、急激なグローバル化と同時に進むローカリゼーション、あるいはナショナリズムなど様々な問題が発生し、新しい課題となっています。社会の構成員である企業や市民は、個々の利益の追求と同時に、周辺社会の利益も検討しなければなりません。グローバル化が進む現代においては、従来の社会の範囲をさらに広げ、地球全体の平和と人類全体の幸福を目指すことが求められ

evaluative and analytical strategies with cooperation across national and disciplinary borders.

The Asia Future Conference is interdisciplinary at its core and encourages diverse approaches to global issues that are mindful of the advancement of science, technology, and business and also take into consideration issues of the environment, politics, education, the arts, and culture. The Asia Future Conference is organized by the Sekiguchi Global Research Association (SGRA) in partnership with like-minded institutions, in order to provide a venue for the exchange of knowledge, information, ideas, and culture, not only by SGRA members, but also by former foreign students of Japan from various educational institutions throughout the world, their own students and collaborators, and anyone interested in Japan.

SGRA began operating in Tokyo in July 2000 as a division of the Atsumi International Foundation, a charitable organization. At its core is a community of non-Japanese researchers who come from all over the world to conduct advanced studies in Japan and obtain doctoral degrees from Japanese graduate institutions. SGRA identifies issues related to globalization and seeks to disseminate research results to a wide audience through forums, reports, and the internet. SGRA's aim is to reach society at large rather than a specific group of specialists through wide-ranging research activities that are inherently interdisciplinary and international. The essential objective of SGRA is to contribute to the realization of responsible global citizens. We look forward to welcoming a diverse and active group of conference participants.

Following the first conference (March 2013 in Bangkok) and the second (August 2014 in Bali), the third Asia Future Conference was held in September 2016 in Kitakyushu, Japan. There were more than 115 full papers submitted to the conference. Of them, we here present the 20 best papers selected by an academic panel. We hope their suggestions will give hints to search for the new direction for the future of Asia.

ているのです。そして、様々な問題を解決する時、あるいは方針や戦略を立てる時、科学技術の開発や経営分析だけでなく、環境、政治、教育、芸術、文化など、社会のあらゆる次元において多面的に検討することが必要となっています。

アジア未来会議は、学際性を核とし、科学技術やビジネスの発展だけでなく、環境、政治、教育、文化芸術などからの多様なアプローチによってグローバルな諸問題に取り組むことを狙いとしています。アジア未来会議は関口グローバル研究会（Sekiguchi Global Research Association：SGRA）が、同じ目的をもつ非営利のパートナー機関と共同で開催しています。SGRA 会員だけでなく、世界中の大学や研究機関に所属する日本留学経験者や、日本に関心のある人々が一堂に集い、知識、情報、アイディア、文化の交流を図りながらアジアの未来について語り合う＜場＞を提供することを目的としています。

2000 年 7 月から東京を起点として活動する公益財団法人渥美国際交流財団の一部署である関口グローバル研究会は、世界各国から渡日し長い留学生活を経て日本の大学院から博士号を取得した知日派外国人研究者が中心となって活動し、グローバル化に関わる問題提起を行い、その成果をフォーラム、レポート、ホームページ等の方法で、広く社会に発信しています。ある一定の専門家ではなく、広く社会全般を対象に、幅広い研究領域を包括した国際的かつ学際的な活動を狙いとしています。良き地球市民の実現に貢献することが SGRA の基本的な目標です。

アジア未来会議は第 1 回（2013 年 3 月、バンコク）、第 2 回（2014 年 8 月、バリ島）に続いて 2016 年 9 月に北九州市で第 3 回を開催しました。今回は 115 本を超える論文が投稿されましたが、その中から厳正な審査により 20 本の優秀論文を選び、本書に収録しました。こうした若い研究者たちの提案が、アジアの未来への新しい方向性を探るヒントになることを願っております。

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特別講演
Special Speech

COBOT: Robots that Collaborate with Us

コボット：人と共に働くロボット。その使命、その課題

Delivered in the AFC Forum of "Humans and Robots —Towards a Society of Coexistence", on September 30, 2016.
本講演は 2016 年 9 月 30 日の AFC フォーラム「人とロボットの共存する社会を目指して」で行われた。

ロボットは本来的に人の雇用を奪うものではない。むしろ人と共生し、人とコラボレートし、仕事をシェアするものだ。人と同じ製造ラインで、人と一緒に働けるロボットを「コボット」と名づけ、その課題を探る。

井上博允
Hirochika Inoue
東京大学名誉教授
(Professor Emeritus, University of Tokyo)

Good morning, everybody.

My name is Hirochika Inoue, professor emeritus of University of Tokyo. It has been so much time since I retired from the university. It is not so often to come and present my talk, but today Imanishi-san asked me to come here. I think it is a very good opportunity to talk a little bit of the future of robotics.

The title today is 'COBOT'. I will talk about COBOT later, but anyhow, I would like to begin my talk by introducing myself by movie.

(narration of a self-introductory video)

Object handling is realized as a physical interaction between a robot and with an object. A computer directs the robot how to move, and at the same time the robot must follow the physical constraints from the environment. Thus, the bilateral aspect of servo control is essential.

This is the experimental setup, a manipulator, controller, and computer. 16 touch sensors were built in this hand. When the hand touches an object, it stops. By sense of touch, the hand can close without moving the object. When the block is pulled up, the robot feels and releases the block. When the person's hand blocks the object, the robot feels and releases the block. Force reflection, or to use a different word, compliance is the key. Compliance is key to realize this beautiful stacking task.

This is an operation called 'pin into hole'. Here the robot pulls out the pin, moves the pin above the hole, lowers it, searches the hole, pulls the pin upright, and puts the pin into the hole successfully.

Here is a demonstration of crank rotation. The trajectory of the rotation is constrained by the crank itself, so the robot must obey the crank given trajectory while turning. Compliant motion control is the foundation of all dexterous manipulation of robots.

This movie begins with the world first computer-controlled bilateral manipulator. It was many years ago, about a half century. As a young researcher I learned this, and later as a university professor, I have enjoyed robotics very much on the frontline of R&D.

Three years ago I joined with Kawada Robotics Corporation as the last career of my life. My motivation is to create a new genre of robot which works with us as our partner.

Resurgence of Domestic Manufacturing

Since the industrial robot was invented half a century ago, robots have changed manufacturing from labor-intensive work to automated mass production. By robot-empowered production, the manufacturing power of countries moved from the United States to Japan. And then, from the 1990s, cheap labor triggered the transfer of manufacturing from Japan to Korea, Taiwan, and China. However, now Japan and the United States are seriously considering not only re-shoring, but also a resurgence of our domestic production.

I will show an example of the factory of the future. This is the company which I joined, Kawada Robotics Corporation. This is a small spin-off company from Kawada Industries and is mainly concentrated to build humanoids, whole-body humanoids and upper-body humanoids, and so on. It is now seriously thinking about building new things.

(voice over a video playback)

This is an example of the humanoids. Just only humanoids make the machines in factories. When you go to the bank you use an ATM. The ATM handles the coins and notes. The machines that handle the coins and the notes are very complex mechanism. Glory is the manufacturer, a world top manufacture of the key machines. Humanoid robots are mostly assembling this by using 20 humanoid robots in an assembly line.

After this challenge to introduce humanoids into the factory, I found that humanoids have a very good possibility to think about the style of working with humans, so I will talk about it a little bit later.

A humanoid is consisted of a head, two arms, a torso, and mobility. Mobility means legs or wheels. A shape that looks like human is not the matter. The important thing, the key feature is that geometry is the same; human geometry and human functionality. Everything must be in one package, all in one. This is a very important point.

On these features human has new ways. A humanoid can easily roll into where a person used to stand because of the same geometry, and the work is almost the same to the humans, so the humanoid will roll in directly.

Second, human and robots can alternate shifts and share a job. That means if a human is out of work, then the humanoid will slip in and work. If humanoids have some trouble, then you can step into instead of the humanoid. In such a way, shift and share human and humanoid can do.

Third, humanoids can use the same tools and peripheral devices.

Fourth, we can teach the task to humanoids intuitively because the geometry and function of them are almost the same.

Recently I am thinking about *not* robot. Because the definition of robot is now spread too much, many people say something ‘robot’, but I think a new word is needed for collaborating robots, cooperating robots, so I have decided to call that kind of robot ‘COBOT’, not robot. A COBOT is a new genre of robot of which their collaborative capabilities/capacities with the humans are highly enhanced. The current situation is just the beginning, but in the future COBOTs are very key robots which can coexist with humans.

High-mix, Low-volume Production

COBOTs open a new paradigm of manufacturing that is flexible, compact, and work-sharable. Usually, manufacturing is aimed at mass production. It is the most popular thing for manufacturing. However, in manufacturing, we are now seriously thinking about change; changes of the way of working. The flexibility and compactness – the size must be compact and manufacturing is work-sharable. The

smart flexible production must do high-mix. 'High-mix' means the products are very high-mix. In the same line, this product, another program, very mixed product must run, and low-volume. Each product is low-volume, and production, the number is changing. Today it is 10 items. Tomorrow it will be 100. The day after tomorrow it will be three or something. In such a case, high-mix, low-volume variable production, that is the kind of manufacturing that now can be done only by humans, but in the future our society needs that kind of variety of the things which customers want to buy. Therefore, the manufacturing side must be changed like this.

The second, for the worksite, robot manufacturing is not huge enterprises. Maybe this kind of flexible compact work-sharing in manufacturing will open the small/medium scale enterprises and home factory, shop, atelier, and studio, so just only the individual company, very small companies can use this kind of COBOT with you. Therefore, you are the CEO, and one CTO, and three or four humanoids that can do design and make and sell, that kind of thing. That kind of work will be possible by human/robot cooperation.

The users, the workers are not technical people. They have no experience using a robot before – the elderly or housewives, part-timers, share-workers. At the Glory's plant, most of the production is done by part-timers, part-timers who are housewives and so on. They work from 10:00 a.m. to 3:00 p.m. Humanoids work 8:00 a.m. to 5:00 p.m. Also, it is interesting that Glory engineers consider new ways of using. In the daytime, humanoid will be working on the production line that I showed, but after 5:00 p.m. the line stops. Then the humanoid is moving to other places and doing the second job at night to prepare for tomorrow's work. In such a way, humanoids can change easily from one site to another. In such a case work-share will be realized.

Creating New Opportunities

Therefore, COBOTs enable a new way of working in collaborative work-share by humans and robots. A working team can be composed of a human and COBOTs. Of course, difficult jobs for humanoids are done by the humans, simple tedious jobs for the robots. A COBOT can do multiple jobs by moving to different work cells, as I said now taking the example of Glory. Total operation speed can be adjusted by employing plural robots into same work cell. That means if for one robot the operation speed is very slow, in that case another robot must be hired. Then the operation speed doubles. In such a way, very flexible considerations of the manufacturing line can be done. The key point is 'work-share', maybe not only the manufacturing, but also in all society, the work-share will be general tendency, not only business, but all over societies. The elderly, housewives, part-timers, and students who are studying and sometimes working. All of them can share their works, with each other, and with COBOTs. Two or three people may share single work. By using that kind of working style we can make our lives very, very fruitful.

Therefore, I think the effect of COBOTs is very future looking. When I talk about the humanoid introduction into the production and so on, particularly in Europe they say they do not like the robot because it takes jobs from humans, but I think COBOTs do not take jobs from humans. Rather, by introducing COBOTs many jobs will be created to adjust, to talk, to care, teach. In such a way, new jobs and new value chains of the work will be done. In such a way, COBOTs bring us job opportunities of a very good work-life balance.

Lastly, safety issues, this is very important, particularly important in Europe. Also in Japan, safety issues become very important because so far robots are enclosed in the production line, separated from the robots working and humans working. However, collaborative robots must do jobs side by side. That means that safety is very important. In such a way,

technically, a very important point is compliance. That means robots must be controlled by computers. At the same time, robots must be driven from the outside by humans.

Robot compliance is the topic of the research which I did 50 years ago. That is a key point of the assemblies. At that time, of course, the interaction between the robot and the outer world, some machine assembly, the interaction is a key to realizing dexterous manipulation, the force feedback, compliance or bilateral aspects are the key, but after 50 years, that becomes the most important aspect for the safety issues. Robots must obey the physical interactions by the people which sit or stand side by side with the robot.

Thank you.

特別寄稿
Special Contribution

境界と国籍：“美術”作品をめぐる社会との対話

Borders and Nationalities: A Social Dialogue on “Art” Works

Presented in the SGRA China Forum of “Toward the East Asian Cultural History without Borders”, on September 29, 2016.
本論文は2016年9月29日のSGRAチャイナ・フォーラム「東アジア広域文化史の試み」に提出された。

美術作品を国境の枠に閉じ込めることはできない。美術史も同様で、国民国家の要請で生まれた一国史的な美術史には限界がある。新しい「東アジア美術史」の構築には何が必要か。

塚本麿充
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はじめに　“東アジア美術史”再考
―中間領域（マージナルエリア）に存在する作品の評価をめぐって―

1990年代の日本の美術史学界を牽引した大きなトピックは二つあった。一つは美術史という言説の近代的恣意性をあぶりだすこと、もう一つは、そこから敷衍して、「日本」という一国史的な美術史を批判し、東アジアという新たな枠組みから美術史を再考することにあったと言えよう[1]。しかしながらその後に残された私たちには、さらなる困難な課題が残されていた。このような新しい東アジア美術史の認識とは、如何にして東アジアの人々のなかで共有されることが可能なのか、という次なる問いである。それぞれの近代国家によって紡ぎ出されてきた「東アジア」の認識は、あまりにも違いすぎていたし、もし東アジア美術史を構築しようとしても、それは結局、従来までの一国美術史とその歴史観の寄せ集めになってしまいがちだったからである。

「美術史」は価値を問う学問である。どのようなモノであっても、社会の中で価値づけられてこそ「美術史」の対象となりうる。そしてそれを価値あるものと意味づけ、伝承し、理解して見出していく「眼」の存在こそが、美術史の唯一の存在理由であるともいえる。しかし価値を扱う学問である以上、それが社会のなかでの価値変容の影響を最も受けやすいというのも、自明の理といえよう。すなわち、ある地域、ある時代、ある共同体では「名品」とされ、優れた芸術的感動をもたらすとされた作品でも、それを見出す「眼」を持たない別の場所では、ただの「モノ」として扱われることも多いということである。その意味で、美術史家にとって、どこに住んでいるか、そしてどのようなコレクションに出会うかは、その存在の根幹にかかわる重要な問題となるとも言えよう。

ここで小さな個人的な体験を語ることをお許し願

1　佐藤道信『美術のアイデンティティー』吉川弘文館、2007年。また近年この分野は活発に議論されており、近年の成果として、「特集：グローバリズムの方法論と日本美術史研究――国主義と受容研究を越えて」『美術フォーラム21』32号、2015年、また、洪善杓「国史形美術史の栄辱―朝鮮後期絵画の解釈と評価の問題―」（中尾道子訳）『美術研究』405号、2012年。中国という概念の再考については、葛兆光『宅茲中国――重建有关“中国”的历史论述』中華所局、2011年、を参照のこと。

いたい。私は日本の大学で中国美術の授業を受けた時から、北宋、南宋の作品はいいと思っていたけれど、どうしても分からないことがあった。先生方が授業で力説された、元・明・清絵画のよさが、全く分からなかったのである。修士課程を修了し、博士課程に入ると同時に南京に留学する機会が与えられ、はじめて訪れた南京博物院に陳列されていた中国絵画を参観することができたが、そこで、それこそ、眼を開かれるような体験をした。はじめて、中国の明清絵画の素晴らしさ、美しさに感動した、いや、正確には感動できるようになったのである。

今考えると、このような体験が導かれたのも当然であったと思う。私の大学のあった仙台には中国絵画コレクションはなかったし、東京や京都の展覧会でも、それらをまとまって見る機会はなかった。日本には南宋、禅画、仏教絵画、浙派などの優れた中国絵画コレクションは存在しているが、中国絵画史のメインストリームである、北宋から元代の文人画、呉派文人画、四王など清代正統派の作品は、存在はしているものの、中国のコレクションと比べると、やはり見劣りすると言わざるを得ないからである。南京に留学してその作品に実際に触れ、その価値を知っている人たちの共同体とともに暮らすことによってはじめて、それらの「よさ」を認識する「眼」を持つことができたと言えよう。

私はそのあと台湾にも留学した。台湾では國立故宮博物院に存在する、正統中の正統の中国絵画に触れることができたのもよかったが、それ以上に感動したのは、台湾には「台湾美術」があるという当然のことで、その「美しさ」を、はじめて知ることができたことである（この点に関しては「おわりに」で後述する）。おそらく私がこの時期、台湾に留学することがなければ、台湾美術の「よさ」、それをよいと認識する台湾人の眼があることを理解することも、私には難しかったであろう。

その後、私は奈良の大和文華館に職を与えられた。関西には内藤湖南が提唱し、羅振玉らの協力を得て財閥が収集した中国書画の大コレクションが存在しており、それらはいわゆる清朝の文人趣味、いわば中国の正統絵画史観に沿って収集された作品が多い[2]。その意味で関西にいた頃には、それまで留学や大学生活で習った、研究や「眼」の方向性や有効性を疑うことなく過ごすことができたのだが、しばらくして東京国立博物館に移ることになり、その収蔵庫におさめられたコレクションを見て、再び大いに驚くことになった。今までの中国絵画史の知識では全く太刀打ちのできない、不思議な画家とコレクションが、そこにはあったからである。

関西のコレクションのほうが中国の正統に近く、東京のほうがより日本的（あるいは海域的、雑種的、異端的）だというと、あるいは逆ではないかと首を傾げる方もいるかもしれない。しかしそれは以下のような日本の中国絵画コレクションの歴史的な特性によるものである。日本の中国絵画コレクションのうち、その伝来の時期によって、室町時代以前のものを「古渡り」、江戸時代以前のものを「中渡り」、明治から大正に入ってきたものを「新渡り」と呼び、その内容は全く異なっている。関西の中国書画コレクションは、この分類によれば新渡りの優品群と言えるが、東京国立博物館の中国絵画コレクションはそれらの層が複数に積み重なって形成されていたものであるからである。

まず、最も古い層として、奈良・平安時代に遣唐使、入宋僧によってもたらされた作品や、足利将軍家によって収集された「東山御物」といった古渡りの一群があり、その次に、江戸時代の文人である市河米庵コレクションの中渡りがある。そして高島槐安、林宗毅、青山杉雨コレクションといった大正・昭和期のコレクターが収集した個性的な新渡りの層が、東京国立博物館のコレクションには幾重にも累積している。これら、多様な歴史観・中国絵画史観によって収集された作品たちによって、いわば南京、台北、関西、東京といった、様々なコレクショ

2　曽布川寛監修 関西中国書画コレクション研究会編『中国書画探訪―関西の収蔵家とその名品』二玄社、2012年。

ンの場に身を置くことができた僥倖によって、私は今までの教科書で習った中国絵画史以上の「中国絵画」の多様な歴史と、それを支えてきた人々の豊かな地域が存在していたことを知ることができた[3]。つまり、東アジアの豊饒な諸地域で生み出されたそれら作品たちの「よさ」を語るためには、私が従来持っていた既成の歴史観や「眼」のほうこそを、大きく変化させる必要があることに気が付いたのである。

日本の学界では、1967 年の米澤嘉圃「日本にある宋元画」[4] によって、日本の中国美術コレクションは中国の中国美術コレクションとは違い、その正統に属するものが少ないこと、さらにそれを統合した研究が必要なことが説かれ、さらに 1997 年の戸田禎佑『日本美術の見方』[5] によって、日本美術史研究における一国史的な日本美術理解が徹底的に批判されていた。コレクションやモノを理解するために有効なこのような東アジア史的観点は、一方でさらなる課題を読者に差し出すものでもあった。すなわち何が「中国美術」で、何が「日本美術」なのか、私たちの身近にあるコレクションはそのように現在の国別による分類で、単純には二分することはできないのではないか、というさらなる問いである。中国の文人士大夫によって継承されてきた絵画史観によって収集された故宮博物院に所蔵されるような正統な中国絵画と、京都や江戸の絵画を直接比較することはできないし、むしろその間にある広大な、どちらにも属していないような中間領域こそが、この二つの地域を結びつける鍵になるのではないか、という視点である。

私たちが視覚芸術によって受ける感動とは、常に何かしら、自分たちが生活し、属していると感じている共同体に伝承される、一種の「眼」の形式と大きく関連しており、それゆえに、それが近代の国家主義、民族主義と結びついたとき、その美しい言説は狂気のように国家に属する人々を圧迫してきたことは、従来までの多くの研究で指摘されてきた。ここでもう一つ強調したいのは、近代において人々が何かしらの国籍をもたされ、どこかの国に属するように分類されていったように、アジアの「モノ」たちも、(特にその生産地によって) 国籍が再付与されて分類され、それぞれの国別美術史の語りの中へと分割、収斂されていったという事実である。

しかしながら、実際のモノの世界に身を置いてみると、そのように、単純に国籍を分類できる作品はごくわずかであることに気が付く。むしろ大部分は、豊饒な地域文化のなかで生み出され、アジアの多様な人々の間を彷徨しながら私たちの目の前に残されてきた。それは近代の「国家」美術史の語りのなかでは、そのアイデンティティーの複雑さのゆえに、国家と言う共同体によって編纂されるべき民族と名品の価値体系からは、評価を受けることが難しかった、一群の作品たちであったとも言えよう。

そこで本稿では、このような近代による国家の線引きの中間に存在してきた作品（ここでは「中間的（マージナル・オブジェクト）作品」とでも呼ぼう）に新たなスポットをあて、それらが教えてくれる豊かな世界観について考えていきたい。ここで取り上げるのは、①日本美術のなかにあった「唐物」のなかから分離されていった朝鮮・琉球の作品、②日中間を行き来した来舶清人の作品、そして、③中国で生まれながらも日本で加工されてしまった作品、である。これらはそれぞれの国家と民族を中心とする正統絵画史、いわば、国別歴史観では評価し得なかった作品たちである。ここで問題とするのは、それらを評価する歴史観の問題であり、これらの存在が私たちに教えてくれる新しい「価値」評価のあり方であるはずである。

3　拙稿「中国絵画の至宝をめぐる旅」『上海博物館 中国絵画の至宝展』図録、東京国立博物館、2013 年。

4　米澤嘉圃「日本にある宋元画」『東洋美術』朝日新聞社、1967 年。

5　戸田禎佑『日本美術の見方　中国との比較による』角川書店、1997 年。

1）「唐物」から朝鮮・琉球絵画へ

―豊饒なアジア世界の発見―

よく指摘されるように、日本のモノの世界には「唐物」という不思議なジャンルがある。日本の伝統的な美術（モノ）の世界は、「和」と「漢」という概念から形成されてきたが、その「漢」とは、実際の「中国」そのものと等価でもないという、不思議な概念である。単純に言ってしまえば、日本に存在した多様な「モノ」のうち、純粋に日本ではないものの総称が「唐物」という名称で、一括りに概念化されてきたと言えよう[6]。

近年、この「唐物」のなかから、新しい中国・朝鮮・琉球など、諸地域の絵画作品が続々と“ 再発見 ” されている。再発見と言っても文字通り蔵の中から見出されるのではなく、こちらの見方が変化していった、と言ったほうが正確である。「唐物」というのは、一種、中国を代表する概念であったので、「唐物」に属する作品は、中国の画家の名前が付されて伝来する場合が多かった。そちらのほうが（市場的な意味での）価値が上がるという実際的な理由と、それしか対象を認識する概念がなかったという理由、どちらも有り得る。しかし現代に至ってそれらをよく研究してみると、中国ではなく高麗や朝鮮、琉球の作品であった、という事例である。

もっともよく知られるのは朝鮮仏画の例であり、最初期の研究として熊谷宣夫「朝鮮仏画徴」（1964年）[7]がある。従来“ 中国 ” の作品（日本ではないというカテゴリーに分類された作品）のなかに、実は多くの朝鮮の作品が含まれていることを最初にまとまって指摘した重要な論考であり、これらの様式的根拠をもとに美術史家たちは作品研究を進め、「高麗仏画」展（1978年、大和文華館）[8]などが開催されて、その高麗・朝鮮仏画のイメージは次第に大方に共有されるようになっていった。また高麗仏画の研究の進展は同様に、その隣接カテゴリーである宋元仏画という領域の成立を促していったが、現在では井手誠之輔『日本の宋元仏画』（2001）などによって、その複雑な「アイデンティティー」の輪郭は、徐々に明確になっている[9]。

一方、「世俗画」（山水画）においても同様の軌跡が描かれている。この分野において従来の「唐物」の世界から朝鮮山水画を分離し、“ 再発見 ” の過程を牽引するのが、「朝鮮王朝の絵画と日本」展（2008年）などの開催であり、板倉聖哲氏などによって、それら従来の中国絵画のカテゴリーの中から朝鮮絵画という具体的な様式史が存在し、独立して概念化される過程が明らかにされている[10]。

日本では「高麗もの」の伝称を持ってきた少数の仏画や山水画、もしくは朝鮮絵画というカテゴリーの存在を認識していた谷文晁など非常に洗練された江戸時代の鑑定家を除いて[11]、やはり朝鮮絵画は「唐物」の一部と認識されることが、一般には多かったとされる。実際、つい近年にいたるまで中国絵画として伝来してきた朝鮮絵画は数多く、「郭熙」の箱書きを持つ「山水図」（福岡市美術館）、「瀟湘八景図屏風」（紀州徳川家旧蔵、晋州博物館）、「米友仁」として伝来した「山水図」（毛利博物館）など、多くの例を挙げることができる[12]。日本のなかで従来は「唐物」というカテゴリーで一括して扱われてい

6　島尾新「彼我を行き交うモノ 書画」『日明関係史入門』勉誠出版、2016年、等を参照。

7　熊谷宣夫「朝鮮仏画徴」『朝鮮学報』44、1967年。

8　菊竹淳一、吉田宏志『高麗仏画』朝日新聞社、1981年。

9　井手誠之輔『日本の宋元仏画』日本の美術 No.418、至文堂、2001年。また、同「作品の個別性とアイデンティティ―寧波仏画と地域社会ー」『アジア遊学』70号、2004年。

10　『朝鮮王朝の絵画と日本　宗達、大雅、若冲も学んだ隣国の美』2008年。

11　板倉聖哲「幕末期における東アジア絵画コレクションの史的位置ー谷文晁の視点から」『美術史論叢』28号、2012年。

12　これらの問題点についても、板倉聖哲「朝鮮王朝の絵画と日本ー宗達、大雅、若冲も学んだ隣国の美」展によせて」『東方』東方書店、2008年。なお、これら仏教美術の伝来時期とその複雑な文化状況については、楠井隆志「高麗朝鮮仏教美術伝来考」『高麗・李朝の仏教美術』展図録、1997年、を参照。

たそれらの作品を、今世紀の日本や韓国の美術史家たちは「朝鮮絵画」というカテゴリーから新しく分類して見せることに、情熱を注いできたのであり、今後もその努力は続くであろう。

しかしながらそれらを朝鮮絵画として単純明快に分類できるかというと、実際には多くの困難が横たわっている。美術史家たちが依拠するのは「様式」という絵画の描き方による分類であるが、そのどこまでを朝鮮と考え、どこまでを中国、日本とするかは、それぞれの研究者によって大いに議論の余地が残されているからである。例えば、「山水図」（図1、金地院）や「山水図」（「隠斎」印、京都国立博物館）は、筆者が朝鮮絵画と分類している作品であるが[13]、これに対して朝鮮絵画ではなく、中国の地方様式の一部と考える意見も根強い[14]。また「水亭清興」「雲林逸趣」図（陳孟原、永保寺）のように実際の制作地について日中韓の研究者で全く意見の違う作品もある。実はこの議論にはさらに奥深い問題が潜んでいる。どこまでを「中国」という地域の様式のなかに包括し、何を「朝鮮」、「日本」の様式と考えるかという問題である。もしかしてこれらの作品は、中国でも朝鮮でも日本でもない、第三の地域の作品である可能性もあるからである。

例えば、中国絵画の様式の中心は、北京や蘇州、杭州といった大都市であったことは間違いないが、それ以外の地域にも特徴ある絵画様式は存在していたことがすでに確認されている。例えば先述した、特徴ある仏画を生産し続けた寧波や、近年陸続と新しく認識されたマニ教との関連のある一群の絵画の生産地としての福建などがあげられ[15]、その後の明、

図1　高然暉「山水図」（朝鮮王朝？明？、金地院）

清にかけても福建には独自の絵画様式が存在していたことが指摘されている[16]。「中国」の様式が各地方によって多様性を見せているように、朝鮮も決して一つではないし、日本でも例えば、九州や瀬戸内文化圏、関東画壇など、「地方」を名乗る有力な制作グループは、それぞれ親近する中国や朝鮮の様式に近い作品を制作している。私たちが、「日本」でも「中国」でも「朝鮮」でもないと頭を抱える作品は、もしかしたらこのような、広大なアジア地域のなかにある、まだ見知らぬある「地方の様式」を反映した作品かもしれない。「モノ」たちは、単純な国籍では分類できない、多様なアジアの人々の地域のあり方を反映しているのである。

ここでいま一つ、琉球の問題を考えてみたい。琉球は独自の美術作品を制作していた、いや、作業仮説としてはしていたはずである。しかし、この「独自性」というのはとても困難な概念を含んでいる。琉球の美術作品の研究も同様に、かつて「唐物」のなかに存在していた一群の同様の傾向を見せる漆工

13　拙稿「解説」『崇高なる山水―中国・朝鮮、李郭系山水画の系譜―』大和文華館、2008年。

14　張辰城「동아시아 회화사와 그림의 國籍 문제：高麗・朝鮮時代 傳稱 회화작품에 대한 재검토」『美術史論壇』30号、2010年

15　古川攝一「江南マニ教絵画の図様と表現―元代仏教絵画との関わりを中心に―」『中国江南マニ教絵画研究』臨川書店、2015年。

16　板倉聖哲「張瑞図の書画とその日本における受容」『張瑞図』謙慎書道会、2013年、同「王鐸―「弐臣」として、書家・画家として」『王鐸』謙慎書道会、2014年。

芸作品に、「琉球漆器」として特別なカテゴリーに分類したのが研究の早い例で[17]、今では北京や台北の故宮博物院のなかにも、大量の琉球漆器が所蔵されていることが知られている。絵画の場合も同様に、従来まで「中国絵画」や「日本絵画」として分類されていたものの中に、琉球の作品がまぎれ込んでいる可能性は大いにある。しかし注意しなくてはならないのは、これらのいわゆる「琉球」の定義が、非常に難しいことである。

それは琉球という地域の歴史的特性に由来している。琉球で作られたものが琉球美術だろう、と思われるもしれないが、事実はそう単純ではない。琉球では多くの中国・日本との人的な交流が行われた結果、そこで制作された作品には多様な交流の痕跡が存在しているからである。例えば琉球漆器ならば、材料は福建や日本で作られて輸入された場合もあるし、中国や日本の技術を使って制作した時期もあり、中国製か琉球製か、頭を悩ませる作例は数多い。また琉球絵画には中国の宮廷・文人画様式から日本の狩野派・大和絵に至るまで、多様な様式が混在していることが指摘されている[18]。これらのどこにその “ 独自 ” 性を見出し、琉球での制作を証するのか、作品に確固とした落款でもない限りその製作地を、作品の表面からの観察のみで見極めることは、極めて難しい。しかし、むしろここで問題としたいのは従来の美術史において、これらの製作地の個性（独自性、民族性と言ってもよい）がしっかりと表明されない作品、つまり製作地が確定できない作品の価値づけが、非常に曖昧なままであったことである。国別美術史の語りによる限り、その民族の独自性の表明に、これらの作品たちは寄与のしようがなかったからある。

しかしここで、東アジア美術史というものを構想したとき、このような混交した文化状態を示す作品こそが、最も重要で魅力的な価値を持っていることに気が付く。はっきりと日本や中国、朝鮮という「国籍」を分けることが困難な作品、中間的作品（マージナル・オブジェクト）に、むしろこのような、東アジア美術史の紐帯を示すものとしての、新しい可能性と価値づけを与えることはできないだろうか。それは私たちが国別美術史を超越するための重要な扉を開いてくれるかもしれない。

これからも「唐物」のなかからの琉球や朝鮮の作品の “ 再発見 ” は続くだろう。それは作品が変化したのではなく、その特性を見極める人間の「眼」が変化したものであった。国別ではなく、地域のもつ豊かさを認識する、私たちの歴史観が変化することによって、作品の価値づけは変化し、新しい地域像が立ち現われてくることを、これらの作品は教えてくれると言えるだろう。

2）来舶清人の終焉

―地域から国家への変化―

このように、従来までの民族と国家によって分割された単純な文化カテゴリーに、さらにその中間にあるものという新しい価値のあり方を想定してみると、その領域に存在する大量の作品（中間的作品（マージナル・オブジェクト））があることに気が付く。江戸時代に日本にやってきた中国人画家、すなわち来舶清人の作品はその一例で、これらの作品は琉球の作品と同じく非常に複雑なアイデンティティーを持っていると言えよう。

現在、東京国立博物館に寄託される橋本末吉(1902―1991) 氏の収集されたコレクションには、大量の来舶清人の作品が含まれている。それらを見てみると、不思議な違和感を感じることがある。それは画法が中国画でありながら、材料は日本のものを使っていることで、その画面からはどちらの文化

17　先駆的な展覧会として『琉球漆器』徳川美術館、1978 年、があげられる。また、琉球の工芸品に多くの日本製や中国の材料が使用されており、単純な日本や清といった二分論で割り切ることができないことは、久保智康『琉球の金工』日本の美術 No.533、ぎょうせい、2010 年、等を参照。

18　近年の琉球絵画研究の代表的なものとして、黄立芸「琉球畫家殷元良（座間味庸昌）的中國繪畫學習」『藝術學研究』第 16 期、2015 年、があり、その中国や日本との複雑な関係が詳細に分析されている。

にも属さない、不思議な感覚を覚えるのである。それらは日本漢文にも似て、日本でも中国でもあるような、中間領域に存在する作品たちの不思議な属性であると言えよう。そしてそこに、来舶清人の面白さは存在しているのである。

来舶清人の大部分は、中国ではほとんど名を知られていない文人たちである[19]。彼らは主に18世紀から近代、すなわち明治維新以降にわたって来日し、長崎を中心に活躍、その大部分は浙江や福建、広東といった中国の南方諸都市の出身であったことに特徴がある。例えば、雍正9年（享保16年、1731年）12月長崎に来日し、同11年（享保18年、1733）9月に帰国した沈銓（南蘋、浙江省湖州の人）はその初期の例で、徳川吉宗の招聘を受けて来日したとされている。すでに多くの先学によって指摘されているように、滞在期間は3年と言う短い期間であったにもかかわらず、その画法が日本画壇に与えたインパクトは莫大なものであった。それは如何にして可能になったのかと言うと、鄭培、高鈞などの有力な中国人弟子の滞在によって、熊代熊斐（1712—1773）や森蘭斎（1740—1801）など有力な日本人画家がその画風を継承し得たこと、また海眼浄光（鶴亭、1722—1786）が京都、大阪、宋紫石（1715—1786）などが江戸でそれぞれ活躍し、直接の師弟関係や様々な模写、絵手本、版本が広がることでその画風が全国に広まったこととがあげられる。

しかしそれよりも重要なのは、沈銓が帰国後も、その作品を陸続と日本に送り続けていたことにあろう。すでに先学によって指摘されているように、日中両国で500件近くに上ると言われる沈南蘋の伝称作品のうち、来日以前の作品が数点知られるほか、そのほとんどは沈銓の帰国後に描かれたものである[20]。現在、中国にも多くの沈南蘋作品が所蔵されているが、その品質は一定ではなく、本人の作品を含め、工房作、後世の模倣作、そして日本での模倣作をふくめ[21]、多くの鑑定上の問題が存在している。すなわち、沈銓の来日の背後には、個人の画家の動向のみならず、工房や弟子たちをふくめた、巨大な人の動きを想定しなければならないのである。

また、沈銓の作品がここまで日本で受け入れられたのは、その復古的な画風に原因があることはよく指摘されている。沈銓の画風は当時中国で流行を極めていた四王正統派でも清朝宮廷絵画でもなく、明時代の宮廷画家であった呂紀以来の保守的なものであり、それは清朝という国家を代表する作風と言うより、浙江地方の沈銓とその工房で伝承されていた一種の地方画風と言ってよい。来舶清人と日本との交流とは、清朝と日本と言う国家同士での交流ではなく、やはり、浙江・福建と言った中国の地方様式と、日本との交流であったと言ったほうが、実態に即していると言えよう。

その意味で、沈銓「鶴鹿同春図屏風」（図2、乾隆四年〔1739〕、東京国立博物館）は象徴的な作品である。興味深いのはこの作品が屏風の形式をとることで、実際にこの作品は徳川将軍家の御道具として江戸城に納められ、さらには水戸徳川家の依頼によって文政3年（1820）には狩野養信によって模写（というよりも、模写としての作品）が制作されており[22]、その「群鹿群鶴図屏風」（江戸、板橋区美術館）も現存する。これは清朝の地方画家が、日本の注文にあわせて、そのフォーマットで制作し、そ

19 鶴田武良『宋紫石と南蘋派』日本の美術 No.326、至文堂、1993年。

20 板倉聖哲「来舶（旅日）画人研究初探—乾隆朝を中心に—」『宮廷與地方：乾隆時期之視覺文化國際研討會』臺灣大學藝術史研究所、2011年。

21 周積寅、近藤秀実『沈銓研究』江蘇美術出版社、1997年。

22 松原茂「奥絵師狩野晴川院「公用日記」に見るその活動」『東京国立博物館紀要』第17号、1981年。また、この時期の中国絵画収集については、杉本欣久「八代将軍・徳川吉宗の時代における中国絵画受容と徂徠学派の絵画観—徳川吉宗・荻生徂徠・本多忠統・服部南郭にみる文化潮流—」『古文化研究』13号、2014年、を参照のこと。

図２　沈銓「鶴鹿同春図屏風」（清・乾隆四年〔1739〕、東京国立博物館）

図３　方済「富士山図」（清／江戸、橋本コレクション）

図４　孟函九「人物図」、鄭培「蕉翁図」（清／江戸、橋本コレクション）

れを日本に輸送してきた例であり、それゆえに将軍家の御道具としてふさわしい格式をもった例と言える。

さらに来舶清人たちが残した作品はより多様である。乾隆 43 年（1778）に房州に漂着したとされる方済は、長崎へ護送される途中で富士山の絵を描いたと言われている（図３）[23]。これは間違いなく日本製の画絹に描かれており、中国人が日本で日本の風景を描く、という妙味を追求した作品である。また、同じく来舶清人である孟函九（江蘇省呉県の人、1781―1806）の「人物図」には「上見れば及ばぬことの多かりき 笠見て暮らせおのが心に」という教訓歌、鄭培「蕉翁図」（図４、橋本コレクション）には、沈璠（号、草亭）という蘇州出身の来舶清人の、これも仮名による「いかめしき音や霰の檜木笠」という松尾芭蕉（1644―1694）の句がつけられている。これらはいずれも清人が仮名を書けたら面白い、といった趣向の作品であり、その真偽は一考の余地があるものの、日本のなかにこのような絵画の需要があったことが分かる。

清末に太平天国の乱（1851 ～ 1864）が起こると、戦乱を避けてさらに多くの清人が日本を訪れるようになった。羅清（雪谷）もその一人で、広州番禺の人、同治年間（1862 ～ 1874）に日本を訪れたことが知られる。羅清については鶴田武良氏の詳細な研究があるが[24]、近年さらに興味深い資料が見出されたので、ここで少しく紹介しておきたい。熊本藩の御用絵師であった杉谷雪樵（1827―1895）の「画論」（熊本美術館、明治４年）は、「辛未」

23　古原宏伸「波濤を超えて―来舶画人論―」『橋本コレクション 十八世紀の中国絵画―乾隆時代を中心に―』渋谷区立松涛美術館、1994 年。

24　鶴田武良「来舶画人研究―羅雪谷と胡鉄梅」『美術研究』324、1983 年。

(1871、明治 4 年／同治 10 年）に長崎からやって来た羅清に、自身の画を批判された際に反論したもので[25]、44 歳の雪樵にとって来舶清人からの批判は、弟子たちに弁明すべき重要な重みを、この時期には持っていたことが分かる。その後羅清は上京し、「壬申（1872)」の年号を持つ「蘭竹図」を残しており、その落款からは浅草寺に寄寓していたことが知られ、同じく医師の松本良順に贈った作品も知られている。またその暮らしぶりを好奇心のまなざしから描いた作品も残されている[26]。

羅清は東京で新しいパトロンを見つけることとなる。かつての高崎藩主であった大河内輝声（1848—1882）である。その大河内家の菩提寺である平林寺に所蔵されている羅清「花卉図」(明治 4 年〔1875〕、平林寺）が、昨年の展覧会で紹介された[27]。大河内家の本邸は当時、同じ浅草の今戸にあったが、この作品はその本邸内にあった「桂林荘」において輝声のために描かれたもので、指頭画で描かれた贈答用の非常に華麗な大幅と言える。しかしこのような交流があったとしても、その絵画芸術は、江戸時代のように画壇に大きな一大潮流をなすことはなかったのである。大河内輝声は、その一方で、明治 10 年に開設された清国公使館に出向き、来日していた清国公使・何如璋 (1838—1891)、書記官黄遵憲 (1848—1905)、随員であった楊守敬 (1839—1915)、また後任の公使であった黎庶昌 (1837—1897) らと筆談を通じて交流を深めていくこととなるからである[28]。

この新しい清国文人官僚たちとの交流の中で、大河内輝声の書法観は、従来の江戸時代までの日本書壇に君臨し、自身も師事していた市河米庵（1779—1858）のそれから、新しい清朝の碑学の尊重へと、大きく変化していくことが指摘されている[29]。いわば、現在の「中国文化史」にも燦然と名を残す、中国の正系につらなる大文人たちへの傾倒である。このような中、羅清は明治 9 年ごろには広東へと帰り、二度と日本の土を踏むことはなかった。大河内輝声のこの「中国」文化への接触とその変化は、なぜ引き起こされたのであろうか。そこで彼は何を得、何を捨て去ったのだろう。

近代にも日本を訪れ、日本人と交流を深めた清人は多い[30]。しかしやはりその役割は次第に変化していったと言える。実際の身近な人的な交流を通じた浙閩の地方文化ではなく、国家としての中国そのものを代表する人物やその文化と、直接に交流できるようになった結果、浙江・福建・広東から来舶した清人たちの影響力は次第に低下し、「来舶の時代」は終わりを迎えた。それは、文化交流の主体が、そして語りの枠組みが、地方から国家主体へと変化していったことと、軌を一にしていると言えよう。

朝鮮通信使や燕行使の研究がさかんに行われているのに反して、来舶清人たちの作品の評価は、現在のところ、実はあまり高くはない。それは彼らが「国家」同士の交流ではなかったことと、またその作品が両義的な性格を持っていたからだと言えよう。つまり、「中国美術史」の語りからすれば彼らはただの地方文人に過ぎず、「日本美術史」の語りからすれば江戸絵画に影響を与えた外来要素の一つでしかない。その双方の国別美術史に、彼らが登場することはほとんどなく、民族を中心にした「国民芸術の歴史」を語ろうとする時、このような両義的

25　村田栄子「解説」『杉谷雪樵 熊本藩最後のお抱え絵師』熊本県立美術館、2000 年。

26　これらの肖像の、いわば諧謔的な表現は、同じく北京から来た清国文人たちを描いた肖像画と大きく異なることに注意する必要がある。川﨑智子「暁斎·夏良筆「東京開化名勝 浅草奥山」に見える羅雪谷『暁斎 : 河鍋暁斎研究誌』110、2013 年、参照。

27　林祐一郎「解説」『武蔵野の禅刹 平林寺 —伝来の書画名宝展—』花園大学歴史博物館、2016 年、参照。

28　『大河内文書 : 明治日中文化人の交遊』平凡社、1964 年。

29　中村史朗「大河内文書」にみる明治期の日中書法交流 :—楊守敬来日前後の事情をめぐって—」『書学書道史研究』18、2008 年。

30　この時期の、近代来舶清人については、西上実「王治梅と森琴石 - 近代文人画家と銅版出版事業の関わりについて」『中国近代絵画と日本』京都国立博物館、2012 年、などを参照。

な意味を内包する作品は、非常に厄介な存在であるからである。しかしながら、まさに来舶清人の作品の魅力は、ここにあるとも言えよう。

来舶清人の作品は、「中国」美術の一部分でありながらも、「日本」美術の一部分でもある。いやむしろ、そのような国別美術史の枠組みでとらえる限り、来舶清人の作品の魅力を十分に語ることはできないかもしれない。近代の国民国家が「一つの美術史」に作品を収斂させる以前の、モノや画家たちが持っていた、地域の豊かな想像力を、来舶清人の作品は教えてくれるように思われる。

3）加工された中国絵画

―多元的理解への挑戦―

一つの民族には一つの固有の民族様式があるべきだ、という考え方は、近代の国民国家によるアジア美術史が構築される際の支配的な考え方であったように思われる。しかしながら実際の豊饒なモノの世界に身を浸してみれば、その中間領域で生み出された作品は、すでに上述したようにたくさん存在するし、さらにモノは移動することによって自在にその形を変え、多様な意味を発生させていることが分かる。もしも、一つの民族が一つの民族様式を、古代から途切れることなく現在に至るまで保持してきたとしたならば、このような様々に加工されたモノの存在は、その持続性を脅かす存在ともなるだろう。

馬遠「寒江独釣図」（図５、東京国立博物館）は、近年の修理によってその上部の三分の一が切れていることが明らかとなった作品である。これはこの作品が、もとはより大きな作品を切り取って再創造されたものであることを示している。重要なのは「寒江独釣図」が、南宋画の情趣を端的に示す作品とされ、評価されてきた点である。南宋絵画は大きく空間を広げることによってそこに無限の詩情を込めることに特徴があるが、凍てつく冬に静かに釣り糸を垂れる高士の姿は、あたかもそこに鑑賞者の自己を見つめる精神を映し出すようで、まさに南宋絵画の

図５　（伝）馬遠「寒江独釣図」（南宋／室町時代？、東京国立博物館）

図６　（伝）毛松「猿図」（南宋、東京国立博物館）

究極の姿として「中国絵画史」の語りの上で評価されてきた。しかし、このような構図の作例は中国絵画のなかには存在せず、おそらく日本のなかで切り詰められ、再構成された構図である可能性が高いのである[31]。

このことはこの作品が、ボディー（材質）は中国製でも、その最も重要な画趣を発生させる装置である構図が日本製、というハイブリッドな作品であることを示している。しかも興味深いことに、この作品は南宋絵画の究極の姿を示すものとして、つい近年まで日本、中国、そしてアメリカで高い評価を得てきたと言う事実である。一方、（伝）毛松「猿図」（図６、南宋、東京国立博物館）という作品もある。これもその思い悩むような内省的な姿勢か

31　拙稿「「日本が見た中国」という誤解の系譜 」『美術手帖』2016 年 1 月号。

ら、南宋絵画の傑作として国際的な高い評価を得てきた作品である。しかしながらこの作品には、元亀元年（1570）に武田信玄から曼殊院覚如が天台座主に就任した際に贈られたものであることが付属の書状からわかり、この事実から素直に考えれば、近代の「美術批評」の文脈からは内省的と精神的側面から評価されてきたこの猿の姿は、当時、比叡山の守護としての日吉大社の神猿の姿であったことがわかる[32]。実際に多く現存する「山王曼荼羅」には、この姿をとる猿が多く描かれているからである。

ここで重要なのは、一つの作品をどのようなコンテキストから評価するのか、という価値づけの問題である。もしも中国絵画という一つのコンテキストをのみ重視すれば、この絵に込められたこのような他民族・他社会による二次的な加工、そしてそれによる意味づけは、全て意味をなさないこととなる。近代における中国美術史研究の発展は、このように作品に付随してきた様々な前近代的な社会的意味を、（普遍的価値を有するとされた）“美術”という側面から再解釈し、新しい価値評価の体系のなかに位置付けていった歴史ともいえるが、『唐絵手鑑（筆耕園）』（東京国立博物館）もそのなかで大きく価値を変容させた一例である[33]。

『唐絵手鑑』は全60図、48人の中国画家をおさめた手鑑で、大部分の作品に落款はないが、狩野安信（1614-1685）による「極め」（鑑定）によって固有の中国画家の作品に同定されている。20世紀の中国美術史家たちは、莫大に伝来する作品から、従来の作品の鑑定を見直し、写真技術の発展によって作品を比較検討してその品質を見極め、作家本来の真筆作品からその様式史を構築することを目標としていた。興味深いことは、そのような科学的美術史学の角度から近代の研究者が『唐絵手鑑』を見た時に気付いたのは、そのうちほとんどの作品が「偽物」であったことである。その結果『唐絵手鑑』は、安信の鑑定の非科学性が指摘され、中国本土や故宮に収蔵される作品との様式的比較から、比較的「真筆」に近いと考えられる作品だけが摘出されて美術全集に掲載され、評価を受けるようになった。

私たちの美術史はこのような、科学的な比較検討を経た妥当な判断の積み重ねの上に成り立っており、このような先人たちの判断を否定することには全く意味がない。しかしながら、今その作品全体を分析すると、そのほとんどが「君台観左右帳記」に記載の画家で、その画風に合うような作品が集められているのが分かる。この手鑑は狩野安信から画事を学んだ福岡藩・黒田綱紀（1659-1711）に、東山以来の武家の式法を教示するために編集されたことを考えれば、実はこの作品については一枚一枚の様式判断もさることながら、全体を合わせた画冊としての意味が、江戸時代にはむしろ重要であったことが分かる。伝世する過程で次第に全体の表具も大振りなものに改められ、実用的な目的から観賞用・威厳を示すための道具へと変化していったこの画冊からは、中国本土での中国絵画史観とは違う、多様な中国絵画史の一部が、17世紀ごろの日本ではすでに存在していたことを知ることができるのである。

近代以降の中国美術史研究で評価が低下していったのは、むしろこのような、中国絵画の本流からは、はずれてしまう、その周辺地域の人々によって加工され、意味を変容させられた「中国絵画」たちであった。そのことは、以下のような江戸時代の中国絵画に関する出版からも窺うことができるだろう。

日本では中国画人の印を集めた『君台官』（江戸時代・承応元年(1652)）と呼ばれる印譜集が出版されている。そこには中国にはそもそも存在しない「高然暉」や「西金居士」といった画家たちの印も所収されており、「高然暉」はおそらく元時代

32 Maromitsu Tsukamoto, Monkey, Hongxing Zhang ed., *Masterpieces of Chinese Painting 700-1900*, , Victoria and Albert Museum,2013,p.192.

33 拙稿「《唐繪手鑑（筆耕園）》與江戸時代中國繪畫知識的架構」『創新與創造：明清知識建構與文化交流』論文集、中央研究院、2014年。

の「高克恭」が訛ったもので、「西金居士」は寧波の画家であった金大受の署名「大宋明州車橋西金大受筆」を日本で誤って読んだために生まれた、言わば「誤読」の画家であり、中国に「金大受」は存在しても、「西金居士」は存在しない。しかし、その印は、日本では実在し、流通していたのである。また和刻本『図画宝鑑』には本来の中国刊本には存在していない『君台官』が堂々と付録されており、江戸時代の人々にとっては、元、明、清朝のどんな立派な文人画家たちよりも、室町時代から日本で愛され、多くの作品が流通していた架空の中国画家たちのほうが、よっぽど現実味を帯びた存在であったことを教えてくれる[34]。そしてこのような、作品の加工や新しい絵画史の構築は、日本だけではなく、中国絵画というモノが存在するすべての地域で普遍的に観察できる現象であるということも付言しておきたい[35]。

問題はこのような多様な「中国絵画史」の存在と、その歴史観に基づいて加工、編集された作品たちをどのように評価するかにある。作品は一つの民族に属し、その歴史観も一つでなければならないとしたならば、これらの作品は、全て「誤解」が生んだ「偽物」であり、嘲笑すべき価値のない存在となってしまう。しかし私にはこのような、どちらの文化圏にも属さないこれらの不思議な「中間的（マージナル・オブジェクト）作品」たちから、むしろ、近代の国家と民族にもとづく作品評価の価値システム自体の再考を迫られているように思われるのである。

おわりに

―多様な中国絵画史の共生―

かつて私は、東アジアにおける作品の価値発生のシステムには、「地方的個別の価値」と「普遍的文脈」の二つのあり方があり、それらが時として矛盾を起こすのではないかと考えていた[36]。本稿では、近代における「美術」の成立とその普遍化によって、また一国／民族式の美術史記述が盛行することによって、モノの個別・地域的な価値が、覆い隠されてしまった側面があることを認識するために、上述した三つの事例に即して記述してきた。これらはいずれも「近代」と「美術」のはざまに入り込み、結果その価値を大きく変容させていったモノたちであり、その中間領域（マージナル・エリア）に存在してきた人々の歴史であったと言えよう。

例えば台湾の女性画家・陳進（1907 ～ 1998）。彼女は日本統治時代に生まれ、女子美術大学で学び、いわゆる「台湾三少年」として一世を風靡する華麗な画風を築いた台湾人画家である。その代表作として知られる「悠閒」（1935 年）などの作品には、日本人から見た台湾イメージである「ローカルカラー」の強烈な反映が見られることは、研究史でも必ず指摘されてきたことである。しかし陳進はさらにその後複雑な人生を歩むこととなる。国民党が台湾に遷居したことによって、それまでの台湾の日本画家たちは中国本土から移って来た水墨画家たちとその絵画表現を巡っての論争に巻き込まれることとなり、林玉山や郭雪湖が水墨表現を試みていくのに対して、陳進ははじめ水墨を取り入れた表現を試みるが、すぐにそれをやめ、身近な人物や花という題材を、晩年に至るまで描き続けることとなったの

34　拙稿「江戸時代所見之中國繪畫―狩野畫派的摹本製作與中國畫史研究」『典藏古美術』第 248 期、2013 年。

35　*James C.Y.Watt,Introduction, The World of Khubilai Khan Chinese Art in the YuanDynasty*, The Metropolitan Museum of Art,2010,pp.3-38. 一方で、ヨーロッパ向けの伊万里や、日本向けの製品を大量に生産していた景徳鎮など、受容者にあわせた商品づくりを行うのは、アジアの市場において普遍的に行われていた事象である。また、謝明良「鳳尾瓶的故事」『陶瓷手記 3：陶瓷史的地平與想像』石頭出版、2015 年、を参照。

36　Tsukamoto, Maromitsu. “Frictions in Universal Contexts and Individual Values: Chinese Paintings at the Toyokan”, *Orientations*, Vol.44,No.5,2013,pp.40-47.

である[37]。

1930年代の陳進作品が高く評価されるのに反して、この後期の作品の評価はいまだ定まってはいないように思われる。国際的かつ中華民族の表現形式と考えられていた水墨表現の放棄は、彼女に新しい社会での栄達の道を断たせてしまったが、ここではむしろこのような社会の変化による絵画の表現や価値づけの激しい変化を経験した台湾画壇にあって、安定した家庭生活のなかで自らの愛する対象を心のままに描き続ける道を選んだ陳進の晩年の作品には、さらに評価すべき側面が含まれていると考えることができる。つまり陳進はここではじめて、中国でも日本でもない、つまりどちらかの国家的民族的なものとして社会的に価値づけられた表現様式ではない、何かしら別の絵画評価のあり方を、自身の絵画作品に見出していたに違いないということである。

「美術作品」は、一つのコミュニティーによる価値づけが絶対なのではなく、様々な評価の形式が有り得、それは変遷していく。もしある国家や民族に特有の様式があるかと言えば、それはやはり存在していると答えざるを得ない。それらを見出し、つなぎ合わせていくことで、近代の一国史的美術史は各地に生起したのだが、しかし、それは絶対の価値を持っているのではなく、社会が変わればその意味も変容していく。さらにそれだけでは理解できない、中間領域に属する作品や様式も、同じように存在していることを改めて認識すべきであり、それを評価する新しい眼を持ち得ることが今後の「東アジア美術史」構築にとってさらに重要となっていくのであろう。私たちの身近にあるモノを子細に観察すれば、アジア世界というのが、非常に多様な地域の視覚的集合体であることに、容易に気が付くことができるからである。モノを巡って争うことなく、モノをめぐる世界の多様さから学び、そこから新しい歴史観のヒントを得ることができないだろうか[38]。モノが持つ本来の豊かさを学ぶことで、新しい「東アジア美術史」の姿を垣間見ることができたらと思っている。

37　顔娟英「日本画」の死－日本統治時代における美術発展の困難－」（拙訳）『美術研究』398、2009年。また「国画論争」については、蕭瓊瑞「戒嚴體制與新傳統的建立」『台灣美術史綱』藝術家、2009年、を参照のこと。

38　この点に関しては、稲賀繁美「表象による憎悪を断ち切るために ―― 近年の絵画表象研究への批判的鳥瞰」『絵画の臨界 近代東アジア美術史の桎梏と命運』名古屋大学出版会、2014年、を参照。

The 3rd Asia Future Conference Report

第３回アジア未来会議報告

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The Third Asia Future Conference (AFC#3) was held from Friday, September 30 to Sunday, October 2, 2016 in Kitakyushu, Japan with 397 registered participants from 20 countries. Hence the City of Kitakyushu is a former industrial area turned to an environment-friendly city, the overall theme of AFC#3 was "Environment and Coexistence", including broad range of issues in various social and cultural environments.

OPENING EVE (September 29)

The night before the official opening of AFC#3, the 10th SGRA China Forum "Toward the East Asian Cultural History Without Borders" was held at the Kitakyushu International Conference Center. *The manuscript of the opening speech of this forum is shown in this book through pages 12 -25.*

DAY 1 (September 30)

MORNING: There were three roundtable discussions and a forum at the Kitakyushu International Conference Center.

Roundtable 1 "Dialogue of National Histories; Japan, China and Korea"

We all agree that we have to overcome our history in order to realize historical reconciliation in East Asia. The first step should be to "establish a dialogue" among the three national histories of China, Japan and Korea. This was the first of a series of 5 forums of the same theme aiming at establishing a "Dialogue among National Histories" among researchers from Japan, Korea and China.

Roundtable 2 "Religious Responses to Changing Social Environments in Southeast Asia"

We took into consideration the present situation wherein religion tends to be viewed as a cause of conflict and clash, despite its genuine aim of achieving happiness of humankind and society. Based on Southeast Asian case studies, invited researchers from this region, together with foreign and Japanese research-

第３回アジア未来会議は 2016 年 9 月 30 日（金）～ 10 月２日（日）、北九州市において 20 ヵ国から 397 名の登録参加者を得て開催されました。総合テーマは「環境と共生」。かつての同市は製鉄業を中心とする工業都市で、一時はひどい公害に悩まされましたが、市民・行政の努力により、今は環境にやさしい都市に生まれ変わっています。会議では、このような自然環境と人間の共生はもとより、さまざまな社会環境や文化環境の中で、いかに共に生きていくかという視点から広範な領域における課題を採り上げ、国際的かつ学際的な議論が繰り広げられました。

開催前夜　9月29日（木）

北九州国際会議場において第 10 回 SGRA チャイナフォーラム「東アジア広域文化史の試み」を開催。SGRA が毎年秋に中国各地で開催しているものを、今回はアジア未来会議にあわせて日本で実施し、過去２回のフォーラムの論点に沿ってさらなる研究成果が報告され、今後の展開につなげました。

第１日　9月30日（金）

午前：北九州国際会議場で３つの円卓会議と１つのフォーラムを並行して開催しました。

円卓会議１「日本・中国・韓国における国史たちの対話の可能性」

東アジアの歴史和解を実現するとともに、国民同士の信頼を回復し、安定した協力関係を構築するためには歴史を乗り越えることが必要と捉え、各国の「国史」を対話させることが大事であることを確認しました。今回は今後５回程度のシリーズの初回と位置づけ、日本、中国、韓国の歴史研究者が集まって「国史たちの対話」の可能性を検討しました。

円卓会議２「東南アジアの社会環境の変化と宗教の役割」

宗教が本来人間や社会を幸福にするために生まれたものであるにもかかわらず、近年は対立や衝突の原

LEFT: Posters displayed in Kokura Station.
RIGHT: Opening Ceremony.
【左】小倉駅構内に掲出されたポスター
【右】北九州国際会議場での開会式

ers active in Japan, discussed universal themes such as the relation of society with religion, as well as the role of religion.

Roundtable 3 "Humans and Robots: Towards a Society of Coexistence"
After the introductory speech by Dr. Inoue Hirochika on "COBOT", we discussed the present situation and challenges in robot R&D in Japan, Korea, Russia, Europe and China. *Dr. Inoue's speech is shown in this book through pages 8 -11.*

AGRI Economic Forum "Population Problems and Solutions in Asia"
Four specialists from the Asian Growth Research Institute took up various population problems facing Asia and discussed these problems and lessons for other Asian countries.

AFTERNOON: The Opening Ceremony commenced with a welcome speech by Dr. Michiaki Kondo, President of the University of Kitakyushu, followed by the proclamation of the opening of the conference by Mr. Yasushi Akashi, Conference Chairman. The keynote speech was given by Yoshikazu Tanaka, Chief Engineer of MIRAI, Toyota Motor Corporation on the theme "Development of the Fuel Cell Vehicle, MIRAI and the Challenges towards Hydrogen Society". The Commemorative Symposium of the 70th Anniversary of Foundation of the University of Kitakyushu "Sustainable Development and Asian Civil Society —Toward the Hydrogen Energy Society—" started right after the keynote speech.

EVENING: The Sake Barrel Breaking Ceremony was held to celebrate the 70th Anniversary of the University of Kitakyushu, using the sake produced in a collaboration between the University and local producer. Then, the Welcome Party started and participants were offered the sake in the courtyard. There was a local drum performance, followed by this conference's highlight event, projection mapping, which showed the 1500-year history of Kitakyushu in 3 minutes on the big wall of Conference Center.

因と見なされがちである現状を踏まえ、民族と宗教のモザイクで構成され、各国で固有の宗教と社会の関係が見られる東南アジア各国の事例をもとに、宗教と社会のかかわり、社会変化と宗教の役割などの普遍的なテーマを議論しました。

円卓会議３「人とロボットの共生社会をめざして」
ロボットが日常生活の中に入る時、どのように人々とかかわり合い、どんな働きをすべきか。人々とロボットが信頼関係を築き、共生していく社会は実現できるか。こうした問題意識に基づき、理工系研究者の発表の後、若手の哲学、デザインの研究者を交えて、人とロボットが共生する近未来の社会を構想しました。

AGI 経済フォーラム「アジアの人口問題と対策」
北九州市に本拠を置くアジア成長研究所主催の本フォーラムは、「アジア諸国は目下、少子高齢化、人口減少、人口移動、人口の都市化、外国人労働者の流入、性差などの人口問題を抱えており、その対策が急務となっている」という問題意識に基づき、アジア諸国が直面している様々な人口問題を検証しました。

午後：午後３時から北九州国際会議場メインホールにて開会式を挙行。共催の北九州市立大学の近藤倫明学長の歓迎の挨拶の後、明石康大会会長が開会を宣言しました。続いてトヨタ自動車の MIRAI チーフエンジニア田中義和氏による「燃料電池自動車 MIRAI の開発と水素社会の実現に向けたチャレンジ」と題する基調講演の後、北九州市立大学創立 70 周年記念シンポジウム「持続可能な発展とアジア市民社会－水素エネルギー社会の実現を目指して－」を開催しました。

夕方：松元照仁北九州副市長の祝辞をいただき、北九州市立大学創立 70 周年を祝して、大学の研究成果の麹と地域民間企業のコラボが醸造する日本酒「ひびきのの杜」で鏡開きが執り行われました。参加者がホールを出ると、奇跡的に雨が止んだ中庭で、

LEFT: Traditional drum performance.
RIGHT: State-of-the-art projection-mapping.
【左】小倉祇園太鼓の演奏
【右】北九州の歴史をまとめたプロジェクションマッピング

DAY 2 (October 1)

All the participants went to the Kitagata Campus of the University of Kitakyushu, where 225 papers were presented in 58 panel sessions, including 8 arranged group sessions. As the AFC aspires towards an international and interdisciplinary approach, each session was arranged by the topics such as “Peace”, “Happiness” and “Innovation”, which the presenters selected during the submission process. As such, each session did not necessarily consist of specialists in a specific academic field. This approach helped foster many rich and diverse discussions. Poster presentations were displayed next to the coffee break corner. A piano performance and a tea ceremony were conducted by the students and volunteers of the University of Kitakyushu.

The Best Presentation was chosen by two chairpersons in each of the 50 sessions (excluding arranged group sessions). Also two Best Posters were selected by the AFC Academic Committee.

In addition, the Academic Committee chose the Best Papers before the conference. 46 judges reviewed 115 full papers, which were uploaded to the AFC Online System by February 28, 2016 (with abstracts submitted by August 31, 2015). The papers were divided into 13 groups, and 4 reviewers read each group. Reviewers were asked to evaluate based on the following 5 criteria: (1) Is the theme of this paper in accordance with the AFC Theme “Environment and Coexistence”? (2) Is this paper perspicuous and persuasive? (3) Is this paper original and innovative? (4) Does this paper hold international aspects in some points? (5) Does this paper have an interdisciplinary approach? Each reviewer recommended two papers out of nine or ten in each group. After compilation, 20 papers were selected as the Best Papers.

EVENING: Farewell Party was held at the Station Hotel Kokura. After a brief conference report by myself as the Organizing Committee Chair, a toast was given by the Vice-president of the University of Kitakyushu, Dr. Saeko Urushibara. AFC

第２日　10月１日（土）

北九州市立大学北方キャンパスを会場に、８つの自主セッションを含む58の分科会で225本の論文発表が行われました。アジア未来会議は国際的かつ学際的なアプローチを目指しているので、各分科会は発表者が投稿時に選んだ「平和」「幸福」「イノベーション」などのトピックに基づいて調整され、学術学会とは違った多角的で活発な議論が展開されました。またポスター発表は地下１階の休憩所に隣接して行われました。休憩時間には北九州市立大学の学生やボランティアによるピアノ演奏やお茶のお点前があり、国際交流を盛り上げました。各分科会では座長の推薦により優秀発表賞が選ばれました。またポスター発表についても、AFC学術委員会により２本が優秀ポスター賞に選ばれました。なお優秀論文は学術委員会によって事前に選考されました。2015年８月31日までに発表要旨、2016年２月28日までにフルペーパーがオンライン投稿された115本の論文を13グループに分け、１グループを４名の審査員が、(1) 論文のテーマが会議のテーマ「環境と共生」と適合しているか、(2) わかりやすく説得力があるか、(3) 独自性と革新性があるか、(4) 国際性があるか、(5) 学際性があるか、という指針によって審査しました。各審査員は各グループの論文から２本を推薦し、集計の結果、上位20本を優秀論文と決定しました。

夕方：ステーションホテル小倉にてフェアウェル

LEFT: Farewell Party.
RIGHT: Presentation of Best Papers Awards
【左】ステーションホテル小倉でのフェアウェルパーティー　【右】優秀論文賞の授賞式

Academic Committee Chair, Dr. Hitoshi Hirakawa, Professor of Kokushikan University, gave a selection report and then the Award Presentation Ceremony was held. 20 authors of Best Papers came on the stage and the Conference Chair, Mr. Yasushi Akashi, handed a Certificate of Best Paper to a representative.

DAY 3 (October 2)

Participants took part in organized study tours and excursions, along with a hot spring experience.

ADMINISTRATION

The Third Asia Future Conference was hosted by the Atsumi International Foundation Sekiguchi Global Research Association (SGRA), co-hosted by The University of Kitakyushu and City of Kitakyushu, supported by many institutions and people. We listed the names of supporters and sponsors on page 237.

The Organizing Committee and Academic Committee for this conference were organized by former Atsumi scholars (known as “Raccoons”), and together with the SGRA Steering Committee members, they voluntarily took part in almost all aspects of the holding of the conference. A separate Organizing Committee was established in the University of Kitakyushu with more than 120 professors, staff members and student volunteers.

FUTURE OF AFC

AFC started in 2013 and was originally planned to be hosted five times within a span of ten years. But after three successful AFCs, the Atsumi International Foundation has decided to continue even after 2020. The Fourth Asia Future Conference will be held in Seoul, Korea, from August 24th to 28th, 2018.

パーティーを開催。今西淳子 AFC 実行委員長の会議報告のあと、北九州市立大学の漆原朗子副大学長が乾杯の音頭を取りました。その後、AFC 学術委員長の平川均国士舘大学教授から選考報告があり、優秀賞の授賞式が行われました。最後に、韓国未来人力研究院院長の李鎮奎高麗大学教授から第４回アジア未来会議の概要の発表がありました。

第３日　10月２日（日）

スタディツアー：水俣や北九州の環境視察を中心に、周辺の観光や温泉体験などを実施しました。

大会運営

第３回アジア未来会議は渥美国際交流財団関口グローバル研究会（SGRA）の主催、北九州市立大学と北九州市の共催で開催されました。また多くの方々から後援、助成、協力、協賛をいただきました（一覧を 247 ページに掲載）。

また運営にあたっては元渥美奨学生を中心に実行委員会、学術委員会を組織し、フォーラムの企画からホームページの維持管理、優秀賞の選考、当日の受付まであらゆる業務を担当しました。さらに北九州市立大学にも実行委員会が設けられ、延べ 120 名を超える教職員、学生ボランティアの方々のご協力をいただきました。

今後の予定

2013 年に始まったアジア未来会議会議は、当初 10 年間で５回の開催を計画していましたが、既に３回の会議を成功裡に終えることができたので、2020 年以後も開催を続けることになりました。第４回は 2018 年８月 24 日から 28 日まで韓国ソウル市で開催します。

ACKNOWLEDGMENT
謝辞

On the opening night, a huge projection mapping of
1500-year history of Kitakyushu was played out
on a big wall of the Convention Center.
We are sincerely grateful
to all the producers and creators
who joined force to this project.

開会式の晩、北九州国際会議場内庭の壁面に、
北九州 1500 年の歴史を凝縮した映像を
プロジェクションマッピングで投射しました。
このプロジェクトを実現させてくださった
関係者の皆様に
心より感謝申し上げます。

第３回アジア未来会議優秀論文集

The Best Papers of the Third Asia Future Conference

held in Kitakyushu, Japan

through September 29 to October 2, 2016

Estimating Household Benefits from the Cagayan de Oro River Basin Ecosystem

河川の下流域に暮らす住民は、そのエコシステムから多様な恩恵を受けている。その受益額を住民から徴収し、河川の管理費に充てる仕組みを考える。

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Abstract

Households, especially those in the downstream communities, benefit from the Cagayan de Oro River Basin (CDORB) ecosystem in terms of a stable supply of good quality water, flood control, food (fish) supply, recreational activities and biodiversity. These benefits encompass both use and non-use values which are integrated in a single estimate using the contingent valuation method (CVM). In the study, CDO households are asked for their willingness to pay (WTP) or contribute to watershed rehabilitation and preservation efforts in terms of a certain proportion of their water bill. Mean WTP per household range from 12.19% to 17.58% of the water bill. With a total household population of 137,465 in CDO (2010 Census) and a mean monthly water bill per household of PhP531.8, the total value of the perceived benefits that can be derived from the rehabilitation and preservation of the CDO River Basin is estimated to be about 9-13 million pesos (US$198-285 thousand) per month or 107–154 million pesos (US$2–3 million) per year. Further, results of the regression analysis imply willingness to pay or contribute for watershed rehabilitation is associated with the age of the respondent, the perceived condition of the watershed and its impact on the livelihood of the people. These findings can help focus and design public awareness and information campaign programs to promote widespread participation in a payment for environmental services scheme for the preservation of CDO River Basin.

Keywords river basin, ecosystem services, willingness to pay, payment for ecosystem services (PES), contingent valuation

Introduction

This research aims to measure the total economic value (TEV) of the flow of ecosystem services that accrue to households from the Cagayan de Oro River Basin (CDORB) in Mindanao, Philippines. The resulting estimates provide the rationale for the adaptation of the river basin-wide payment for environmental services (PES) scheme which Xavier University-McKleough Marine Center (XU-MMC) is currently undertaking in collaboration with the Cagayan de Oro River Basin Management Council (CDORBMC). Through PES, financial resources can be generated and used to reward local initiatives that restore and preserve the ecosystem. This approach has been identified as one strategic way to safeguard and enhance the continuing flow of environmental services from the CDORB.

This paper focuses on the household sector as a potential group of buyers or sources of rewards/payments for the providers of services to rehabilitate and preserve the CDO River Basin. As a well-protected watershed can provide security of water supply, fish

supply, recreation, biodiversity, flood control and increased resilience to extreme weather events and power supply, the general public, especially those in the downstream communities, stand to benefit substantially. Estimates of the economic benefits that can be derived by households from the CDO River Basin ecosystem can provide the underlying basis for the contributions that may be potentially collected from this sector. The poblacion and 40 village settlements (17 urban and 23 rural barangays) in Cagayan de Oro city comprise the biggest group of communities located at the downstream of the CDO River Basin.

The identification of the beneficiaries of ecosystem services and the estimation of the values of the stream of benefits they derive from the CDO River Basin will significantly facilitate the up-scaling and acceleration of the implementation of the CDORBMC/XU-MMC PES program that aims to reward the following up-stream communities for their rehabilitation and preservation activities: (1) MILALITTRA (Miarayon Lapok Lirongan Tinaytayan Tribal Association), the resource managers working in the sub-watershed in Batang, Mt Kalatungan; and (2) the Kitanglad-wide Council of Elders with the Tribal Guards (Kitanglad Guard Volunteers) of Mt Kitanglad.

It is also hoped that this research project, with all the surveys, key informant interviews, focus group discussions, research findings dissemination seminar/workshop and other activities it entails, can assist and contribute to the CDORBMC-XU-MMC PES information campaign, policy lobbying of PES/EbA-related laws in the Local Government Units, and the development and integration of PES in the Cagayan de Oro River Basin Master Plan.

The Study Site

The Cagayan de Oro River Basin (CDORB) has a total area of approximately 137,000 ha, spreading over 3 provinces (Bukidnon, Misamis Oriental

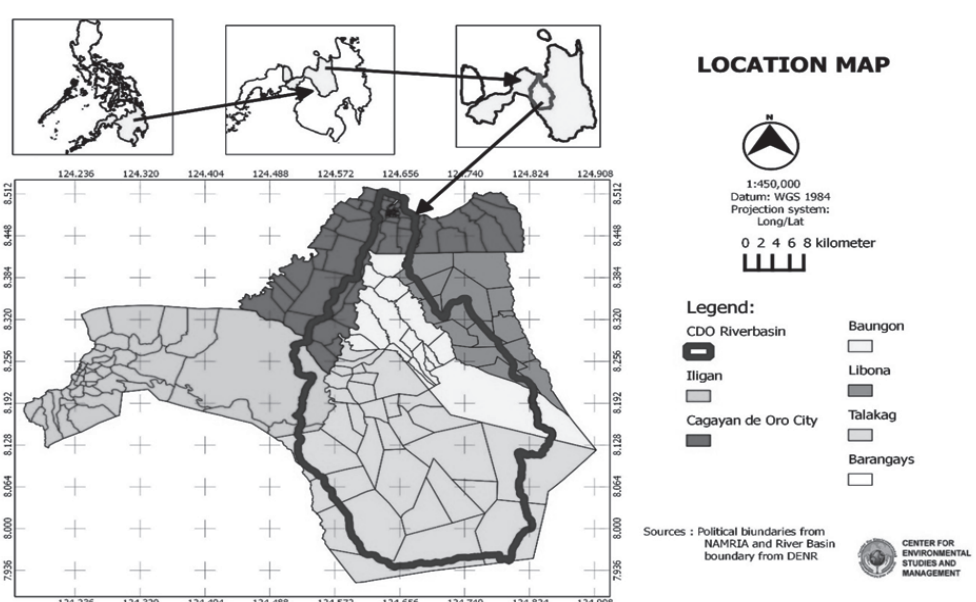

Figure 1. Cagayan de Oro River Basin Map
(Source: CDORB Management Council and Center for Environmental Studies and Management)

and Lanao del Norte), 3 municipalities (Baungon, Libona, and Talakag in Bukidnon), and 2 cities (Cagayan de Oro City in Misamis Oriental and a small portion of Iligan City in Lanao del Norte).

CDORB lies between 124°0'39" and 125°21'39" latitude and 7°32'20" and 8°57'39" longitude. It is bounded by Northern Cotabato in the south, by Lanao del Sur in the south west and by Bohol Sea in the north. The highest elevations within the CDORB can be found at the peaks of Mt. Kalatungan and Mt. Kitanglad at 2,824 masl and 2,899 masl, respectively. The steep slopes are predominant in the upland area in the south and southeastern portion of the basin where majority of the river's headwaters are located. They can also be found in the ridges of sub-basins where they serve as topographic divide between sub-catchments. Gentler slopes prevail along the coast and on the flat portions of several elevated terraces around the basin (CDO River Basin Management and Development).

Methodology

Households, especially those in the downstream communities, benefit from the Cagayan de Oro River Basin (CDORB) ecosystem in terms of a stable supply of good quality water, flood control, food (fish) supply, recreational activities and biodiversity. These benefits encompass both use and non-use values which are integrated in a single estimate using the contingent valuation method (CVM). CVM is a survey-based approach that is now used extensively in both developed and developing countries to incorporate values of non-marketed services and amenities in public policy/program assessment. Studies that employed CVM in estimating the total benefits from watershed rehabilitation and preservation programs include Alcon et al 2013, Almanza and Martinz-Paz 2011, Perni et al 2011 and Birol et al 2010.

In a CVM survey, respondents are asked to state their willingness to pay (WTP) for a good, service or public program. The stated WTP is the monetary estimate of the total benefits (tangible and intangible, use and non-use values) that is derived from the good, service or public program. (Please refer to Mitchell and Carson 1989, Bateman et al 2002 and Boyle 2003 for a thorough discussion of CVM.)

CVM Scenario and Survey Instrument. The instrument used for our CVM survey was finalized after a series of key informant interviews, focus group discussions and pre-tests.

The CVM scenario adopted the set-up of the on-going payment for environmental services (PES) scheme of Xavier University-McKeough Marine Center (XU-MMC) and Cagayan de Oro River Basin Management Council (CDORBMC). The watershed protection service providers and recipients of the rewards/payments are the upstream communities in Mt. Kitanglad and Mt. Kalatungan in Talakag, Bukidnon. The CDO Water District and other water utilities/providers (such as Rio Verde, subdivision management and maintenance groups, real estate developers, etc.) serve merely as a collection agent as each household's contribution/payment is computed as a certain proportion of the household's water bill and is included in the water bill. PES fund manager is Xavier Science Foundation and the monitoring authority is CDORBMC.

The WTP question followed the dichotomous choice format. As the common approach for public policy/program assessments, the CVM question was framed within the context of a referendum. Each respondent was asked if they would vote for the proposed CDORB rehabilitation and preservation program and be willing to pay an amount equivalent to a certain percentage of his/her household's current water bill. The respondents were told that if majority of the households would vote in favor of the program, then all, including those who did not vote for the program would be made to pay for the program.

In addition to the WTP valuation scenario, sections that elicit information on socio-economic profile, social capital, awareness and attitude on watershed and watershed protection, water supply, sanitation

and sewerage, water pollution[1], flood experience, fishing and tourism were included. Visual aids such as pictures of the CDORB, forest cover before and after proposed rehabilitation and preservation program were shown to the respondents as the CVM scenario was explained. Thus, the implementation of the survey itself, through the CVM scenario, served as an information campaign tool for the XU-MMC/CDORBMC PES program for the rehabilitation and preservation of the CDORB ecosystem. A number of respondents expressed appreciation for gaining relevant information on the state of the CDORB, its implications on their day-to-day living, and the rehabilitation and preservation plans. Focus group discussion and pre-tests were undertaken in setting the following six bid levels used in the final survey: 1%, 3%, 5%, 10%, 20% and 50% of the water bill.

Sampling and Survey Protocol. A total sample of 963 respondents was generated for the final survey through face-to-face interview with the household head or the member making expenditure decisions in the family. All barangays (40 Poblacion barangays and 41 other barangays; or a total of 81 barangays, only 17 of which are rural) of CDO City, the downstream portion of the CDORB, were included in the sampling frame. Systematic sampling procedure was employed in selecting the respondents in each barangay. The number of respondents in each barangay was set in proportion to the share of the barangay in the total CDO City population. The six bid levels were randomly assigned to respondents in all survey sites.

Data Analysis. The yes-no response to the dichotomous choice CVM question was analyzed using the framework developed by Hanemann (1984) based on the random utility model. A binary probit regression model was run to calculate parametric mean willingness to pay (WTP). For the non-parametric estimate, the Turnball formula was employed. Individual household's WTP was aggregated to arrive at total WTP.

Results

***Socio-economic Profile of Respondents*.** Majority of the responding household members are female (70%). This corresponds to the female spouse in the family. Our enumerators particularly asked for the household member who is responsible for budget allocation among household expense items. In the Philippine setting, this responsibility is usually assumed by the female spouse, whether or not she is earning income. On the average, the respondent is 48 years old, has 10 years of formal education (ie, a high school graduate), and a non-smoker.

74% of households own the house where they reside. The dwelling place of the average household has 2 bedrooms, 1 toilet, 1 television set, 1 radio, 1 electric fan, 3 phones (all kinds of phones, mobile and non-mobile), and no air-conditioning unit, washing machine, computer and automobile. On the average, each household has a total monthly income of PhP14,650/US$324.84 and a monthly electricity bill of PhP1.003/US$22.24.

***Knowledge and Awareness about the CDO River Basin*.** Survey results reveal some degree of familiarity among CDO households with watershed and the CDO River Basin ecosystem, in particular. Majority has correctly identified as a watershed an illustration that consist of lands and water bodies through which rain water drains over two other illustrations depicting mainly bodies of water. Nearly half of the respondents claimed that they are familiar with the CDO River Basin, and majority claimed they are aware that the basin includes the forestlands in Bukidnon from which the CDO River water originates and that the destruction of these forestlands would affect the supply of water in CDO, the downstream portion of the watershed.

At present, two years since the creation of the CDORBMC, only 15% of the respondents have heard about the council and its activities. Informa-

1 The questions on socio-economic profile, awareness and attitude on watershed and watershed protection, water supply, sanitation and sewerage, and water pollution are adapted from the survey instrument developed in Palanca-Tan 2015.

tion about the council was gained mainly through television and radio. No respondent was able to identify correctly the head of CDORBMC, implying the lack of solid knowledge/familiarity with the Council among survey respondents.

Survey respondents reveal a somewhat ambivalent attitude towards the degradation of CDORB and the need to address the problem. Although 75% of respondents think that the current condition of the CDO River Basin is already alarming, 50% believe that there are other more important environmental issues than this. Even if 63% agreed with the generic statement that "Filipinos must contribute to the rehabilitation and preservation of all forestlands in the Philippines", only about half are willing to make a financial contribution for the restoration and preservation of forests in CDO and Bukidnon. It appears that not many are willing to support a watershed program despite recognition of the watershed's role in their life, particularly with regard to water supply and flooding--two concerns closely identified with watershed degradation by the respondents.

The survey also reveals that households are more concerned about the impact of watershed degradation on water supply and flooding than on fishing, tourism, biodiversity and global warming.

CVM Scenario and WTP Question. In the CVM scenario, the plan to rehabilitate the CDO River Basin to restore and maintain forest cover to 40% of the watershed area was described. A map of the whole watershed area indicting forest cover before and after rehabilitation was shown to the respondent. A discussion of the Payment for Environmental Services (PES) scheme to finance rehabilitation and maintenance activities by upstream communities in Mt. Kalatungan and Mt Kitanglad under the supervision and monitoring of the CDORBMC then ensued. Before the WTP question, the respondent was asked if he/she had heard of this CDORB program before. About a tenth of the respondents answered in the affirmative and half of these respondents indicated televisions and radio as sources of the information. A few respondents indicated obtaining information from priests (F. Nathan and Fr. Ledesma) during mass, conversations with officials from the city hall and barangays, Xavier University, non-government organizations, internet and neighbors.

The proportion of respondents who would vote for the CDO River Basin program and be willing to pay for the program monotonically decreases as the bid level (or program cost) increases from 1% of the water bill to 50% of the water bill. Almost 77% of respondents would vote for the program and be willing to pay if the program cost is only 1% of their current water bill. If program cost is 50% of the current water bill, only 11% of respondents would vote and be willing to pay.

Water supply stability and flood and soil erosion control are the predominant reasons for voting and willingness to pay for the planned CDORB rehabilitation and preservation program. Fishing, recreation/tourism and biodiversity, other benefits that can be derived from the program, are not the primary factors for the "Yes" response.

Mean and Aggregate Willingness to Pay for CDORB Rehabilitation and Preservation. To determine the factors that influence the likelihood that a household in CDO would vote and be willing to pay for the CDO River Basin rehabilitation and preservation program, a binary logit regression of the "yes-no" response to the WTP question is run with bid, household income and other characteristics, respondent characteristics, awareness and attitude variables as independent variables. The results of two regression runs are shown in Table 1. Regression 1 includes all variables that intuitively could affect household's behavior. Regression 2 retains mainly the variables that turned out to be significant in regression 1.

Expectedly, the coefficient of Bid is significantly negative. This means that the household would be more likely to vote for the CDORB rehabilitation and preservation program if the cost of the program to the household is lower. This is consistent with the law of demand in economics. Household income did not turn out to be a significant factor. While gender of the respondent does not affect the likelihood of

voting and contributing for the program, age does. The younger the respondent, the higher the probability of voting for the program. Furthermore, respondents who think that the current state of the CDO River Basin is alarming and that their livelihood is affected by it are more likely to vote for the program. Respondents indicating that they would be willing to contribute money for the preservation of the forests in Bukidnon if these are part of the CDO River Basin are also more likely to vote for the program. Experience with flooding, water rafting; knowledge of rare fish species; and familiarity with the CDO River Basin, the Council and its plan are not significant.

The non-parametric estimate of the mean WTP for the CDO River Basin rehabilitation and preservation program is 12.19% of the water bill. A parametric estimate using the coefficients of regression 2 is 17.58%.

With mean WTP per household ranging from 12.19% to 17.58%, and with a total household population of 137,465 in CDO (2010 Census) and a mean monthly water bill per household of PhP531.8, the total value of the benefits (stable supply of good quality water, flood control, fishing and recreational value, biodiversity) that can be derived from the rehabilitation and preservation of the CDO River Basin would be PhP8.9-12.8 million (US$197,591-284,959) per month or PhP106.9-154.2 million (US$2.4-3.4 million) per year.

Conclusions

There is a substantial amount that can be potentially collected from households in Cagayan de Oro City on a regular basis. Collection of this amount in the form of an additional water charge shall ensure a sustainable flow of funds to reward the upland communities that will undertake watershed rehabilitation and preservation efforts. Thus, a more sustainable payment for environmental services (PES) scheme for the river basin may be realized. Currently, fund contributions in the PES scheme being implemented by the CDO River Basin Management Council (CDORBMC) is on a voluntary basis. CDORBMC approaches potential donors (mostly non-government organizations and some private corporations and individuals) to make one-time donations. This approach entails substantial transaction costs and may not yield sufficient funds for continuing watershed preservation activities.

Acknowledgement

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Table 1 Binary Logit Regression Results

Variable	Description	Coefficient	
		Run 1	Run 2
Constant		1.871**	1.476***
Bid	Program price to household as % of water bill	-0.082***	-0.081***
Household Income	monthly in PhP	0.000	0.000
Respondent Gender	1 if male, 0 if female	0.159	0.204
Respondent Age	in years	-0.025***	-0.023***
Respondent Education	In years	-0.005	-0.003
WaterConsumption	Household water consumption from main supplier	0.002	-
DrinkingWater	1 if respondent's household buys bottled water or from refilling stations for drinking water, 0 otherwise)	-0.114	-
EnvironGrpMember	1 if household is a membr in an environment-related group	-0.318	-
SeminarParticipate	1 if respondent has taken part in a seminar on watershed	-0.557*	-0.665**
FamiliarCDORB	1 if respondent is familiar with the CDORB	-0.240	-
HeardCDORBMC	1 if respondent has heard of the CDORBMC	-0.244	-
HeardCDORBPlan	1 if respondent has heard about the CDORB rehabilitation and preservation program	-0.033	-
ForestLossSendong	1 if respondent thinks loss of forest cover was a main cause of Sendong flooding	-0.012	-
LivelihoodEffect	1 if respondent thinks that the condition of the CDORB affects their livelihood	0.347**	0.351**
BukidnonForestPart	1 if respondent is willing to contribute if Bukidnon forest is part of the CDORB	1.197***	1.159***
CDORBStateAlarm	1 if respondent thinks that the current state of the CDORB is alarming	0.399**	0.459**
SendongFloodVictim	1 if household experienced flooding during Sendong and Pablo	-0.147	-
DumFloodRarely	1 if household rarely experiences flooding in current place of residence	-0.108	-
DumFloodAlways	1 if household always experiences flooding in current place of residence	0.293	-
WaterRafting	1 if household member/s has/have gone water rafting	0.332	-
KnowAhaan	1 if respondent knows ahaan	0.239	-
KnowPigok	1 if respondent knows pigok	0.149	-
Log-likelihood			
No. of observations			

Notes: * = significant at α=0.10; ** = significant at α=0.05; *** = significant at α=0.01.

『満文金瓶梅』に見られる清朝初期の満漢言語接触

The language contact between Chinese and Manchurian at Manchurian *Jin Ping Mei* in the beginning of Qing dynasty

明代に成立した長編白話小説『金瓶梅』は清朝初期に満州語に翻訳されたが、その行間のところどころに漢字が記されている。この『満文金瓶梅』の成立の謎と、漢字が付された理由を考察する。

荒木典子
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Abstract China had contacted with a lot of different cultures which were brought by the changes of dynasties. *Manchurian Jin Ping Mei*, which is translated from the Chinese vernacular novel *Jin Ping Mei* in Ming dynasty, resulted from the language contact between Chinese and Manchurian. This translation was published in 1708, the Emperor Kang Xi's era. There are mainly three mysteries in *Manchurian Jin Ping Mei*. First, who translated? Second, which text in Chinese did the translator base on? Third, we often could find Chinese characters between the lines, what is the purpose of them? This study analyzes the second and third mysteries. Teruhiro Hayata (1998) discovered basic text should be one of the books which were published in 1638-1644. We are going to compare the translation with these books. About the Chinese characters between the lines, some of researchers note that Chinese characters often appear next to person's name, place-name, and the names of government post and express signification of these nouns. And they mention that the purpose of these Chinese characters is to let Manchurians understand unfamiliar things from Chinese culture. The explanation is not satisfactory. Because most of all Manchurians didn't understand Chinese in the Emperor Kang Xi's era, a lot of Chinese novels were translated to Manchurian. The readers shouldn't understand what the Chinese characters explain. There may be a system that readers could study the Chinese culture and language by reading this translation.

Keywords translation, original text, Chinese characters between the lines

はじめに

『金瓶梅』は明代に成立した長編白話小説であり、『三国演義』、『水滸伝』、『西遊記』と並ぶ四大奇書の一つである。豪商西門慶を主人公とし彼と妻妾たちの日常を描いたもので、生々しい性愛描写のイメージが独り歩きする傾向があるが、登場人物による会話文が多く、口語の資料としての価値が高いことも夙に有名である。この『金瓶梅』の最初の翻訳は満洲語版であった。早田 1998:4 に拠れば、『金瓶梅』が西欧に知られたのは、その満洲語からの翻訳であるという。『金瓶梅』のみならず、清代には多くの漢語文学作品が満洲語に翻訳された。その理由は主に、清初の満洲八旗は漢語がわからなかった、統治者が漢族の統治階級を理解する必要に迫られていた、満族自身の文化的な要求があった、の三つだったという（季永海 2009:41）。入関前は軍事、法律、歴史に関わるものが翻訳され、入関後は経典や文芸作品も翻訳されるようになった（同 :42-43）。『満文金瓶梅』をめぐっては不明な点が多々あるが、まず以下の三つの問題が挙げられる。

①誰が翻訳したのか。

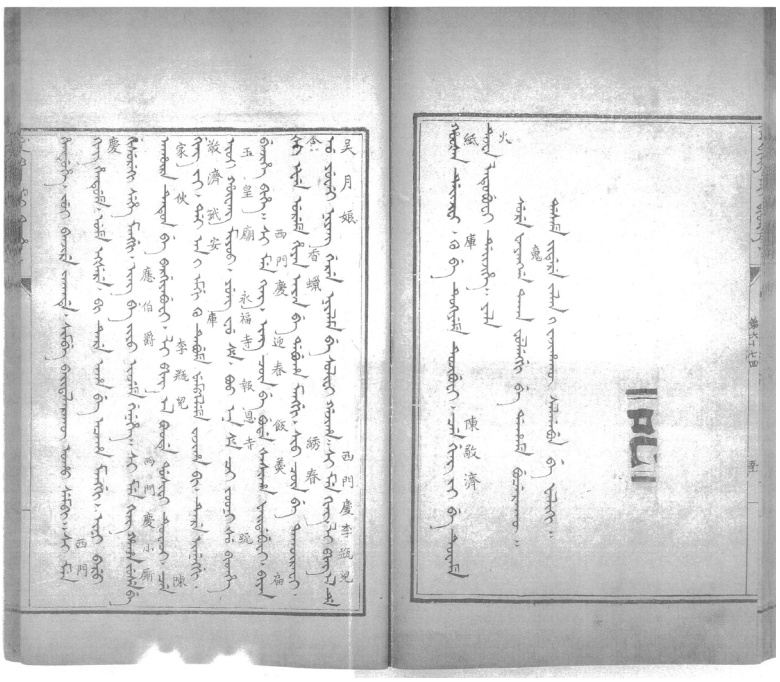

図　『満文金瓶梅』（京都大学人文科学研究所蔵本）

②金瓶梅は複数の版本が存在するが翻訳の底本（元になった本）はどれなのか。

③満文本文の行間に時折書かれている漢字語彙は何のためにあるのか。

①については和素や徐元夢などの名が挙がっているが決定打はない。本稿は②、③についての初歩的な調査報告である。

1．『満文金瓶梅』について

1.1『満文金瓶梅』の序文

現存する本書の刊本には巻頭に序文があり、「康熙四十七（1708）年五月穀旦」と記されている。季永海 2009:46 に拠れば順治・康熙年間（1644-1722）は漢語小説類の翻訳のピークだったという。

序文には以下の一節が見える。

ememu ursei hendurengge, ere bithe. ming gurun –i sula bithei niyalma lu-nan, yan-sung, yan-ši-fan -i ama juse be darime banjibuhangge sembi. inu waka be sarkū. gūnin ilibuha targacun　obuhangge, getuken iletu ofi, tuttu ubaliyambubufi, bi šolo de dasatame toktobuha.

（或人の言うには、本書は明の逸儒蘆楠が、厳嵩・厳世蕃父子を諷刺して著したものという。その真否は知らぬが、意を留めて訓戒を成していること明らかなので【満洲語に】翻訳させて、私が暇な時に推敲した）[1)]

この記述通りならば翻訳者と序文の筆者は別人ということになるが、両者の名前は書かれていない。また、本来『金瓶梅』諸版本についていた序跋の類は翻訳されていない。このことについて季永海（2007:65）は「満文訳本には一つ共通した特徴がある。原書の序文や跋文を削除し、あるものは自分で序文を付け加え、物語に入る。この簡潔で明快な形式は早期の満族文学の特徴のひとつでもある[2)]」と指摘している。

1.2『満文金瓶梅』の版本

現存する版本には、以下のようなものがある。

【刊本】

a. 中央民族大学図書館蔵本。全百回、六函四十冊。匡郭内のり高さ 18.5㎝、幅 14cm、白口、単魚尾、四周双辺。半葉九行、毎行字数不等、竹紙印[3]。

b. 中国国家図書館蔵本。

c. 静嘉堂文庫蔵本。

d. 天理図書館蔵本。

e. 趙則誠先生蔵本（残本）。

f. 中国社会科学院民族研究所蔵本（残本）。

g. 北京民族文化宮蔵本（残本）。

h. カナダ・トロント大学東亜図書館蔵本（アメリカ・アジア文化研究センター蔵本の影印だと言うが、Geside Eastern Library of Princeton University 蔵本の影印の可能性もあるという）。

以上の刊本 a~h については王汝梅 2012 に所在、及び書誌情報が記載されている。

i. 京都大学人文科学研究所蔵本。

j. 中国・首都図書館蔵本（残本）。

【抄本】

いずれも王汝梅 2012 の記述による。

k. 大連図書館蔵本。（タイトルは『世態炎涼』）

l. 吉林大学図書館蔵（精写本）。

m. 中国・首都図書館蔵本（残本、「孔徳学院」の印あり）。

筆者が実際に見たのは c, i, j, m である。刊本 c, i, j の書誌情報は a と同じであり、同版と思われる。Chinese Material Center, INC. San Francisco 1976 という縮小した影印本もある。この本は稀に落丁が見られるが i と同版と考えられる。本稿の調査で主に使ったのはこの影印本である（落丁は i で確認した）。

注1）翻訳は早田 1998:15 による。

2）以下、特に断りのない限り日本語訳は筆者（荒木）による。

3）宋代以降、竹を原料として作った茶色がかった脆弱な紙。（堀川 2010:119）

2．翻訳の底本について

年代から考えると、底本の候補となり得る『金瓶梅』には三系統ある。およその刊行年代順に並べると以下のようになる。

ア.『金瓶梅詞話』万暦 45（1617）年以前刊。詞話本と呼ばれる。年代は現存最古の刊本の序文による。複数の刊本が現存しているが、一部分が差し替えられている他は皆同版と見なせる。

イ.『新刻繍像（批評）金瓶梅』崇禎年間（1628-1644）刊。改訂本、または崇禎本と呼ばれる。アにかなりの改訂を施している。第一回の内容が異なり、各回目（タイトル）も変更が多い。アにおけるプロットの矛盾、誤字脱字、わかりにくい語彙も改められている。複数の刊本があり、版式から二つの系統に分かれる（後述）。

ウ.『第一奇書金瓶梅』（1695）。張竹坡本と呼ばれる。張竹坡が批評（コメント）をしているため。内容はイとほぼ変わらない。

アとイはかなりの違いがあり、イとウの差はそれほど大きくない。各回目を見るだけでも、または第一回を読むだけでも、満文本がアに基づいたものではないことはすぐにわかる。では、改訂本か張竹坡本なのかということになるが、早田 1998:4-5 では張竹坡本である可能性を否定している。

『満文金瓶梅』の底本が目に附く限り皆、張竹坡評本とされているのは不可解である。（中略）例えば、第四十八回末尾の蔡太師の上奏文七条に『詞話本』及び『崇禎本』は「端的上面奏行【词话本：行，崇祯本：着】那七件事」として一千字近くを費やしているのに對し、『張竹坡本』では七条を五条にし且つ「大约上面奏着」として僅々五十字以下の箇条書、前文を入れても百字に満たない簡略な物にしてしまっている。『満文金瓶梅』では、wesimbuhe baita ya nadan hacin seci、《上奏した事はどんな七件かと言えば》として、三十二丁表から三十九丁裏まで八丁（十六頁）近くを費やして

翻訳している。底本の『詞話本』でない事が明らかである以上、『張竹坡本』を底本にして翻訳し部分的に『詞話本』なり『崇禎本』なりから本文を持って来たとしない限り、このような翻訳の底本となりうる物は、現在本稿の筆者の知る限り、『崇禎本』系統のものしか無い。それとても筆者の眼にしうる『崇禎本』そのままの翻訳とはとても言える代物でない―満訳に際しての故意の簡略化、不注意による脱落、誤訳を考慮しても猶問題になる箇所があるのである。それが『崇禎本』諸本を綿密に勘校する事により解決されるのかどうか現在明らかでない。

複数残っている「崇禎本」(「改訂本」)の中のどれであるか、というところまで絞られた。勿論、未発見の版本であるという可能性もあるが、今回の調査で一つの系統を候補から消すことができたのである。

周文業 2011:1 に拠れば、現在残っている改訂本は版式の違いから以下の二つの系統に分けられる。

一　北京大学図書館蔵本（北大本）を代表とする系統。天理大学図書館蔵本、上海図書館蔵甲本及び乙本、天津図書館蔵本など。版式の特徴は、毎半葉十行、毎行二十二字、毎半葉合計二百二十字、一葉は四百四十字になる。

二　内閣文庫蔵本を代表とする系統。東京大学東洋文化研究所蔵本（東大本）、北京首都図書館本（首図本）など。版式の特徴は毎半葉十一行、毎行二十八字、毎半葉合計三百八字、一葉は六百十六字になる。

二つの系統は、版式は異なるが文章は基本的に同じである。しかし、原稿を書き写す時や製本する時に手違いがあったらしく、二の系統、またはその中のいずれかの版本にしか見られない脱落があるという。以下、今回の問題に関わるものだけ取り上げて論じる。

【周文業 2011 が指摘する二の系統の脱落箇所（一部)】

ⅰ）二の系統の東大本、内閣本、首図本を一の系統である北大本と比べると、第 59 回 42 葉～43 葉の間から 616 文字（二の系統の一葉分の字数）脱落していることがわかる。

ⅱ）二の系統の東大本、内閣本、首図本の第 43 回 17 葉からは 20 字脱落している。

ⅲ）二の系統の東大本、内閣本、首図本の第 77 回 34 葉から 17 字脱落している。

『満文金瓶梅』でこの箇所の内容を確かめたが脱落は確認できず、一の系統の天津本と一致する。具体例としてⅲ）の状況を紹介する。

北大本・第 77 回・第 34 葉・表・第 7 行

廉使趙訥綱紀肅清市民服習 , 提學副使陳正彙操砥礪之行嚴督率之條 , 兵備副使雷啟元軍民咸服 ,…

（廉使趙訥（れんしちょうとつ）は、綱紀粛正にして、士民服習す。提学副使は、砥礪（しれい）の行を操（と）り、督率の条を厳にす。兵備副使雷啓元（らいけいげん）は…）[1]

東大本・第 77 回・第 34 葉・表・第 4 行

廉使趙訥綱紀肅清市民服習 ,（脱落）兵備副使雷啟元軍民咸服 ,…

北大本の下線部が東大本では脱落している。周文業 2011:17 では、この部分は公文（原文は“邸報”＝「官報」となっている）であるため大変わかりにくく、書写する時に脱落してしまったのであろう、と述べている。しかし満文本では第 77 回・第 35 葉・表・第 5~6 行に訳出されている。

以上より、東大本を始めとする二の系統は満文本の底本の候補から外すことができる。

注 1）日本語訳は小野忍・千田九一訳『金瓶梅』1974 年岩波文庫による。

3．漢字語彙の併記について

3.1　併記語彙の種類と先行研究の見解

冒頭の図で示したように、満文本文の行間にはところどころ漢字語彙が書かれている。これらは隣接する満洲語に対応しているいわば傍訳である。康熙四十九年の序を持つ『満漢合璧西廂記』のように全文満漢併記という方法は取らず、部分的に漢字語彙が付されている。この現象については当然先行研究でも触れられている。

a. 本文中、人名と一部の語彙には漢文の傍注が

ある。熟語や韻文にも漢文が付されている。（黄潤華 1983:10）

b. 全文が満文であるが、満族にとって分かりにくい人名、地名、官名及び成語、熟語、韻文などの横には漢文が付されている。（季永海 2007:65）

c. 満族が読んでわかるように、人名、官名、地名、詩詞などの満文の横に漢文を加える。（季永海 2009:46）

d. 固有名詞、特殊語彙には漢字で傍注をする。（王汝梅 2012）

漢字の併記される語彙が人名、地名、官職名などに集中していることは指摘のとおりである。筆者の調べによると、第 1 回だけで延べ 700 弱の箇所に漢字語彙またはフレーズの併記が見られた。大部分は名前（登場人物名―本名・あだ名・呼び名―、歴史上の人物名、架空の人物名、神や仙人の名）で 474 例ある。次に多いのは地名（実在のもの、虚構のもの、天上にあるとされるもの、建築物など）で 47 例、官名は 17 例、職業は 6 例、四字以上からなる熟語、成語、しゃれことば[1] などが 11 例、書名・詞牌 2 例、その他がおよそ 130 例ある。その他としたものには楽器、動作、ゲーム、服飾品、飲食物が含まれている。一方で、漢字語彙を付す目的については「満洲族にとってわかりにくい概念を説明するため」と解釈するのは説得力を欠く。先に引いた季永海 2009:46 では「順治・康熙年間（1644-1722）は漢語小説類の翻訳のピークだった」の後に続けてこうも述べているのだ。

この時期の八旗人たちはまだ直接漢語の原著を読むことができなかったので（筆者注：当時読まれた小説は）すべて満文本だった。清代後期には小説は既に極めて少なくなり最も有名な『擇訳聊斎志異』は満漢合璧本である。このころは満洲語が衰退し、多くの八旗人たちは満洲語ができなくなっていたから、かれらは漢語ではなく満洲語を学んでいたのだ。

当初は漢語がわからないから満洲語の翻訳を読んでいるというのになぜわかりにくい言葉をわからせるために解説に使うのが漢語なのか。補助としての役割は期待できないのではないだろうか。筆者が考えるのは、むしろ満洲語主体の物語を読みながらすこしずつ漢語を学習させるための手段だったのでは、という可能性である。

3. 2　漢字語彙併記の目的を探るために

試みとして、満文本に併記されている漢字語彙は漢文本から忠実に写し取られたものなのかどうか調査した。しかし漢文による原著は特定できていないので、2 章の調査により、目下原著の可能性が比較的高いと思われる北大系統の改訂本と満文本を対照した。筆者の手元にはこの系統のうち天津本の影印本（2012 年北京、線装書局）があるのでこれに拠った。

満文本第一回の漢字語彙が、天津本第一回の該当箇所でどのように表記されているかを書き留めていった。その結果、延べ 135 箇所に用字の違いが見られた。内訳は以下のとおりである。必要に応じ実例の一部または全部を挙げる。

Ⅰ　異体字　4 例

天：冰消雪散（2b-7）　満：氷消雪散（6a-7）juhe tuhere, nimanggi wendere

Ⅱ　用字や発音が異なる別の語　12 例

天：抹牌（3b-3）　満：骨牌[2]（8a-6）　gu-pai

天：寺院（6b-9）　満：寺廟（15b-1）sy-miyoo

天：僧家（7b-4）　満：和尚（17a-6）hūwašan

天：城隍社令（12a-10）　満：城隍土地（29a-3）ceng-hūwang tu-di enduri

天：花 二 爹（7a-10）　満：花 二 爺（16b-8）hūwa-el-ye

天：二爹（7a-11）　満：二爺（16b-8）el-ye

天：吳師父（9a-5）満：吳師傅（20b-9）u-sefu

Ⅲ　登場人物の名前に対する操作。　116 例

登場人物には複数の呼称がありうるが姓名の揃った形に集約する傾向がある[3]。天津本では名だけだったところに姓を足す、人称代名詞や単に“婦人”（女）としているところを姓名にする、など。

天：伯爵（6a-6）　満：應伯爵（13b-7）ing-be-jiyo

天：他（4b-4）　満：西門慶（10b-4）si-men-king

天：那婦人（18a-1）　満：潘金蓮（44b-2）pan-gin-liyan

天：這元帥（10a-6）　満：馬元帥（23b-2）ma-yuwan-šuwai

また、末尾の“兒”を取る[4]。

天：桂姐兒（6a-7）　満：桂姐（14a-5）gui-jiyei

天津本では省略されていた文の主語や目的語としての人名が、満文本では書き足されている場合がある。

天：路上撞着謝希大，（　）笑道（14a-8）（道で謝希大に出くわした。[謝希大は]笑って言った）

満：jugūn de siyei-hi-dai ucaraha,siyei-hi-dai injeme hendume（34a-9）

（道で謝希大に出くわした。謝希大は笑って言った）

その他の例。

天：相（15a-9）　満：相公（37a-6）

天津本では“若蒙恩相抬舉”となっている。恐らく語調を整えるため“相公”としなかったのだろう。満文になると漢文における語調は関係がなくなる。

Ⅳ　地名でも人名と同様の操作を施す場合がある。3例

天：本縣（3b-11）　満：清河縣（9a-3）cing-ho-hiyan

天：縣（4b-3）　満：清河縣（10b-2）cing-ho-hiyan

以上全ての例において、満洲語は併記された漢字語彙に対応していることが指摘できる。このことから、まとまった文あるいは回を先に満文に翻訳した後、満文に合わせて漢字語彙を適宜書き足したと推測できる。

これらの例を見ていると、天津本よりも漢語が単純化する傾向があると思われる。特に人名については、同じ人物についての複数の呼び方を覚えなくて済む、二回目以降も人称代名詞を使わず繰り返し名前を出すことで考えなくて済むようにして負担を減らしているのではないだろうか。更に興味深いのはⅡである。漢語語彙でも満洲族に受容された時期、接する機会の多寡といった理由により比較的わかりやすい語彙とそうではない語彙の差というものがあってもおかしくない。外来の言葉を解説するために当該の言語の中でも先に受け入れ、馴染んでいるものを使うという事例は他の資料にも見られる。今野 2009:116 では、江戸時代に岡島冠山によって編纂された唐話辞書『唐話纂要』を紹介し、以下のような現象を指摘している。この辞書は、漢語の見出し語の右に発音をカタカナで振り、下に日本語訳を書くスタイルである。見出し語“安當”は発音が「アンタン」、日本語訳は「アンドスル（安堵する）」となっている。「安堵」はそもそも漢語である。既に日本語に溶け込んでいた漢語によって新しく入ってきた漢語を解説しているのである。 この現象によって「漢語の層」が観察できると今野氏は指摘する。ただ上記の語彙がそれぞれ満洲族に受容された時期が前後するもの同士でペアを成しているかどうかという裏付けが必要である[5]。このうち、“吳師父”と“吳師傅”は誤解か書き間違いではないだろうか。“師父”は僧、尼、道士に対する敬称であるが“師傅”だと師匠や親方という意味になってしまう。

3.3　満洲族にとっての「漢語の層」

前節のⅡを突き詰めると満洲族の漢語受容における「層」を詳しく知ることはできるのだろうか。第2回、第3回まで調査を行ったところ、同様な例が見つかった。

第3回で“曆日”から“黃曆”に変わっている。“黃曆”は清代以降の言い方である。朝廷が黄色い紙に印刷したので“皇曆”または“黃曆”と言うようになった。満文本刊行の時点ではあってもおかし

くない語であり、こちらの方が馴染んでいたのだろう。このようにそれぞれの語の背景を確かめながら第 4 回以降継続して調査を行いたい。

注 1）漢語では“歇後語”（後半を欠く言葉）という。上の句で下の句の意味を推測させるもの。『金瓶梅』は多用することで有名。寺村 2008:191 によると全書から採取した 136 例の内 91 例、つまり 2/3 にあたるしゃれことばに漢文がそえられているという。

2）“抹牌”、“骨牌”は、かるた、カードゲームを指す。

3）“西門大人”（西門の旦那様）など天津本に書かれているあだ名、呼び名のままにしている例もある。

4）わずかだが“兒”を残してある例もある。天：天福兒（13a-4）満：天福兒（31a-8）tiyan-fu-el

5）底本は北大系統の別の本であるという可能性も捨てきれない。

4．小結

乾隆年間を過ぎて満洲語が忘却されてからのことについては『清文指要』、『清文啓蒙』といった満洲語会話本の研究によってだいぶ知られるようになってきた。しかし、清初の満漢両語の接触の初期段階についてはまだよくわかっていない。『満文金瓶梅』はこの時期のことを知るための貴重な資料である。今回の調査により底本をもう一段階絞り込むことができ、底本に近いと思われる天津本を利用した併記された語彙の対照を通して、意識的な操作の下で漢文の併記を行ったことが明らかになった。今後は「漢語の層」についての調査を続け、満洲族の初期の漢語受容について考察を進めたい。

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表　漢文併記が天津本とは類似の別の語になっている例

回	天津本		満文本の併記		満洲語
2	我與你撥火	4.b.7	我替你撥火	8.a.2	bi sini tuwa bedekdebure
	只要一似火盆來熟	4.b.7	只要火盆一似來熟	8.a.2	fileku-i yaha-i gese oci teni sain
	拳頭上也立得人，肫膊上走得馬	8.b.7	拳頭上也立的人，肫膊上走的馬	15.a.4	nujan de niyalma ilici ombi. gala de morin yabuci ombi.
	花朵身兒	11.b.8	花朵的身兒	19.b.4	beye sunggeljeme ilhai adali
	淮上	14.a.5	淮安	25.a.1	hūwai-an
	嫦娥	16.a.9	姮娥	29.a.4	heng-e
	做牽頭，做馬百六	18.a.6	做牽頭，做馬泊六	32.b.3	hehe be yarhūdame yabumbi
3	藍紬	2.b.8	藍緞	4.a.7	lamun suja
	白紬	2.b.8	白緞	4.a.7	šanggiyan suja
	曆日	2.b.9	黃曆	4.a.7	hūwangli
	胡桃	7.a.3	核桃	11.b.3	mase usiha
	折牌	12.b.2	骨牌	20.b.6	gu-pai

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※この他、早田輝洋先生入力のデジタル版『満文金瓶梅』を大いに活用した。

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Ethnobotanical Study of *Oke Sou:* Traditional Herbal Drink from Lako Akediri Village in West Halmahera, Indonesia

ジャワ島（インドネシア）伝統の薬草ドリンク “Oke Sou”。伝承されてきた製法・成分を分析したところ新薬の開発につながる可能性が見えてきた。

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Abstract

Oke sou is a herbal drink from Lako Akediri village in West Halmahera, to maintain health of women's reproductive function. This drink is consumed when women get their first menstruation. This is the first study of *Oke sou* to document all plant species used in preparation of the herbal drink. It describes phytochemical content of the most cited plant based on the study of literature. Ethnobotanical data were collected using semi-structured interviews with indigenous medical practitioners and local women (30 respondents). Plant specimens were collected from the habitat, made into herbarium voucher, and then identified. We recorded as many as 66 plant species from 59 genera belonging to 37 families are used in making the *oke sou*. The most frequently mentioned plants (>5 respondents) are (number of respondents; part used), *Cananga odorata* (Lam.) Hook.f. & Thomson (10; bark), *Curcuma longa* L. (8; rhizome), *Cymbopogon citratus* (DC.) Stapf. (7; stem), *Kaempferia galanga* L. (7; rhizome), *Myristica fragrans* Houtt. (7; fruit and seeds), *Syzygium aromaticum* (L.) Merr. & L.M. Perry (7; leaf & flower), *Cynometra cauliflora* L. (6; bark), and *Tamarindus indica* L. (6; bark). These plants are already well studied regarding phytochemical content in maintaining women's reproductive health. Therefore, the results of this study can be used as a reference for the development of medical products based on local knowledge.

Keywords ethnobotany, oke sou, herbal drink, women, West Halmahera

Introduction

Today in Indonesia, traditional herbal drinks are still used. These drinks have become a part of living culture to maintain body health or beauty care, such as *jamu*. *Jamu* is a traditional herbal drink from Java that has been used for a long time. This herbal drink can consist of a single or some mixed medical plants(17). It is used to treat certain diseases and to maintain good health.

Not only in Java, traditional herbal drinks are also found in other regions such as Bali. Sujarwo et al. (2015) found that the Bali community, especially in ancient villages, still produce and consume *loloh* to prevent and treat various ailments. *Loloh* is the most common herbal drinks in Bali which generally prepared as decoctions of some medical plants.

Traditional herbal drinks are also found in the eastern region of Indonesia, precisely at Lako Akediri village, District West Halmahera, North Moluccas. This herbal drink is made from various kind of plants at Lako Akediri village. It is believed efficacious to maintain health of girls' reproductive function and to eliminate body odor of them. Villagers at Lako Akediri call that herbal drink by the

name of *oke sou*.

In Indonesia, the knowledge of traditional medicine is usually passed down orally[4]. This is true in the inheritance of knowledge about the composition of plants used in *oke sou* herbal drink. Oral inheritance of knowledge is highly vulnerable to disappear because of no documentation can be inherited[22]. Moreover, research on *oke sou* herbal drink has not ever been implemented. Therefore, an inventory about its diversity of plant species is quite important to be conducted.

There are two objectives of this research. First, to inventory all plant species used in preparing *oke sou* herbal drink. Second, to describe and to explain phytochemical content of the most frequently mentioned plants used in *oke sou* herbal drink at Lako Akediri village, West Halmahera, North Moluccas - Indonesia.

Material and Methods

Study Area

The study was conducted at Lako Akediri Village (Fig. 1), on May - June 2014 and October 2014. Lako Akediri Village (Fig. 2) is geographically lied on coastal area E 27°22'17.323'' – E 127°37'5.214" and N 0°58'13.505" – N 1° 8'5.332". Total area of Lako Akediri Village is 10 hectares, which located at an altitude 31 meters above sea level with average rainfall 15 mm/month[16]. The population in 2014 was 344 people; 175 males and 169 females. The number of households was 85. As many as 98% of the people at Lako Akediri Village come from Sahu tribe, while the rest are ethnic immigrants, such as Buton, Bugis, and Sasak. The agricultural plants at Lako Akediri Village are tubers, corn, coconuts, clove, and nutmeg [16].

Ethnobotanical Data Collection

The ethnobotanical data in this research consists of interview results and list of used plant species. Interview data were collected using semi-structured interviews method that conducted individually on key respondents and general respondents. Key respondents are persons who are considered having more knowledge about *oke sou* herbal drink, such as

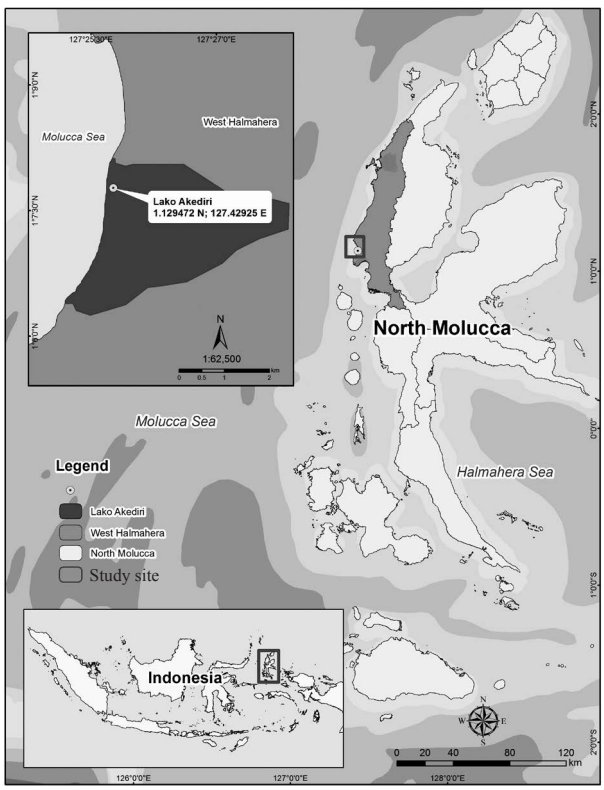

Fig 1. Study site at Lako Akediri Village, Sub District Sahu, District West Halmahera, North Moluccas – Indonesia

(Courtesy of Lesmana, A.B. 2015)

Fig 2. Lako Akediri Village on Sub District Sahu

(Photo by Wakhidah A.Z. 2014)

indigenous medical practitioners. General respondents are local women who ever participated in producing *oke sou* herbal drink with age range of 12–60 years old (30 respondents).

Plant specimens were collected from the habitat together with key respondents. Then plant specimens were made into herbarium voucher. After that specimens were identified at Laboratory of Plant Taxonomy in Department of Biology, Universitas Indonesia.

Data Analysis

Data were analyzed using quantitative and qualitative approaches. Quantitative analysis was conducted to obtain total plant species and families, also to know the most frequently mentioned plants and parts used in *oke sou* herbal drink. Qualitative analysis was aimed to determine phytochemical content in most frequently mentioned plants used in *oke sou* herbal drink at Lako Akediri village.

Results

Plant species used in "oke sou" herbal drink

The investigation recorded as many as 66 plant species from 59 genera used for preparation of *oke sou* herbal drink (Table 1). These plants belong to 37 families which are Acanthaceae, Fabaceae, and Lamiaceae being the most represented families (6 plant species each family). There are eight plant species that most frequently mentioned by respondents (plant species; part used): *Cananga odorata* (Lam.) Hook.f. & Thomson (bark), *Curcuma longa* L. (rhizome), *Cymbopogon citratus* (DC.) Stapf. (stem), *Kaempferia galanga* L. (rhizome), *Myristica fragrans* Houtt. (fruit and seeds), *Syzygium aromaticum* (L.) Merr. & L.M. Perry (leaf & flower), *Cynometra cauliflora* L. (bark), and *Tamarindus indica* L. (bark).

The plant parts, which are harvested to prepare *oke sou* herbal drink, are bark, leaves, stems, rhizomes, flowers, fruits, seeds (Fig. 3). Bark is being the most frequently used part in preparing *oke sou* herbal drink

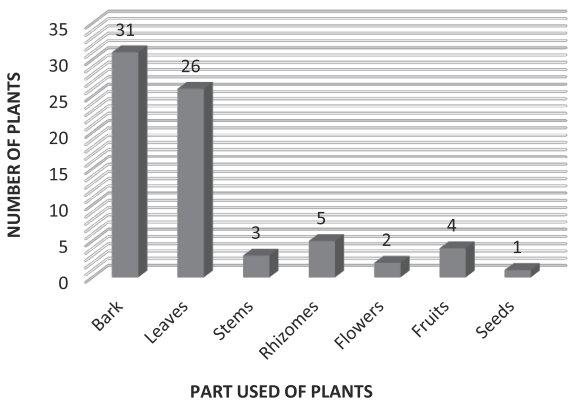

Fig 3. Number of species and plant parts used in preparing *oke sou* herbal drink

(31 species). Meanwhile, the least frequently used part is rhizomes. The data showed that aerial parts (79%) are preferred than underground parts (21%). This may be because of the easier accessibility in picking plant source and the greater quantity of aerial parts than underground parts [(1)(7)].

Preparation of "oke sou" herbal drink

The preparation of *oke* sou herbal drink is started by classifying the same part of the picked plants, such as leaves with leaves, bark with bark, or root with root. Then, each group is crushed separately. The collisions were given water and then squeezed in a clean cloth - same as the technique in making juice-. After that, the juice of each part of the picked plants is all mixed, then boiled until boiling. When boiled, *oke sou* herbal drink is mixed with herb spices to improve the acceptability of this herbal drink. Usually the choices of herb spices are *Coriandrum sativum* L., *Piper nigrum* L., *Curcuma longa* L., *Zingiber officinale* Roscoe., *Cymbopogon citratus* (DC.) Stapf., *Kaempferia galanga* L., *Myristica fragrans* Houtt., and *Syzygium aromaticum* (L.) Merr. & L.M.Perry. The *oke sou* herbal drink is ready to be consumed when its color becoming as brown as the color of strong tea.

Oke sou herbal drink is only taken by a girl when getting her first menstruation in traditional ceremony

Table 1. Plants used in preparing *oke sou* herbal drink at Lako Akediri Village, Sub District Sahu, District West Halmahera, North Moluccas–Indonesia. The life form, vernacular name, part used, and number of informants are also provided.

Plant families and species	Life form	Vernacular Name	Part Used	Number of Informants
Family: Acanthaceae				
Graptophyllum pictum (L.) Griff	clump	*kabi-kabi merah*	leaf	1
Graptophyllum pictum 'Roseum variegatum'	clump	*kabi-kabi putih*	leaf	1
Hemigraphis alternata (Burm. F) T. Anderson	herb	*lire buntal (♀)*	leaf	4
Hemigraphis rependa(L.) Hall. F	herb	*lire panjang (♂)*	leaf	1
Justicia gendarussa Burm. F.w	herb	*gandarusa*	leaf	3
Ruellia simplex C. Wright.	herb	*Puli*	leaf, stem	2
Family: Anacardiaceae				
Mangifera sp.	tree	*mangga dodol*	bark	5
Family: Annonaceae				
Annona muricata L.	tree	*nangka belanda*	bark	5
Cananga odorata (Lam.) Hook.f. & Thomson	tree	*kenanga*	bark	10
Family: Apiaceae				
Coriandrum sativum L.	herb	*surai*	leaf, seed	2
Family: Apocynaceae				
Alstonia scholaris R. Br.	tree	*hange*	bark	4
Family: Asteraceae				
Blumea balsamifera (L.) DC.	herb	*madikapu*	leaf	1
Wollastonia biflora (L.) DC.	herb	*cinga-cinga*	leaf	1
Family: Bombacaceae				
Durio zibethinus L.	tree	*durian*	bark	3
Family: Burseraceae				
Canarium amboinense Hoch.	tree	*kenari*	bark	1
Family: Clusiaceae				
Garcinia mangostana L.	tree	*manggis*	bark	5
Family: Combretaceae				
Terminalia catappa L.	tree	*ngusu*	bark	2
Family: Commelinaceae				
Tradescantia spathacea Sw.	herb	*bia-bia*	leaf, flower	3
Family: Convolvulaceae				
Merremia peltata (L.) Merr.	herb	*koge*	bark	1
Family: Cyperaceae				
Scleria sp.	shrub	*cakagole*	bark	1
Family: Euphorbiaceae				
Homalanthus novoguineensis (Warb.) K. Schum.	tree	*gidilule*	bark	1
Jatropha curcas L.	clump	*balacai putih*	leaf	5
Macaranga tanarius (L.) Müll.Arg.	tree	*same*	bark	1
Mallotus apelta (Lour.) Müll.Arg.	tree	*lufiti*	leaf	4
Family: Fabaceae				
Albizzia saponaria (Lour.) Miq	tree	*fau-fau*	bark	1
Cynometra cauliflora L.	tree	*mano mano*	bark	6
Pongamia pinnata (L.) Pierre	tree	*hatehira*	bark	4
Pterocarpus indicus Wild.	tree	*ligua*	bark	2
Sesbania grandiflora Pers.	tree	*Turi*	bark, leaf	2
Tamarindus indica L.	tree	*asam jawa*	bark, leaf	6
Family: Lamiaceae				
Callicarpa rubella Lindl.	herb	*ngaai madudera*	bark	4
Coleus scutellariodes Bth.	herb	*mayana*	leaf	5
Leucas zeylanica (L.) R.Br.	herb	*gofu hairani*	leaf	2
Orthosiphon grandiflorus Bold.	shrub	*kumis kucing*	leaf	4
Premna serratifolia (Blanco) Benth.	tree	*gumira*	bark	3
Vitex pinnata L.	tree	*gofasa*	bark	2
Family: Lauraceae				
Cassytha cf. *filiformis*	climber	*tali kuning*	stem	2
Family: Lygodiaceae				
Lygodium sp.	herb	*gumoho*	leaf	1
Family: Magnoliaceae				
Michelia champaca L.	tree	*cempaka*	bark	4

Plant families and species	Life form	Vernacular Name	Part Used	Number of Informants
Family: Malvaceae				
Kleinhovia hospita L.	tree	*liwui*	bark	2
Family: Meliaceae				
Xylocarpus moluccensis (Lam.) M. Roem	tree	*lolesou*	bark	3
Family: Moraceae				
Ficus cf. r*ibes*	tree	*senang*	leaf	1
Ficus fistulosa Reinw. Ex Blume	tree	*Coro*	bark	4
Ficus hispida Linn.	tree	*tagalolo*	bark	3
Family: Myristicaceae				
Myristica fragrans Houtt.	tree	*Pala*	fruit, seed	7
Family: Myrtaceae				
Psidium guajava L.	tree	*giawas*	leaf	6
Syzygium aqueum (Burm.f.) Alston.	tree	*gora*	leaf	3
Syzygium aromaticum (L.) Merr. & L.M. Perry	tree	*cengkeh*	leaf, flower	7
Family: Oxalidaceae				
Averrhoa bilimbi L.	shrub	*belimbing wuluh*	bark, fruit	2
Family: Phyllanthaceae				
Breynia cernua (Poir.) Müll.Arg.	tree	*gagilamo*	bark	3
Phyllanthus sp.	herb	*balakama seed*	leaf	3
Family: Piperaceae				
Piper nigrum L.	climber	*rica jawa*	fruit	2
Piper sarmentosum Roxb.	herb	*tofure*	leaf	1
Family: Poaceae				
Cymbopogon citratus (DC.) Stapf.	herb	*gramakusu*	stem	7
Family: Ranunculaceae				
Nigella sativa Linn.	herb	*jinta hitam*	fruit	5
Family: Rhamnaceae				
Alphitonia moluccana Teijsm. & Binn. Ex Brais.	tree	*raurika*	bark	2
Family: Rubiaceae				
Morinda citrifolia L.	tree	*kome*	bark	1
Family: Rutaceae				
Melicope latifolia (DC.) T.G. Hartley	shrub	*sawuyo*	leaf	2
Family: Selaginellaceae				
Selaginella sp.	herb	*rutu-rutu*	leaf	4
Family: Solanaceae				
Physallis peruviana L.	herb	*dagameme*	leaf	4
Family: Sonneratiaceae				
Sonneratia alba Sm.	tree	*posi-posi / soki bulat*	bark	3
Family: Zingiberaceae				
Boesenbergia rotunda (L.) Mansf.	herb	*tumbukunci*	rhizome	1
Curcuma longa L.	herb	*kuning*	rhizome	8
Curcuma zanthorrhiza Roxb.	herb	*tumbulawak*	rhizome	1
Kaempferia galanga L.	herb	*bataka*	rhizome	7
Zingiber officinale Roscoe.	herb	*guraka*	rhizome	4

of welcoming maturity girl. The ceremony is held for 3, 7, or 9 days depending on length of menstruation period and decision of the girl's family. During that time, the girl takes *oke sou* herbal drink 3 times a day. Usually she drinks as much as 8.1 liters of *oke sou* herbal drink during this ceremony.

Phytochemical profile

All the most frequently mentioned plants are well studied and their phytochemical profile, along with pharmacological activities, are shown in Table 2. The common pharmacological activities related to efficacy of *oke sou* herbal drink are antimicrobial, antifungal, aromatherapy, antioxidant, and anti-cancer. From *Canangan odorata* (Lam.) Hook.f. & Thomson, 65 different chemical compounds with more than 13 pharmacological activities have been isolated. This plant is effective to maintain cleanness of vagina area due to its antimicrobial activity that contains essential oil, ethyl acetate ethanolic, methanolic, cyclohexane, and clorofrom [25]. The other plants that also contain antimicrobial activity are *Kaempferia galanga* L., *Syzygium aromaticum* (L.) Merr. & L.M. Perry. and *Tamarindus indica* L. [2][6] [16] [27].

Some plants have essential oil which efficacious to reduce body odor, such as camphene (*Cananga odorata* (Lam.) Hook.f. & Thomson)[26], geraniol (*Cymbopogon citratus* (DC.) Stapf.)[28], myristicin (*Myristica fragrans* Houtt.)[10], and eugenol (*Syzygium aromaticum* (L.) Merr. & L.M. Perry.)[10]. These chemical compounds have pharmacological activi-

Table 2. The most frequently mentioned plant species (>5 respondents) to prepare oke sou herbal drink and their phytochemical profile and pharmacological activities at Lako Akediri Village, Sub District Sahu, District West Halmahera, North Moluccas - Indonesia.

Plant Species	Phytochemical profile	Pharmacological activities
Cananga odorata (Lam.) Hook.f. & Thomson	bornyl acetate (leaves); camphene (leaves, flowers); geraniol (leaves, flowers); geranyl acetate (flowers); limonene (leaves, flowers, fruits); (E,Z)-farnesal (leaves) 1-epi-cubenol (flowers); caryophyllene epoxide (leaves); spathulenol (leaves); *t*-cadinol (leaves); α-amorphene (leaves, flowers); α-ylangene (leaves, flowers); methyl antharanilate (flowers)[26]; liriodenine, sampangine (bark)[19]; methylisoeugenol, benzyl benzoate (flower)[17]	aromatherapy, anti-microbial, anti-inflammatory, antivector[26] antifungal, anti-mycobacterial, antimalarial[28] [13]
Curcuma longa L.	curcumin; dimethoxy curcumin; bisdemethoxy curcumin; sodium curcuminate (rhizomes)[19] [9]	anti-carcinogenic[8] anti-bacteria, anti-HIV, antioxidant, anti-inflamatory, anti-tumor[9]
Cymbopogon citratus (DC.) Stapf.	d-Limonene, geraniol (leaves)[28] ; *α*-citral, *β*-neral, myrcene (leaves)[13]	aromatherapy[27]; antibacterial[12]
Kaempferia galanga L.	*α*-pinene, camphene, carvone, benzene, eucalypto;, borneol, methyl cinnamate, ethyl-*p*-methoxycinnate (rhizomes)[26]; *β*-phyllandrene, *α*-terpineol, ethylcinnate, dihydro *β*-sesquiphylandrene (rhizomes) [21]	anticancer, antimicrobial activity, antioxidant[27]
Myristica fragrans Houtt.	macelignan (fruits)[5]; ethanolic (seeds) [26]; myristicin(fruits)[10]; malabaricone B, malabaricone C(fruits)[14]	anti-bacterial[5]; aphrodisiac[25]; antifungal[14]; aromatherapy[10]
Syzygium aromaticum (L.) Merr. & L.M. Perry.	eugenol, eugenyl acetate, benzyl alcohol (leaves)[12] [15], ethanolic (seeds)[25]	antioxidant[12]; antimicrobial, antifungal[15]; aphrodisiac[24]
Cynometra cauliflora L.	methanolic (fruits)[26]; tannin, saponin, flavonoid (leaves, stems, barks); terpenoid (leaves, stems)[5]	anti-cancer[26]; antioxidant[4]
Tamarindus indica L.	acetone, methanol (seeds)[11]; alkaloids, flavonoids, saponins, tannins (fruits) [6]; glycosides, cardiac glycosides (seeds)[2]	antibacterial[11]; antimicrobial[6] [2]; antifungal hypoglycaemic, cytotoxic effects, cholesterolemic[2]

ties as aromatherapy and become basic material in perfume producing. Based on the data (Table 2) there are antifungal activities in some plants used in *oke sou* herbal drink that are effective against *Candida albicans* activity, vaginal discharge agent [26].

Discussion

The knowledge of diverse plants that are used in preparation of *oke sou* herbal drink is obtained orally from older indigenous medical practitioners to younger ones, who are their daughters or nieces. Indigenous medical practitioners have dominant role in keeping the information about composition of *oke sou* herbal drink. They have prohibition to bequeath that information to people except to her maternal ancestry. Therefore, not all the villagers at Lako Akediri village know composition of the herbal drink.

Oke sou herbal drink is believed by the people in Lako Akediri efficacious to maintain the health of women's reproductive function. Based on scientific investigations, *oke sou* herbal drink maintains the reproductive health by keeping the cleanness of reproductive organs [2][6][16][27][26]; reducing bad odor on vagina area and girl's body[10][26][28]; protecting the reproductive organs from the risk of cancer[8][29][26]; and free radicals[9][27][4]. Those efficacies are obtained from diversity of plants that are used in preparing *oke sou* herbal drink. For example, plants that are useful to keep the cleanness of reproductive organs (vagina) are *Cananga odorata* (Lam.) Hook.f. & Thomson[26][28][13], *Curcuma longa* L.[9], *Cymbopogon citratus* (DC.) Stapf.[12], and *Kaempferia galanga* L[27]. Those plants have pharmacological activities such as anti-microbial, anti-fungal, and antibacterial.

Futhermore, the preparation of *oke sou* herbal drink has a boiling stage that aims to extract the phytochemical content in part of plant used [23]. The efficacy of *oke sou* herbal drink is better when phytochemical content in plants used can be completely soluble in water. Meanwhile the purposes of plant parts classification - bark with bark, leaves with leaves, root with root - and crushing them separately is to facilitate the process of squeezing the juice plant.

Conclusion

We recorded as many as 66 plant species from 59 genera used for preparation of *oke sou* herbal drink, with *Cananga odorata* (Lam.) Hook.f. & Thomson being the most frequently mentioned plant by the people at Lako Akediri village. The phytochemical content in used plants have various compounds, but the pharmacological activities can be summarized in common as antimicrobial, antifungal, aromatherapy, antioxidant, and anti-cancer. The results of this study can be used as new reference for the development of medical herbal products based on science, especially for maintaining the health of reproductive functions of women.

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Cultural Identity of Thai-Muslim Students in Their Learning Activities at Maulana Malik Ibrahim State Islamic University of Malang, Indonesia

その信仰ゆえ、インドネシアの大学に留学するタイ人イスラム教徒は少なくない。彼らの複雑なアイデンティティと学習環境の違いを考察する。

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Abstract

Cultural identity is a current and crucial issue in social life particularly in the field of education. Through understanding this cultural identity, a student is able to fully understand himself or herself and knows his/her position in the society where he or she lives in. As expected, student also has a better tolerant attitude toward other cultures. In the educational realm, it is extremely important not only for the students to comprehend their cultural identity but also for the teachers who interact with the students with diverse multicultural backgrounds. This research examines four Thai Muslim students' experiences in the process of constructing their cultural identity by using phenomenological design. The result of the research stated that Thai students felt as an insider within Indonesian milieu because of their physical (facial) similarity. However the formal Indonesian language is still one of their difficulties to actively engage in their learning activities. Thai students' learning characteristic (identity) is mostly passive compared with Indonesian style. Presentation and class discussion are their barrier factors in educational processes while their self motivation is being their supporting factor. Findings of this research certainly will enrich the literature on Thai Muslim students' identity in their learning activities.

Keywords cultural identity, learning activity, Thai Muslim students

Introduction

This article is an abridged version of my thesis focusing on cultural identity of Thai Muslim students in Indonesia. It is understood by many researchers that cultural identity is an interesting topic discussed by many researchers in the last five years. Every researcher has distinctive methodology, theory and concentration. Some researchers have agreed that cultural identity undergoes constant transformation (Ifrim, 2013; Li, 2008; Cerkezi, Dumi, Celo & Pulaj, 2013; Saljo & Hijorne, 2013; Anbreen, 2015).

Others like Novakova & Foltinova (2014) and Saljo & Hijorne (2013) have argued that cultural identity is formed by daily activities. Cojanu (2014) and Hidair & Alincai (2015) believed that geographic similarity and migration factor have also caused the formation of cultural identity. This article uniquely tries to explore the other aspect of cultural identity that is cultural identity in learning activities.

Studies on cultural identity are often connected by other topics such as cultural identity in education (Maduta, 2014), cultural identity in learning and its method (Villodre, 2014; Cerkezi, Dumi, Celo & Pulaj, 2013; Altugan, 2014 & 2015; Anbreen, 2015),

cultural identity in the development (Novakova & Foltinova, 2014; Silapacharanan & Mongkolpradit, 2012) and connection between cultural identity and migration (Hidair & Alincai, 2015). Maduta (2014) suggested that in order to maintain national identity of citizens, the educational policies are certainly needed (Maduta, 2014: 2847). Based on these significances between cultural identity and education, therefore, understanding cultural identity in the field of education is extremely crucial.

In order to give students an understanding on cultural identity in the educational field, Villodre (2014) stated that the teacher needs to introduce it since early childhood, by using an appropriate method like music (Villodre, 2014: 235), through which the importance and impact of cultural identity is emphasized. In this case, Villodre has a similar idea with Altugan (2014 & 2015) and Abreen (2015) on the importance of understanding cultural identity.

In a more detailed explanation, Altugan (2014 & 2015) pointed out that the cultural identity has a big effect in determining the student's success. When students can identify their identity, they can achieve a success in their learning. It is also important for teachers to understand the diverse cultural identity of students in order to establish an appropriate learning method in anticipating those differences and bringing the student success (Altugan, 2015: 456). Quite different with all studies above, this research does not merely try to explain the connection or effect between cultural identity and learning, but also tries to explore the formation process of students' new identity in their new environment as well. The subjects of this research are also different compared with previous researches which were primary and secondary students. In this research, university students are the main subjects to be studied.

The subjects of this research are Thai Muslim students who came from Southern provinces of Thailand. The selection of Thai Muslim students is due to several reasons that include: a) Southern Thailand is a region where majority of its population are Muslim. Some provinces like Pattani, Narathiwat, and Yala has 90% Muslim population, while Songkhla has 23% Muslim population (Wanlabeh & Othman, 2012: 239), in the midst of Buddist population in Thailand. b) Southern Thailand Muslim has a unique identity. They shared similarity with Malaysian Muslims due to their close cultural relation. The uniqueness appears when they do a cultural assimilation between Thailand and Malaysia culture (Bakar, 2013: 316). Based on this reason, this research also tries to give a great contribution in the development of knowledge especially in the cultural identity among students in the region of Asia.

The school characteristic of Southern Thailand to some degree has similarities with Malaysian Islamic School, where before 1965 those 4 provinces have adopted traditional Islamic education namely "*Pondok*"[1] (Wanlabeh & Othman, 2012: 239). In 1965, the institution changed into Islamic Educational Institution under the control of Thailand Ministry of Education, which have been using a more structural curriculum and teaching methods. By the development of educational system in Thailand, it also creates changes in the minds of Thai Muslim parents in educating their children. One of the informant of the research stated that many parents have suggested their children to study outside Thailand because they believed it will bring many benefits and betterments.[2]

The idea to study abroad emerged particularly after the conflict between Thai-Muslim and Thai-Buddhist, especially since 2004. After that year, some policies have been created by Thai government in order to create peace between both ethnicities (Chongruksa, etc, 2010: 282). It also supported some researches in educational field for meditating both ethnics and understanding multiculturalism by using storytelling technique in Muslim as well as Buddhist school. This technique is mainly success-

1 This term comes from Malay language which mean Islamic Boarding School

2 Interview with Faisol Morlor (Thai student) in UIN Malang, November, 29th 2015, 07.05 WIB

ful for engrafting understanding between students (Chongruksa, etc, 2010: 282).

One of destinations to study as suggested by Thai parents is Indonesia[3]. As stated by this research, Maulana Malik Ibrahim State Islamic University of Malang is one of Indonesian universities that Thai students preferred and enrolled. It is alluring to note that the number of Thai students is increasing year by year. It begins with five to eight students in 2009 and increases rapidly to ninety students in 2015.

The early observation found that Thai students faced some difficulties in mingling with Indonesian style of learning. To get successful learning in Indonesia, therefore, they need to study harder and better than Indonesian students. This study explores Thai student's own identity and the formation of new identity during their study in Indonesia. The research is expected to enrich the understanding of Thai Muslim identity in their learning and the way of getting successful study in Indonesia. This research also will be valuable for students and teachers in the university level because as described by many experts that the understanding of cultural identity in learning is extremely beneficial not only for the students (Altugan, 2014 & 2015; Klos, 2006; Faircloth, 2012) but also for the teachers (Bliss, 2010; Jones, 2005).

Framing the Research

This is a qualitative research with phenomenological design, in which this study tries to explore: 1) formation process of the new identity of Thai Muslim Students that can support their learning success at Maulana Malik Ibrahim State Islamic University of Malang, 2) supporting and barrier factors in the learning process and the solutions they have been opted for the success of their learning at Maulana Malik Ibrahim State Islamic University of Malang. These objectives will be answered using interview, direct observation and documentation.

It is important to note that phenomenological design actually tries to explore the experience of some people in a certain condition. One expert in Phenomenology, Husserl (1973) stated that phenomenological research tries to understand the essence of the phenomena (Husserl, 1973: 45; Langridge, 2007: 20). Other phenomenologist, Schutz (1967) gave attention to the importance of biographic background that can influence people's action (Nindito, 2005: 89), while the biography itself can be understood by understanding an individual identity. Since the nature of this study is giving high attention toward subjectivity, hence the phenomenological design is suitable to be employed (Flick, 2009: 334).

This research explores 4 male Thai students in Maulana Malik Ibrahim State Islamic University of Malang who study in different semester and department. Faisol Morlor is a key informant of the research because he is really mastering Bahasa Indonesia, Malay language and Thai language. He is an Islamic Education student in his last forth year. The researcher asks the informants about their experiences of teaching and learning process in Thailand and Indonesia. Some differences in identity of learning may appear because of the different background of school and their original region before coming to Indonesia.

To analyze the result of interview and observation, researcher used the theory of cultural identity by Stuart Hall (1996) which explains two main concept of identity; identity as being and identity as becoming (Hall, 1996: 4). Identity as being is correlated with 'who we really are', or can be defined as the identity that influenced by social environment where the individual firstly live in. It based on the history, time, place and individual culture that was experienced in the past, whereas the identity as becoming is correlated with 'what we might become' (Hall, 1996: 4). The result of the interview and observation can be seen by this theory.

3 Interview with Faisol Morlor (Thai student) in UIN Malang, November, 29th 2015, 07.10 WIB

Original Identity (Being Thai, Malay or Mixture)

Thai Muslim students try to explain their original identity. According to three of the informants, they consider themselves as being Malay than Thai, because being Malay is actually being identified as being Muslim and being Thai is actually being identified as being Buddhist.

As Faisol stated:

> "*Kalau saya pribadi mas, saya ya Malay. Saya bisa bahasa Melayu, saya tahu sejarah bangsa melayu di Thailand. Saya juga hidup di lingkungan melayu* (for me myself, I am purely Malay, I can speak Melayu, understood the history of Melayu in Thailand and lived in Malay environment)" (Faisol, 25 years old)

He explained that he lived in Malay environment, spoke with Melayu language, and understood the history of Malay in Thailand. This identification is a result of historical conflict (war) between Siamese and Pattani Sultanate that has occurred for long time ago that is still clearly manifested in the worldview of Southern Thailand people. The identification is also dealing with Hall's (1990) study which explained that identity is not something which has already existed, because it is transcending place, time, history and culture (Hall, 1990: 225). It is also because of geographic similarity among Southern Thai and Northern Malay as stated by Cojanu (2014) that geographic similarity can form a similar identity. Bakar (2013) also declared that Southern Thai has already been doing assimilation with Malaysian culture.

In this sense, the informants are connecting the identity to religious identity, so that, their identity is based on their religious background. It is because they got strictly Islamic education from their parents, teachers, and Baboh[4]. They act based on the guidance of Islamic value and avoid the religious prohibition in their daily activity. They usually never wear a short trouser even for doing sport because of the Islamic teaching of covering the 'aurat', they are also forbidden to make a warm interaction and relationship or sitting and going together with another woman except a woman in their family, and some other teachings. The identity to be exposed by them is an Islamic identity that can be a differentiation with Thai majorities who are Buddhist.

In another side, one of the informants is claimed as being Mixture between Thai and Malay. He didn't consider himself as being Malay or Thai, because he lived in Thai environment, spoke with Thai language and belonged to Melayu heritage as explained by his father. So, he purely identified himself as being Mixture. As he stated:

> "*saya ya Campuran mas. Tinggalnya di lingkungan Thai, bahasanya Thai, tapi keturunannya Melayu*. (I am a mixture, I live in Thailand, spoke with Thai Language, but I was Melayu heritage)". (Preedee, 19 years old)

This statement proves the result of research by Novakova & Foltinova (2014) which have viewed that an identity formed by environment and daily activities. A policy of Thai government through education field in maintaining the Thai national identity is accepted by some Southern Thai's. It is proved what Maduta (2014) said that educational policy is really needed for maintaining national identity.

The policy continues by a rule to use Thai language for teaching and learning process in all schools, although some schools are still using both Thai and Malay language. For the students graduated in this kind of school, they usually can speak in both Malay and Thai languages. In addition, some

4 *Baboh* is a person mastering Islamic teachings and values; he is also a leader of Islamic institution. He is called Kyai in Indonesian perspective.

Islamic schools teach an Arabic language and use some of Arabic books.

Southern Thai schools are begun the teaching and learning process at 08.00 am to 03.00 pm. There are six main subjects; mathematics, science, Thai language, social sciences, art, and culture and religion. "Culture and religion" is further divided into twelve subjects including Fiqh, Nahwu, Hadits, etc. The importance of religious teaching also provided since children age. The existence of TADIKA (taman didik kanak-kanak) in order to teach the way in reciting Qur'an in some masjids proved the importance of strengthening an Islamic identity for children. TADIKA is held on Saturday and Sunday at 8.00 am to 2.00 pm and every day after school activity in afternoon.

The learning method used by teacher in Southern Thailand is mostly lecturing method. It causes a tendency of being passive students. The lecturing method existed in all grades of schools, from elementary to high school level. The duties of students are listening, writing and then memorizing. As declared by Zakee:

> "*Semua ustadz disana langsung menjelaskan dan membuka kitab. Murid ya mendengarkan, menulis, terus mengahafal*. (All ustadz (teacher) just explaining and opening the book, hence, the students are listening, writing and then memorizing)" (Zakee, 22 years old)

Regarding with the successful and unsuccessful students in Southern Thailand, The successfuls are decided by the result of examination in the last semester without considering students' active participation in the classroom while the unsuccessfuls are the vice versa. It was his experience in classroom some years ago, but he explains that he doesn't know today's teaching and learning process in Southern Thailand. He hopes that it tends to have some improvement and development.

The exploring identity also examined the teaching reference (madzhab) in Southern Thailand. Southern Thai people are mostly referred to Madzhab Syafi'i, while Wahhabi's teaching is also exist in some parts of southern Thailand. All the informants declare that they are Syafi'i followers, which also doing ziyarah qubr, mauled nabi, tahlil together as same as other Syafi'i followers in the world.

Formation of New Identity

In order to form a new identity, the informants told the researcher their experiences that they faced during the first year in Indonesia. In terms of communication process, they don't have difficulties to mingle with Indonesian students because of similar habit between these two nationalities. The difficulty came from Preedee who cannot speak Malay language. He argued:

> "*...dengan teman, saya lebih banyak diam dan tidak berbicara kecuali dengan teman-teman dari Thailand sendiri* (with Indonesian friends, I tend to be silent and not talkative except with my own Thai friends)" (Preedee, 19 years old)

Despite language difficulty, other habits of Indonesians at Maulana Malik Ibrahim State Islamic University of Malang are similar with Thai Muslims such us being friendly by saying salam when they meet each others. In terms of habitual activities Thai students generally do not face any serious difficulties. In fact, Thai students considered the socialization process as an easy process they have experienced at campus. They felt as insiders within the Indonesian context. This is partly because of the similarity in face between Thai and Indonesian students.

Some Indonesians do not even recognize Thai Students as Thai because their faces are similar. In this case, a Thai student, Faisol stated:

> "*awal pertama kesini banyak orang yang tidak tahu kalau kami orang Thai, banyak yang mengira kami orang Indonesia, kecuali tanya dari*

> *mana, baru tahu kalau kami dari Thailand itupun mereka kaget awalnya* (the first time I came here, most of Indonesian are didn't realize who we really are, they consider that we are Indonesians, except they ask a question about our origin, and they surprised for the answer)" (Faisol, 25 years old)

Indonesians usually could recognize Thai people through the language they are speaking or by asking directly their origin and nationality. Without these two things, Indonesians will never know that we are Thais, Faisol explained. It continuously happened from time to time when Indonesians meet a Thai student for the first time. Despite they feel as an insider; they also need to change some perspective or worldview that has already known in Thailand especially dealing with differentiation between Muslim and non-Muslim.

It is easy to distinguish between Muslim and non-Muslim in Thailand for example by looking at the Islamic dressing code especially for women (veil and long dress). All Muslim women in Thailand are wearing Hijab and non-Muslim women do not wear hijab and never enter masjids. In fact, Thai Muslims in Indonesia are really surprised when an Indonesian muslim woman doesn't wear hijab, entering masjids and performing shalat. This was the experience outside campus that faced by all informants, however they do not have such experience inside an Islamic university.

The experiences faced by Thai students in the university were divided into two categories namely inside and outside classroom. Those two categories dealt with interactions and negotiations of identity in order to form a new identity of learning.

The inside classroom experience took place in the first and second year especially in new learning experience which is relatively different with the learning style in Thailand. While teachers in Southern Thailand (consciously or unconsciously) encouraged students to be passive, Indonesian way of learning tried to explore students' critical thinking through discussion and presentation. These two extreme differences have forced them to form a new learning identity which is the mixture between those two different things. It needs to be done in order to actively engage with the Indonesian way of learning.

Four years experiences of Faisol told the researcher everything. He stated:

> "*selama empat tahun belajar di UIN, saya sudah mengalami dari yang tidak bisa aktif sama sekali sampai aktif kadang-kadang. Kalau boleh jujur, Saya termasuk yang tidak bisa aktif mas seperti orang Indonesia, dan saya rasa semua anak Thailand juga gitu. Kami sudah biasa duduk, menulis dan hafal definisi. Sudah gitu aja* (after studying for about four years in UIN, I have been feeling from being a passive to an active even though I am belonging to a passive compared with Indonesian. I guess all Thai in UIN are feeling so. We are trained to sit, write and memorize, that's all)" (Faisol, 25 years old)

Faisol has forced himself to be an active student in classroom for four years even it was really a difficult thing to do. The previous (old) learning identity still appears even though they have to face different and new environment. By this phenomenon, teachers need to understand Thai's learning identity and guide them the way to be actively engage in the classroom. As Banks and Banks (2010) stated that students must be taught to understand all kind of knowledge, discussing actively about knowledge construction and different interpretation (Banks & Banks, 2010: 20). In other perspective, Jones (2005) noted that teachers need to see the students as cultural beings, embrace students' diversity, and validate the cultural identity of students (Jones, 2005: 150).

When teachers understand a cultural identity of students in the university level like Thai students at UIN Malang, they can lead Thai students achieving their successful learning. Wanfais pointed out:

> "*ketika ada dosen yang faham bagaimana di Thailand kemudian membimbing kami sedikit demi sedikit hingga bisa, maka kami belajarnya sangat enak dan kami bisa benar-benar faham mas* (when we find a teacher who understand the condition and everything in Thailand (especially dealing with learning identity) and then guide us little by little, we feel comfortable and really understand the material)" (Wanfais, 20 years old)

Therefore, the importance of understanding cultural identity of students is to provide an appropriate learning method that will bring the success in students' learning in the university level or in the elementary and secondary level as have been studied by Altugan (2014) and Anbreen (2015).

While the inside classroom experience was solved, the outside classroom experience also needs to be considered. Most of tasks in university are in the form of group presentation despite an individual task. The group presentation forces each member of the group to discuss the material before presentation. It can be a great time for Thai students to prepare and discuss with all the group members, but the fact, some of their friends do not care with them. According to their perspective, they will never contribute in a class discussion and presentation because of their previous learning identity. However the empathy and friendship are still extremely needed for a group. As noted by Zakee:

> "*saya juga butuh belajar dari teman saat belajar kelompok, tapi saya sering tidak diajak mengerjakan cuma diminta sumbangan saat makalah jadi. Kami ya enak saja kalau begitu, cuma tidak dapat ilmu* (I need to study from my friends when we were in a group of study, but the fact, some of my friends didn't ask me to study and just asking for money contribution after the paper was done. It was making us enjoy but we will not get the knowledge)" (Zakee, 22 years old)

The communication problem is faced by Thai students outside classroom experience. They actually need to negotiate the identity with their friends to get more knowledge in order to get successful learning in the classroom.

The identity to be considered by Thai students is identity as becoming as noted by Hall (1990) rather than identity as being. 'Becoming' identity is constantly negotiating the identity; maintaining the old identity and adopting the new ones. If students are just maintaining the old identity, it can be difficult to learn actively, but if they mix the old and the new which is considering how they would become in the new environment, it can easily lead them into successful learning. Hence in this sense, this research strengthened Hall's theory on "being" and "becoming" identity.

Supporting and Barrier Factors in Education

The supporting factors in Thai learning identity came from their own selves and their family. They have a mission to improve the educational quality in Thailand especially for young Muslims. All Thai students feel comfortable in facing the educational activities in the university, although there are some barrier factors that disturb their learning. The old memorized materials in previous school also support them to get successful learning in the classroom.

The barrier factors that faced by Thai students is definitely Indonesian language. For Thai students at UIN Malang, formal and academic Indonesian language was regarded as a high and scientific language that is hard to master. The lack of fluency in formal Indonesian language has therefore created difficulty for them in comprehending the content of learning subject. This worsened by the lack of teachers who cared and showed empathy in the classroom. The "student active learning" style that applied by teachers also became a serious barrier factor for Thai students in their teaching and learning process. Fortunately, they have tried to overcome all those prob-

lems by increasing the habit of reading and actively engaged in discussion after their learning activities.

Conclusion

This article has made an attempt to explore cultural identity of Thai Muslim students in their learning activities at Maulana Malik Ibrahim State Islamic University of Malang. The researcher focused on two questions: 1) formation process of the new identity of Thai Muslim Students that can support their learning success, 2) supporting and barrier factors in the learning process and the solutions they have been opted for the success of their learning. Three of the informants are considering themselves as being Malay Muslim while only one student who remains considering himself as a Thai Muslim. The learning characteristic of Thai students is mostly passive in learning. This is due to the learning method used in their original country which is normally used only one method namely lecturing method.

There is no big difference between Thailand and Indonesia in terms of daily activities, but the challenges have taken place in learning activities. While Indonesia has been applying student active learning, Southern Thailand still maintained the passive learning style wherein teacher becomes the center of the learning process. It unavoidably therefore has created a serious problem for Thai students. However this problem was tried to be solved by forcing themselves to adopt the new (Indonesian) learning style even though it is not easy task for them. The class presentation and discussion became the barrier factors faced by Thai students while self- motivation and previous memorized material fortunately have become supporting factors in gaining the success in their learning.

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Students' Fundamental Perception in Apprehending Global and Local Languages Relation

世界標準としての英語が存在感を増すなかでローカルな言語は生き残れるのか。教育現場でのジャワ語を例に、英語と伝統言語の共存の道を探る。

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Abstract

The study investigates the fundamental concept and perception of global and local languages by examining university students majoring in Javanese[1] education. The existing literature has supported the notion that globalization is mostly blamed by people for the decline of local culture, especially for language aspect. However, English as a global language still plays a significant role, particularly for scholars to participate in global interaction and information access. Seeing such dichotomous relation, this study investigated students' perception through descriptive qualitative approach. The data were critically analyzed within a theoretical framework which included multilingualism concepts. The subjects were 30 junior year college students majoring in Javanese education in one of public universities in Indonesia. Students were asked to fill in the questionnaires about both languages and their inherent relations. The result revealed that Javanese has emerged to be the language of philosophical cognition and knowledge construction. However, Javanese language is also considered less important than English especially dealing with its significance to access global information. As conclusion, the study is essential as one of literature sources in constructing the necessary involvement of the government, schools and society to promote the appropriate approach in responding the relation between global and local languages.

1 Javanese is a language spoken in Java Island, Indonesia, especially in Central Java, Yogyakarta, and East Java. The language is the native language of more than 75,500,000 people spreading across Indonesia provinces and even in abroad such as Malaysia, Hong Kong and Suriname (Hastangka. 2010. *Javanese Language and Cultural Identity in Indonesian Local Curriculum* (a study in Yogyakarta)". The center for pancasila studies. Gadjah Mada University. Yogyakarta).

Keywords global language, local language, students' perception

Introduction

The relation between English and local languages around the globe has been a central topic of debate since long time ago. English, as an international language, is arguably the most important language to master for several purposes, including for academic, political, economic, socio and cultural purposes (Ivone, 2005). Its power and hegemony have been expanded to many countries and affecting the use of local languages.

The body of literature has supported the notion that globalization and the expansion of English are mostly blamed by people for the decline of local culture, especially of local language (Joseph & Ramani,

2012). However, English cannot be put aside directly as this language still plays a significant role, particularly for scholars and universities to participate in global interaction and to access information. Therefore, higher education institutions as the platform of knowledge transfer is a strategic place in keeping the balance between English and local language.

In response to the notion, this study holds two essential points elucidated within the title: students' perception and global-local languages relation. Both will specifically deal with English and Javanese languages in Indonesian higher education system; how university students majoring in Javanese Education respond on the power relation between English and Javanese languages.

Literature Review

The Emergence of English as a Powerful Language

Free-trade policy has rapidly changed how the world advances. The dimension of politics, economy, and culture are interconnected more intensively than ever, including language (Fairclough, 2006; Pennycook, 2007). English is still believed to be an important international language, although lately Mandarin emerges as a new powerful language because China is rising to the top economy of the world. English is manifested as the language for cultural expression, social mobility, and access to a better life (Pennycook, 2007).

The dominance of English in global development has caused some people to be more aware of the position of local language. In most countries, people have started to realize the importance of being multilingual. In fact, several studies (Cummins, 2000; Hornberger, 2003; Pennycook, 2007) have concluded that multilingualism is an inevitable mechanism in current global world. When people can speak more than one language in a multilingual country, they are believed to be more successful. In Indonesia for example, the policy of making English compulsory in national exam is just one of the evidences that English is strongly influential within Indonesian Education System[2]. Hence, with English receives more dominant grows and spreads, local/indigenous languages definitely should be more cautious.

Joseph and Ramani (2006) explain that English has two powerful impacts in two domains[3]: The first is the danger of an educated middle class becoming monolingual (and monoliterate) in English. This scenario has not reached in Indonesia, but in India and South Africa, the number of middle-class people who regard English as their mother language is increasing. Local languages in such countries start losing their importance in being the language of communication.

Secondly, they also mention that the spreading of English can potentially widen the gap of social exclusion. For the time being, English is mostly required for applying a respected position in a company or university. People with good command of English will be likely chosen to be accepted in the application process. In addition, English is also one of the main requirements for continuing higher degree. These cases have elucidated how powerful English is: people with good English is socially more appreciated than those with no English. Therefore, in Indonesia, the belief that mastery of and competence in English will ensure increased statuses, job opportunities, and social mobility is getting increased.

However, despite the importance of English mastery, teaching English in Indonesia is challenging especially when it deals with limited time and difficulty of tracking down adequate sources made for English users (Ivone, 2005). This happens because Indonesia officially positions English only as first foreign language (EFL). According to Lauder (2008),

2 National Examination in Indonesia used to be the only determining mechanism for students passing decision. Although the exam is no longer the only determinant, national exam is still seen as a big deal for schools and students.

3 Joseph,M.&Ramani,E. (2012). "Glocalization": Going Beyond the Dichotomy of Global Versus Local through Additive Multilingualism. *International Multilingual Research Journal*, 6, 22-34.

EFL is a term for the use or study of the English by non-native speakers in countries where English is generally not a local medium of communication. He also concludes that Indonesia is part of "expanding circle" country according to Kachru's three-circle model of World Englishes. In the expanding circle, English language learners mostly encounter some difficulties such as lack of English language exposure, limited use of language in the real life context and limited quality infrastructures and teachers.

The hegemony of English in the current world has created a growing anxiety on local/indigenous languages. People start believing that mastering English, with all global demand and free trade mechanism, will guarantee their future. In Indonesia, international schools, with English as their instructional language, are mushrooming. Additionally, most parents now urge their children to have private courses in English after school hours. However, the portion of local language, especially Javanese language, is declined significantly.

The History of English in Indonesia

In Indonesia, English is a first foreign language. This means that English is not used as an official language within educational or governmental administrations. In the neighboring countries such as Malaysia, the Philippines and Singapore, English is a second language (Lauder, 2008). Therefore, English is only used in a formal academic context such as in school or research center.

In fact, it was not until 1955 that English was officially mentioned by Central Inspectorate of English Language Instruction in the Ministry of Education decree (Lauder, 2008). And finally in 1989, The Ministry of Education (MoE) legally acknowledged English as the first foreign language and made it one of the compulsory subjects to be taught at the secondary level. However, MoE allows it to be taught from Primary Four until now as EFL (*Pusat Kurikulum*, 2007).

Notwithstanding its role as a foreign language, learning English is compulsory for students in Indo-

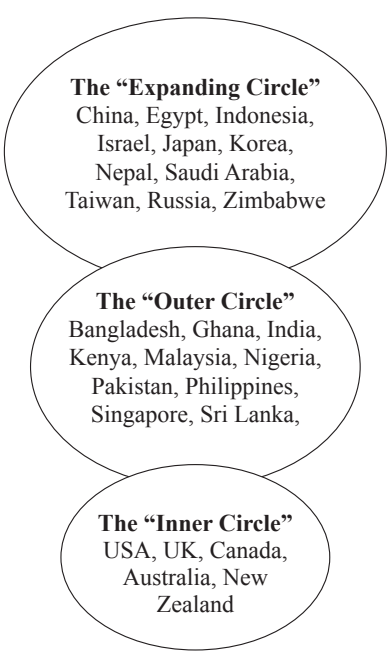

Figure 1. Kachru's Three-circle model of World Englishes.

Source: (Kachru, 1992: 356), reprinted in (Jenkins, 2003: 16).

nesia. Indonesian national curriculum had issued a mandate stating that English is one of mandatory subjects to be examined in national examination along with Mathematics and Bahasa Indonesia.

In higher education institutions, students are required to master English, especially for gaining the information needed as part of their final project writing. Mastery of English is significant to help students reading international publication related to their topic of study. The regulation is also applied for students in Javanese Language Program, such as in Semarang State University, Indonesia. Although their final project is written in *Bahasa* Indonesia and their topic is Javanese, the department makes it compulsory for the students to involve English-written journal articles and books as their references.

Reflecting on the phenomena, a problematic situation will occur when there are two or more languages come into (Winford, 2003). The situation will lead into three scenarios: language maintenance, language shift, or new language creation. Therefore, the interaction between the dominating and dominated languages must be assessed carefully. If the interaction is not maintained thoroughly, the dominating language will potentially endanger or cause any changes to the dominated language, i.e. in the use, structure, and form.

Interestingly, notwithstanding its effect on local language, people seem to be very accepting the fact that English can be expanded widely. Some experts believe that this is due to media which has central influence in such conditioning (Joseph & Ramani: 2012). As we can see, the spreading of international news, Hollywood expansion, and socio-economic interaction among countries play significant part in expanding the use of English.

Further, Dalby (2003) explains that when people stop doing the effort to mitigate the effect, the possibility is to create a new contact language. This new language is referred as a mixed or hybrid language. This circumstance is what probably happens with English and Javanese with some new terms and code switching such as in the following sentences "sorry *ya, aku rak isa mangkat wingi* (sorry, I couldn't go yesterday)", "thanks bro, *masakane enak*!" (Thank you brother, the food is delicious!) [4].

The Existence of Javanese Language

Javanese is one of some indigenous languages in Indonesia.[5] As part of a very diverse country, Javanese has emerged to be one of the most powerful language. According to Subroto, *et.al*, (2007), Javanese language is spoken by more than 75,500,000 people and spread across Indonesian provinces, even in abroad such as Malaysia, Hong Kong, and Suriname. The main areas of Javanese language are in Central Java, Yogyakarta, and East Java Provinces.

Lately, there are many foreigners both foreign students and visitors who are interested in studying Javanese language for various purposes. Javanese language itself is a unique language as it has several styles or registers depending on social context. Each style employs its own vocabulary, grammatical rules and even prosody (Hastangka: 2010). The grammar and structure of Javanese language relies on the area where it is spoken and speakers involved within the context.

Regarding to the styles, Javanese language is categorized into three major styles, namely *Ngoko, Madya,* and *Krama*. This categorization is based on the degree of politeness and contextual situation where the language is used. ***Ngoko*** is used informal speech between friends and close relatives. ***Madya*** is spoken for the intermediary form between *ngoko* and *karma*. And ***Krama*** is used as the most polite and formal style. It is used between persons of the same status who do not wish to be informal or when someone is talking to others with higher status.

4 This code switching starts being common to be used by people both in spoken (daily conversation) and written language (texting short messages)

5 According to Sugiharto, S., it has been estimated that some 700 local languages in Indonesia are in a moribund state. The article is entitled "Indigenous language policy as a national cultural strategy" and published in The Jakarta Post, October 28, 2013.

Table 1: Five-Level System of Danger.

No.	Kincade (1991: 160–3)	Wurm (1988: 192)	Bauman (1980)
(1)	Viable language	Potentially endangered language	Flourishing
(2)	Viable but small language	Endangered language	Enduring
(3)	Endangered language	Seriously endangered language	Declining
(4)	Nearly extinct language	Moribund language	Obsolescent
(5)	Extinct language	Extinct language	Extinct

Source: Chrystal (2000), reprinted in Purwoko (2011).

Krama is also the official style for public speeches, announcements, etc. (Hastangka: 2010).

For most people, Javanese language is believed to have high moral values and ethics. The language contains mystical and philosophical dimensions which serve as Javanese way of life (Hastangka: 2010). Additionally, the language is also believed as the expression of tolerance, humility, patience, and peace (non-violence). Therefore, people who speak Javanese really preserve the existence from getting extinct because it is part of their identity.

However, in reality, Javanese language encounters serious problem. According to Purwoko (2011), Javanese is considered as an endangered language. The argument is based on Kincade's five-level systems of danger.[6] The language under this category means that it is not effectively being passed on to the next generation due to non-optimal efforts to preserve it.

From the field observation, the reality (as reflected in school and daily use) seems to be a declining trend for young generation to speak in Javanese, especially for higher styles (*madya* and *krama*).[7] Purwoko (2011) believes that the problem is highly related to three factors: language maintenance, language shift, and creation of a new contact language. When society is exposed to new language and culture, language interaction is inevitable. When there are two languages come into contact, a mode dominating language will threaten dominated language if there is not any language maintenance efforts from all parties.

Supporting the findings, Hastangka (2010) mentions that there are three main problems in preserving Javanese languages. The first factor is the limited number of competent teachers in teaching this language, especially dealing with method of teaching and information technology mastery. The second factor is the limitation and complexity of learning material. And the third factor is the stereotype amongst students that Javanese language is just for old people.

Reflecting on what has happened to English and Javanese languages, it is very interesting to investigate such dichotomous relationship. Some experts concern that such use of English will eventually put it as a superior language which can endanger the existence of local language. Therefore, analyzing the perception of Javanese education students to view such power relation of languages is essential to critically assess their choices and efforts in preserving Javanese language in their future classrooms.

Research Method

Seeing such dichotomous relation, this study investigated students' perception through descriptive

6 The paper was presented in an International Seminar "Language Maintenance and Shift. July 2011, Indonesia"

7 Higher levels of Javanese styles are considered difficult and inapplicable for the daily context as more people just use the *Ngoko* style.

qualitative approach. There were 30 students participating in this study who came from one of public universities in Indonesia. The students were in their third year and majoring in Javanese education. The decision of involving third year students was based on situation where students were prepared for both micro teaching in school and final project writing.

The data were collected through interviews and questionnaires in regard to their perception on the relation between global and local languages. The students were then asked to fill in the questionnaires about both languages and their inherent relations. The questionnaires were open-ended questions (simple "yes, no, don't know" answers with some follow-up responses). The answers were further reviewed within a theoretical framework of multilingualism concepts.

Results and Discussion

Students majoring in Javanese education are directed to be quality Javanese teachers for all school levels in Central Java, East Java, and Yogyakarta provinces. For example, in Semarang State University Central Java, since its first establishment, the department has been graduating thousands of professionals as Javanese language teachers.

Each year, approximately 125 freshmen enrolled in this department. The number shows significant demand from society to have more Javanese language teachers. Within 8 semesters, the students study some Javanese subjects, both pedagogic and literature aspects. Among them are Javanese culture, folklore, introduction to literature and education, history of Javanese language, micro teaching, final project, and others.

To be able to finish their degree, the students are required to write a final project. When their final project title is approved, their professors will require the students to look for at least 5 international journal articles to support their final project. Therefore, students' mastery in English for this stage is pivotal. They must be able to read and write in English in order to comprehend the journal articles or books written in English.

According to field observation, some students believe the use of Javanese is declining, especially for the higher level (*Madya* and *Krama*). Therefore, they want to preserve it by being Javanese teachers and writing final project related to their topic. However, in order to write their final project, students must master English to access international journal articles for their reference. Not to mention, the expansion of English in entertainment and business has also influenced young generation to be more familiar with English as compared to Javanese language.

The Power of English and Javanese

Based on the questionnaire, the students believe that society in general consider English to be more prestigious. There are 64% of students believe that English is seen more prestigious by society while the other 26% say that they don't know and only 10% say that Javanese is more prestigious. They argue that English is globally used as an international language. The use of English is not only for academic purpose, but also for entertainment and communication in general. They rationalize such perception because English is manifested as international language. The requirement from their department to cite some international journals written in English is one of the examples. Besides, the use of English in mainstream media such as TV, magazines, and newspapers are getting higher.

However, in terms of philosophical values contained in both languages, 60% students believe that Javanese language contains more appropriate teachings and values. They also believe that Javanese language is more polite due to its three styles which depend on the contextual situation and to whom they are talking with. In further discussions with the author, the students agree that English is increasingly needed as people need to access global information. When people do not master in English, they will be eventually left behind. However, the students also

believe that Javanese language, despite its insignificant role in global interaction, is still needed because it teaches them good value and philosophy of life. Referring to what Edwards (2008) has mentioned, such phenomenon is called as the "romantic perspective".[8] The students value Javanese language to be "language-as-identity-expression". The language is used to express people's identity. The students in Javanese education consider preserving Javanese language is not merely as an effort to teach linguistics domain, but also cultural aspects such as ideology, culture, and identity as Javanese people.

However, Janks (2010) explains that English is the medium for cultural and intellectual capital as well. Culturally, English has come to Indonesia with the Hollywood-based entertainment business. Popular music, movies, fashion, and other artworks have been extremely powerful in driving the trends in a country, including Indonesia. In addition, social media growth like Facebook, Twitter, and Instagram have also made huge impact for current generation in accessing English.

As an intellectual capital, English is the language for the advancement of science and technology Janks: 2010). Two thirds of global traffic for email, broadcasting, and academic publications are in English. Books and references for academics are mostly written in English. Therefore, if people want to catch up with the global current issue, English is presumably the first language to master.

Further, Aitchison (2001) mentions that most of language changes are due to language contacts; a situation where a language encounters another language. What happens with Javanese is under this situation. The increasing portion to study Indonesian and English in school, (they even use English as the instructional languages) has declined the power of Javanese to grow. Javanese language, for example, only receives 1 hour meeting (in some schools, it has 2 hours) per week in high schools, while Indonesian and English have 4 hours meetings.

Inequality between Javanese and English

Notwithstanding the higher regard of students to Javanese, 80% of the students believe that English and Javanese languages are not equal. English is seen more dominant in the current world. This inequality is presumably caused by the growing expansion of "Hollywood".[9]

One item asking on whether the use of Javanese is decreasing shows a surprising number. All of the students (100%) believe that Javanese language is declining and English is rising. In Indonesia, English has indeed become more popular. The emergence of thousands of English-language assisting courses and programs shows how massive the influence of English is. Amidst these English language centers, Javanese language is like nothing to compare.

In academic context, we must say that the opportunity for students in practicing local language is very rare. According to Hasangka (2010), the trend in preserving local language, especially at school is not satisfying enough. He finds that Javanese language teachers are still lack of competency and professionalism. Moreover, Javanese language handbook for teachers and the opportunity of training and seminar for teachers in Javanese language teaching and learning are still lacking.

The decline of Javanese is also caused by a stereotype amongst student that Javanese language is just for elderly people (Purwoko: 2011). There are 82% of the students who believe that English is more popular than Javanese language especially for young generation. The students think that younger generation has the mentality of "knowing English makes you cool". Therefore, it is not uncommon to see teenagers using English slangs when they commu-

8 Edwards, J. (2008). The ecology of language: Insight and illusion. In A. Creese, P. Martin, & N. Hornberger (Eds.), *Encyclopedia of language and education Vol. 9. Ecology of language* (pp. 15–26). Philadelphia, PA: Springer.

9 English is considered as the medium for cultural and knowledge capital through the expansion of Hollywood-based entertainment business.

nicate on Fb, Twitter, or other SNSs (thanks, sorry, on the way, etc). In addition, most students think that society looks down on Javanese language because they think that it has "low value" in the global competition.

Not only serving as scientific language, English is also a language of cultural capital. According to Bourdieu (1991), cultural capital means dominant discourses, languages, and knowledge to which elite groups usually have access. Cultural capital has potential to be a dominant hegemony which can overrule marginalized language or groups.

In addition, many Javanese vocabularies have been lost because they are undocumented (for example, household vocabularies). Therefore, there are not many Javanese vocabularies related with technology and science. Eventually, Javanese language cannot be used in scientific writing. Therefore, even for Javanese scholars, they must learn English in order to make their findings to be internationally published.

Several Efforts to Preserve Local Languages

The decline of Javanese and the increase of English trigger the concern from society. There must be some tangible actions to prevent local language to be endangered. There are 92% of the students who believe that government must intensively provide programs that can empower Javanese language as local language. However, they are aware that the responsibility to preserve the language does not exclusively belong to the government only.

The expansion of English as an international language has threatened the existing local languages around the world. Restriction programs on English and resistance to the hegemonic impacts of English by empowering the power of local languages and literatures are needed as part of the protection for the local national languages. Government, education system, and society must work hand in hand in realizing the programs. Government must regulate policies about the use of local language. They also must provide financial support and periodical monitoring program to the policy that they have issued.

In regard to education system, teachers must be trained how to be a professional instructor of local language by providing them comprehensive understanding through seminar, books, training, and other programs. Teachers need to comprehend how to create strategic learning material and curriculum development which enhance students' awareness in practicing their local language. Evaluation and assessment for the techniques and students' progress are important as well.

As community, people should start making some supporting programs for local language preservations such as language day and social gathering in Javanese language. Society, especially family, plays a central role for young generation to practice and apprehend both local and global languages.

Conclusion

As conclusion, the study finds that although Javanese has emerged to be a language of high-level cognition and knowledge construction, Javanese language is also considered lesser than English by the students especially dealing with its significance to access global information. The students consider English as an international language that has the power to help people in accessing knowledge and information. In addition, English is the most widely-used language for academic purpose such as books, journal articles, research finding, etc. Therefore, in order to gain the knowledge and share their ideas in a global scale, they must master English, even for Javanese language scholars.

Government and society must create programs for people to preserve Javanese language, as well as to understand and master English for global interaction. Education system and national policy also need to consider some prevention efforts so that the negative impact of global language expansion can be minimized.

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Enhancing Micro Gas Turbine Performance by Inlet Air Cooling Using Ejector Refrigeration

マイクロガスタービン（MGT）は有望な分散型発電システムだが、外気温が上がると発電効率が落ちる。この欠点を克服する冷却方法を検証した。

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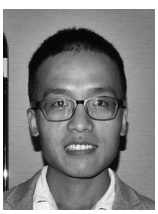

Abstract

Micro gas turbine (MGT) is attracting a lot of interest in the distributed generation (DG) market. But there is a significant limitation on the application of MGTs; the performance of MGT is strongly sensitive to ambient conditions, and its output and generating efficiency will drop with the increase of the ambient temperature. This paper presents a novel inlet air cooling method by ejector refrigeration driven by waste gas heat from the MGT, enhancing the performance of MGT under high temperature condition. First, the influence of inlet air temperature on the micro gas turbine is analyzed. The experimental results show power output decrease 0.47kW/K. A thermodynamic simulation model of the recuperated gas turbine at full condition is developed with Matlab/Simulink software. Heat recovered from the exhaust gas drives the ejector refrigeration to cool the inlet air, the performance of the ejector refrigeration is obtained through numerical calculation under different conditions. Cooling effect comparison between evaporative and refrigerated cooling methods was carried out under different meteorological conditions. Results show this novel inlet air cooling method through jet refrigeration driven by waste heat has obvious advantage under high temperature and heavy humidity environment condition.

Keywords micro gas turbine, Matlab/Simulink, inlet air cooling, ejector refrigeration

1. Introduction

Micro gas turbine (MGT) is relatively new technology that is attracting a lot of interest in distributed energy system (DES) with the electrical output ranging from 25kW~500kW[1-4]. As a prime mover in DES, even if MGTs perform low electrical generation efficiency compared with reciprocating engines (ICEs), MGTs offer a large number of advantages like, short construction period, fast response, high power density, low environment compact, low operation and maintenance costs and multi fuel capability. The use of micro turbine is considered a very attractive option in cogenerations system, to meet both electrical and thermal energy needs of residential and non-residential buildings. The performance of MGT largely depends on environment; high ambient temperature limits the air mass intake and thus leads to the reduction of power output and electrical efficiency, compared with the ISO conditions of 1.01 bar pressure, 288K, 60RH[5]. Typically, a IK rise in the ambient temperature will drop 0.5%~0.9% power output on medium/large GTs[6-9]. The electrical power output of MGTs is shown to larger decrease with ambient temperature at a rate of about 1.22%/K[10-12], due to a reduction of both air density and volumetric flow. Inlet air cooling techniques have been studied and applied to reduce its influence, several methods are available[13]: (i)

wetted media evaporative cooling (ii) high-pressure fogging (iii) refrigeration cooling (iv) absorption chiller cooling. Evaporative cooling methods are most effectively applied in hot and dry areas to cool the ambient temperature near to the wet-bulb temperature. Refrigeration cooling methods usually use the mechanical chiller, which are relatively simple and reliable in design and operation but require large electric power. Absorption cooling can recover energy from the GTs exhausts but are complex systems requiring expertise in design, operation and maintenance. Compared with traditional vapor compression refrigeration system, jet refrigeration has a good advantage of simplicity in construction, installation and maintenance. Moreover, ejector refrigeration system can be driven by low grade heat without consuming mechanical energy[14].

In this study, it is proposed to cool the intake air through the jet refrigeration driven by waste gas heat from the micro gas turbine. The paper is organized as follows: the MGT C30 Simulink model under analysis is presented and the effect of temperature on its performance is discussed; reports the design of the jet refrigeration system and the description of the refrigeration performance; illustrates the applied results of this cooling method; finally reports the concluding remark.

2. Description of the Inlet Air Cooling System

The schematic of this novel MGT inlet air cooling system is presented in Fig.1. This system consists of two parts: jet refrigeration system driven by heat recovered from the fuel gas and micro gas turbine C30 system. Air is compressed in compressor and passes through the regenerator. The fuel is injected into the combustion chamber and ignition occurs. The fuel gas passes through the turbine blades and produce about 28 kW power. The hot fuel gas increase the refrigerant temperature and transform it into saturated steam to drive the jet refrigeration system to work. The inlet air pass through the refrigeration evaporator part as air cooler before gas turbine intake reducing temperature and enhancing the performance of MGT under high ambient temperature condition.

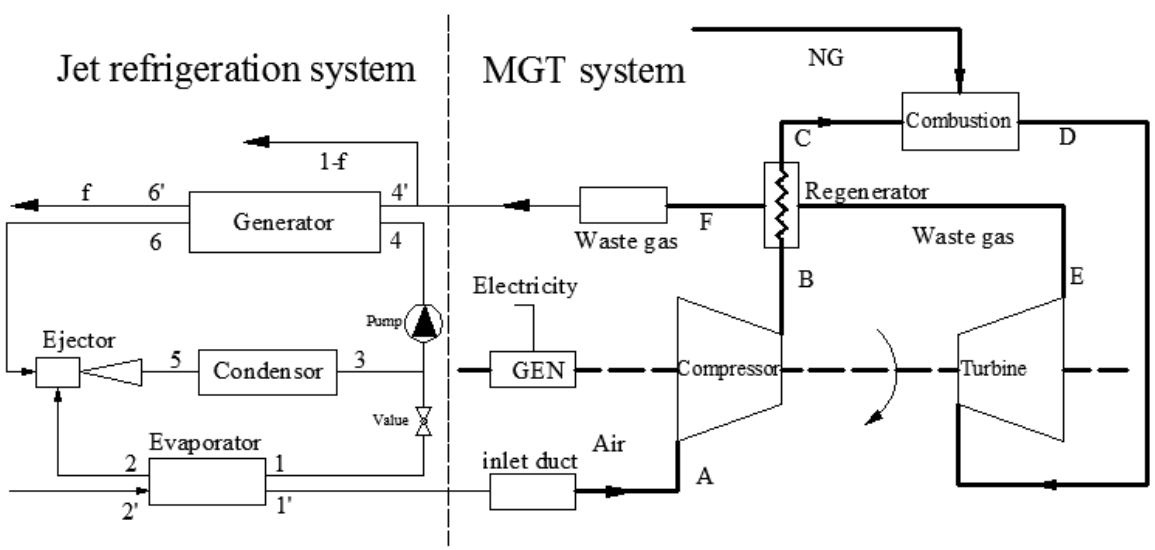

Fig.1 Schematic of ejector refrigeration inlet air cooling driven by waste heat from MGT

3. The MGT system

3.1 MGT Plant C30

The machine chosen for the analysis was a Capstone C30 based on a regenerative Brayton cycle. This system was divided into five main parts: compressor, regenerator, combustion, turbine, rotor. Each component is described individually.

Table 1 Parameters of MGT C30

Fuel	Natural gas
Power	28±2kW
Electrical Efficiency	26%
Exhaust Temperature	275°C
Exhaust Gas Flow	0.31kg/s
Net Heat Rate LHV	13.8 MJ/kWh

Nominal full power performance at ISO conditions: 59°F, 14.696 psia, 60% RH

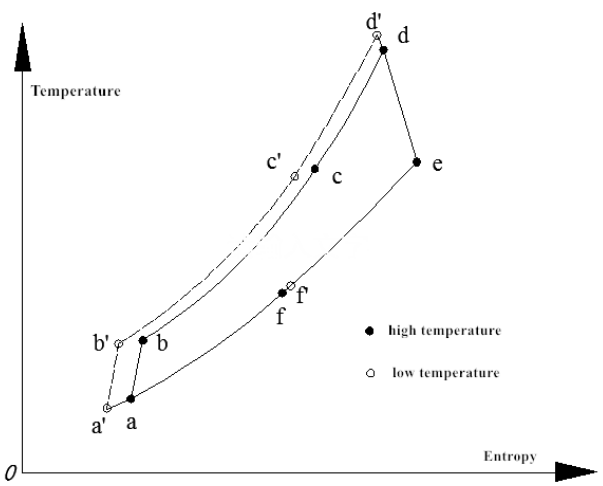

Fig.2 T-s diagram of micro gas turbine under different ambient temperature

The effects on the entropy-temperature diagram of the micro gas turbine utilizing a regenerator is presented in Fig 2. Air at ambient conditions is drawn into the compressor, where its temperature and pressure are raised (*a*-*b*). The high-pressure air leaving the compressor can be heated by transferring heat to it from the hot exhaust gases in regenerator (*b*-*c*). The air proceeds into the combustion chamber, where the fuel is burned at constant pressure (*c*-*d*). The resulting high-temperature gases then enter the turbine, where they expand to the atmospheric pressure while producing power (*d*-*e*). The exhaust gases leaving the turbine are thrown out (*e*-*f*). As ambient temperature T_a decreases the cycle (*a'-b'-c'-d'-e-f'*) is shown in Fig 2, the MGT power output increases.

3.2 Gas Turbine Model Analysis and simulation

The micro gas turbine C30 was developed with Matlab/Simulink software. The each component's mathematical model and solving procedure are described as follows.

(1) Compressor

The centrifugal compressor in design condition was modelled using the nominal pressure ratio β_c, the air mass flow rate m_a, inlet air temperature T_a, air adiabatic exponent k_a, air specific heat capacity $c_{p,a}$,=1.004 $kJ/(kg{\cdot}k)$. The temperature T_b at the out of the compressor and the power consumption P_c can be caculated by means Eqs (1) and (2)

$$T_b = T_a \beta_c^{\frac{k_a-1}{\eta_{y,c} k_a}} \qquad (1)$$

$$P_c = m_a c_{p,a} (T_b - T_a) \qquad (2)$$

Some modifications are needed to describe the off-design behavior of the compressor, the following performance formulas for compressor are proposed.

$$\bar{\beta}_c = \frac{\beta_c}{\beta_{c,0}} \qquad \bar{m}_a = \frac{\frac{m_a \sqrt{T_1}}{p_1}}{\frac{m_{a,0} \sqrt{T_{1,0}}}{p_{1,0}}} \qquad (3)$$

$$\bar{n}_c = \frac{\frac{n}{\sqrt{T_1}}}{\frac{n_0}{\sqrt{T_{1,0}}}} \qquad \bar{\eta}_{y,c} = \frac{\eta_{y,c}}{\eta_{y,c,0}} \qquad (4)$$

The air mass flow can be calculated by equations:

$$\bar{\beta} = c_1 \bar{m}_a^{\,2} + c_2 \bar{m}_a + c_3 \quad (5)$$

$$\bar{\eta}_{y,c} = \left[1 - c_4(1-\bar{n})^2\right] \frac{n_c}{\bar{m}_a}\left(2 - \frac{n_c}{\bar{m}_a}\right) \quad (6)$$

where

$$c_1 = \frac{n_c}{p(1-\frac{m}{\bar{n}_c}) + \bar{n}_c(\bar{n}_c - m)^2} \quad (7)$$

$$c_2 = \frac{p - 2m\,n_c}{p(1-\frac{m}{\bar{n}_c}) + \bar{n}_c(\bar{n}_c - m)^2} \quad (8)$$

$$c_3 = -\frac{\eta_c pm\,\bar{n}_c - m^2\,\bar{n}_c^{\,3}}{p(1-\frac{m}{\bar{n}_c}) + \bar{n}_c(\bar{n}_c - m)^2} \quad (9)$$

$$c_4 = 0.3 \quad (10)$$

Typical value for compressor in design condition β_c=4.0, inlet air temperature $T_{1,0}$ =288.15K, air mass flow $m_{a,0}$=0.31kg/s, compressor efficiency $\eta_{y,c,0}$ =0.80, p=1.8, m=1.8[15,16].

(2) Turbine

The parameters of radial turbine are: inlet pressure P_d, inlet temperaature T_d, turbine pressure ratio β_t, gas mass flow m_f.

Turbine pressure ratio :

$$\beta_t = \eta_p \beta \quad (11)$$

Power output of turbine:

$$w_t = m_f c_{p,f}(T_d - T_{ge}) \quad (12)$$

Outlet temperature of turbine:

$$T_{ge} = \frac{T_d}{\beta_t^{\frac{\eta_{y,t}(k_f-1)}{k}}} \quad (13)$$

η_p is the pneumatic efficiency of the system, which takes into account the pressure drops due to combustion and regenerator, η_t is the hydraulic efficiency. Typical data value are assumed $c_{p,f}$=1.091$kJ/(kg\cdot k)$

Some modifications are needed to describe the off-design behavior of the turbine, the following performance formulas for turbine are proposed.

$$\bar{m}_f = \frac{\frac{m_f\sqrt{T_d}}{p_d}}{\frac{m_{f,0}\sqrt{T_{d,0}}}{P_{d,0}}} = \sqrt{1.4 - 0.4\frac{n}{n_0}}\,\frac{p_{d,0}}{p_d}\sqrt{\frac{\beta_t^2 - f}{\beta_{t,0}^2 - f}} \quad (14)$$

$$\bar{\eta}_{y,t} = \left[1 - s(1-\bar{n}_t)^2\right]\frac{\bar{n}_t}{\bar{m}_f}\left(2 - \frac{\bar{n}_t}{\bar{m}_f}\right), \quad \bar{n}_t = \frac{\frac{n}{\sqrt{T_d}}}{\frac{n_0}{\sqrt{T_{d,0}}}} \quad (15)$$

Commonly f=4.0, s=0.3[15,16].

(3) Combustion chamber

The parameters of interest for the combustion chamber are: air inlet temperature T_c, fuel mass flow m_b,air and fuel mass ratio α, energy conservation are used to caculate the outlet temperature T_d.

$$T_d = T_c + \frac{\eta_b LHV_b}{(1+\alpha)c_{p,f}} \quad (16)$$

$$\alpha = m_a / m_b \quad (17)$$

$$w_b = m_b LHV_b \quad (18)$$

(4) Regenerator

The inputs for this modeling block are: inlet exhaust gas temperature T_{ge}, inlet air temperature T_b, ε_{re} is the efficiency of the regenerator, T_c is the outlet temperature of the air exhaust from the regenerator.

$$T_c = \varepsilon_{re}(T_{ge} - T_b) + T_b \quad (19)$$

(5) Rotor

The electrical power output and efficiency can be caculated by means of equation (21) and (22). P_t, P_c and P_m are the mechanical power produced by turbine, the mechanical power required by compressor and power deliverd to shaft, and $\eta_{el,PG}$, η_{el} are the power generator efficiency and electrical efficiency respectively.

$$P_m = P_t - P_c \qquad (20)$$

$$P_m = \frac{P_{el}}{\eta_{el,PG}} \qquad (21)$$

$$\eta_{el,g} = \frac{P_{el}}{P_b} \times 100\% \qquad (22)$$

(14)

Table2 List of data input for the model

Parameter	U.m.	Value	Source
β	-	4.0	Datasheet
η_c	-	0.80	0.80[17] 0.82[15-16]
η_t	-	0.82	0.83[17] 0.85[15-16]
η_b	-	0.99	0.99[15-18]
η_p	-	0.89	0.89[15,19]
$\eta_{el,PG}$	-	0.86	0.85[15]0.87[16]
ε_{re}	-	0.82	Datasheet
α	kg/kg	135.30	Datasheet
m_b	kg/s	2.24×10-3	Datasheet
V	m³/h	12.0	Datasheet
LHV_b	MJ/kg	49.24	Datasheet

Condition 101.03kPa, 293.15k, natural gas density 0.6733kg/m^3, Composition of the natural gas : N_2-2.1579, O_2-0.4094, C_1-94.0917, C_2-1.5142, CO_2-0.0431, C_3-0.6353, i-C_4-0.2876, n-C_4-0.3753, i-C_5-0.1651, n-C_5-0.1914, i-C_6-0.0373, n-C_6-0.0193, i-C_7-0.0240, n-C_7-0.0065,ΣC_8 -0.0408.

Air specific heat capacity [32]

$$c_{p_a} = \frac{8.314}{28.97}(3.653 - 1.337\times10^{-3}T_{av} + 3.294\times10^{-6}T_{av}^2 - 1.913\times10^{-9}T_{av}^3 + 2.763\times10^{-13}T_{av}^4)$$

A Simulink model was developed with the thermodynamic cycle process and parameters of each component. The model shown in Fig.3 consists of compressor, turbine, regenerator, combustion and generator. The aim is to show the effect of inlet air temperature on C30 power output by real time input from 0 to 45 represent the simulation inlet air temperature value.

Simulation performance results for the inlet air temperature slow increase for the MGT C30 are represented in Fig.4-5, the comparison of the silmulation data and experimental results under different inlet air temperature, Fig6.

Fig.6 reports the electrical power output as a function of the inlet air temperature. The blue dots refer to the experimental data carried out under different ambient conditions. The black line refers to the simulation results. It is clearly visible in the data series showing power output decrease trend with the increasing inlet air temperature. Experiment data shows that about 0.47kW power output drop for every 1 K temperature increase. Simulation data has a similar trend of 0.23kW/K. Experimental data shows inlet air temperature has a greater effect on power output than simulation condition. Micro gas turbine C30 output decreases sharply under the high ambient temperature, power can only reach 18.71kW at the inlet air temperature of 38.50 °C, about 35.50% reduction compared with the ISO condition.

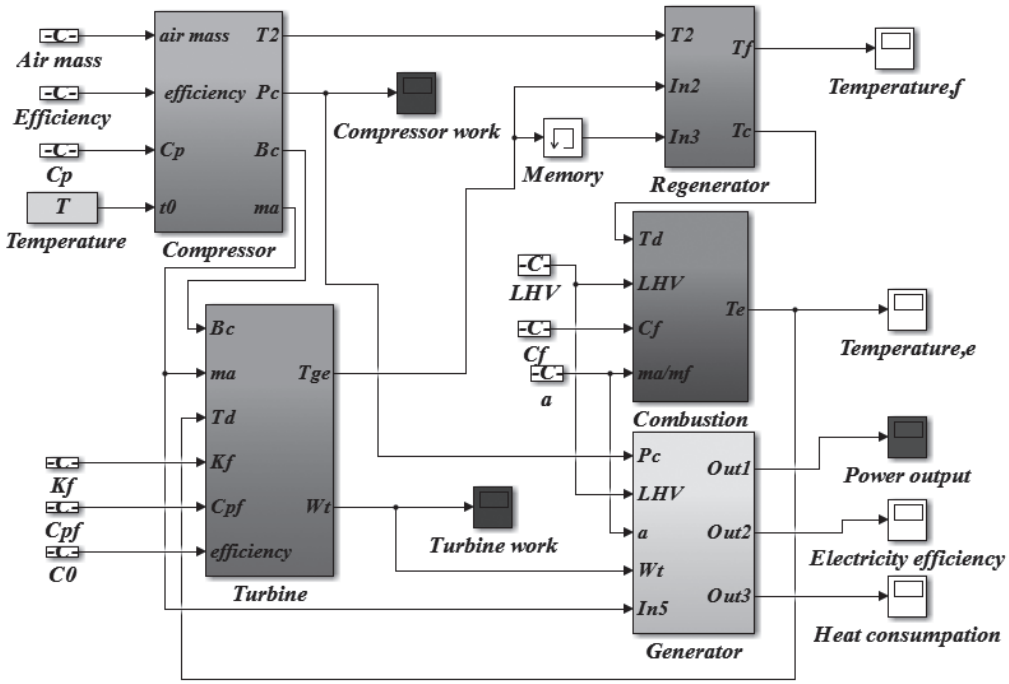

Fig.3 Simulation model of MGT C30 built by Simulink

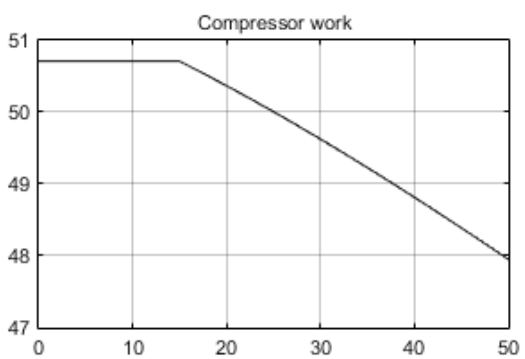

Fig.4 C30 Compressor simulation power consumpation

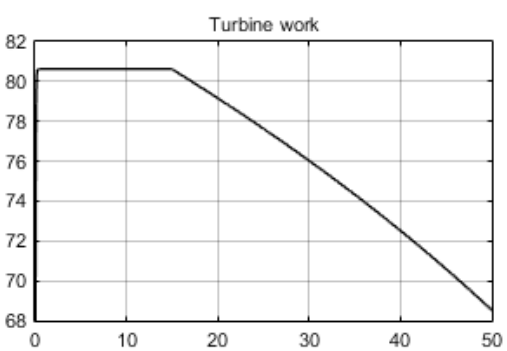

Fig.5 C30 turbine power output simulation

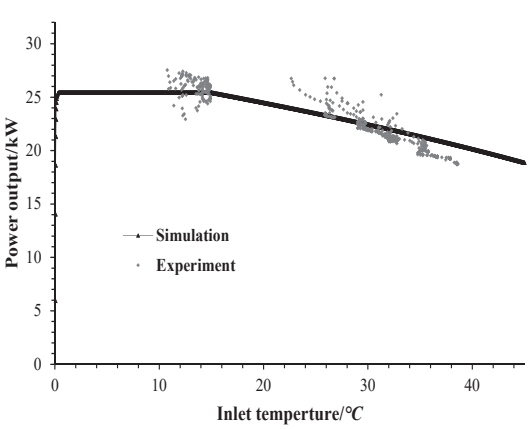

Fig.6 Comparison of inlet air temperature influence on micro gas turbine performance by simulation and experiment data

4. The Ejector Cooling System

There are three main types of heat-driven cooling technologies: absorption, adsorption and ejector refrigeration. Jet refrigeration has a good advantage of simplicity in construction, installation and maintenance, which can be driven by low grade heat source such as solar and waste industrial heat and enables the reduction of the mechanical work requirement. [19,20].

4.1 Description of the Ejector Refrigeration Cycle

A ejector refrigeration system employs an ejector to fulfill the function of a compressor, which can be seen in Fig.7. This mainly consists of four parts; primary nozzle, suction chamber, mix chamber and diffuser. The high pressure hot refrigerant gas from the generator enters the primary nozzle, expands, accelerates and reaches the supersonic state. At the exit of the nozzle, the high velocity gas enters the suction chamber, creating an area of low pressure at the secondary entrance of the ejector into which the fluid from the evaporator is entrained. The two fluid begin to mix in the mixing chamber undergoes a shock and increase the static pressure and become subsonic. Then the mix fluid flows into the diffuser with an additional pressure lift, the flow finally discharges into the condenser and becomes fluid state.

An ejector refrigeration cycle is a thermo-compressor cycle, the compressor effect is achieved using low grade heat source supplied to generator. Fig.8 shows a schematic diagram of the jet refrigeration system, consisting of ejector, condenser, evaporator, generator and a circulation pump. As is shown in Fig.8 the mixed fluid discharged from ejector becomes condenser fluid by rejecting heat to environment. One part of the mixed fluid enter the evaporator after passing through the throttle value, where it evaporates and produce the refrigerating effect (3-1-2). The other part is lifted to the generator via the pump and be vaporized by the delivered heat energy then the high pressure vapor enter into the ejector again (3-4-5). The two parts of fluid mix in the ejector, complete the cycle.

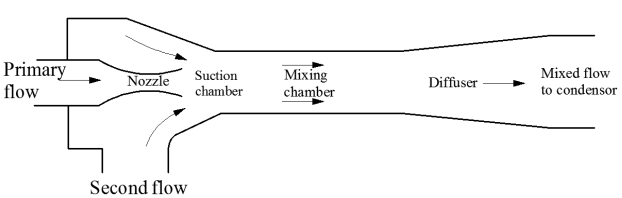

Fig.7 Schematic view of ejector structure

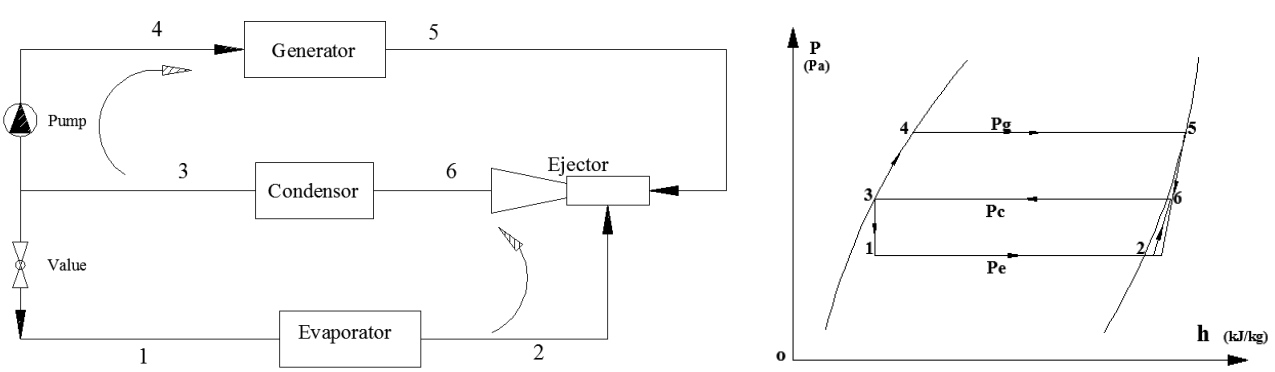

Fig.8 Ejector refrigeration cooling cycle

4.2 Mathematical Modeling and Performance Criteria

The coefficient of performance (COP) can be defined as the ratio of the refrigerating capacity to the heat supply to the generator

The cooling capacity obtained at the evaporator is determined as follows:

$$Q_e = m_e(h_2 - h_1) \quad (23)$$

The heat input to the generator:

$$Q_g = m_g(h_5 - h_4) \quad (24)$$

Performance of the ejector is evaluated by the entrainment ratio, defined as mass ratio of the secondary to primary flow rates:

$$\omega = \frac{m_e}{m_g} \quad (25)$$

The coefficient of performance of the jet cycle is calculated as the thermal ratio of cooling capacity over generator capacity:

$$\mathrm{COP} = \frac{Q_e}{Q_g + W_p} \quad (26)$$

Neglecting the pump work, the COP of the refrigeration cycle is:

$$\mathrm{COP} = \frac{Q_e}{Q_g} \quad (27)$$

The COP can be defined as:

$$\mathrm{COP} = \omega \frac{h_2 - h_1}{h_5 - h_4} \quad (28)$$

The ejector performance simulation is carried out based on the one-dimensional constant pressure model. Huang[22,23] postulated a one dimensional model to analyze the ejector performance, which shows a good agreement with the experimental data. R141b shows a good performance compared with most refrigerant, which have been certified by many researchers[22,23,24,25], in addition the condenser pressure of R141b is closely to the ambient condition and we selected R141b as the work refrigerant. To obtain the system COP, a computational procedure based on C++ with iteration process was developed to calculate the entrainment ratio ω and the refrigerant properties were taken from the NIST database[26]. In the resent analysis, efficiencies of primary nozzle, secondary nozzle and diffuser were selected as η_p=095, η_s=085, η_d=085 suggested[22].

Fig.9 (a)-(b) show the effects of evaporator temperature on entrainment ratio ω and COP under different generator temperature with a condenser temperature 30 °C. An increase in the T_e leads to a rise in both ω and COP. This is because refrigerant R141b saturated evaporation pressure increases with the corresponding evaporator temperature increasing, leads to the increase of the mixed flow pressure in ejector mix chamber. The rise of pressure difference between the mixing chamber and the diffuser outlet, leading to a higher entrainment ratio ω and improving the coefficiency of refrigeration performance.

Fig.10 (a)-(b) show the effects of condenser temperature on entrainment ratio ω and COP under different evaporator temperature with a generator temperature 90 °C. An increase in the T_c leads to a decrease in both ω and COP. This is because refrigerant R141b saturated condenser pressure increases with the corresponding condenser temperature increasing. The decreasing pressure difference between the mixing chamber and the diffuser outlet, leads to a decrease both ω and the coefficiency of refrigeration performance.

5. Case Study

To get a better understanding of the inlet air process, one often refers to the psychometric chart. Fig.11 illustrates the various psychometric processes applicable to an inlet air cooling unit[7,27]. Evaporative

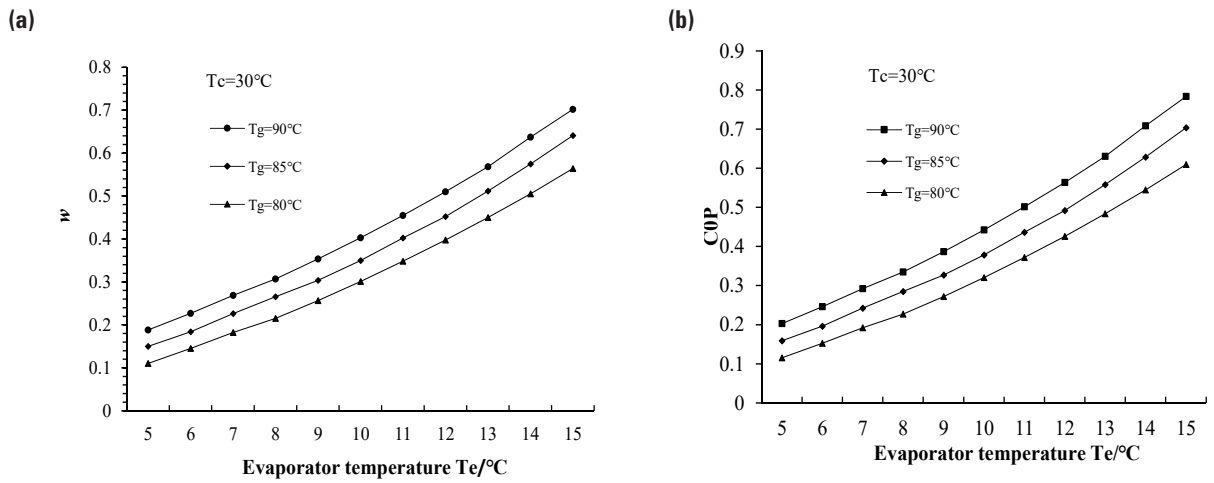

Fig.9 Effect of evaporator temperature on the system performance for Tc=30°C

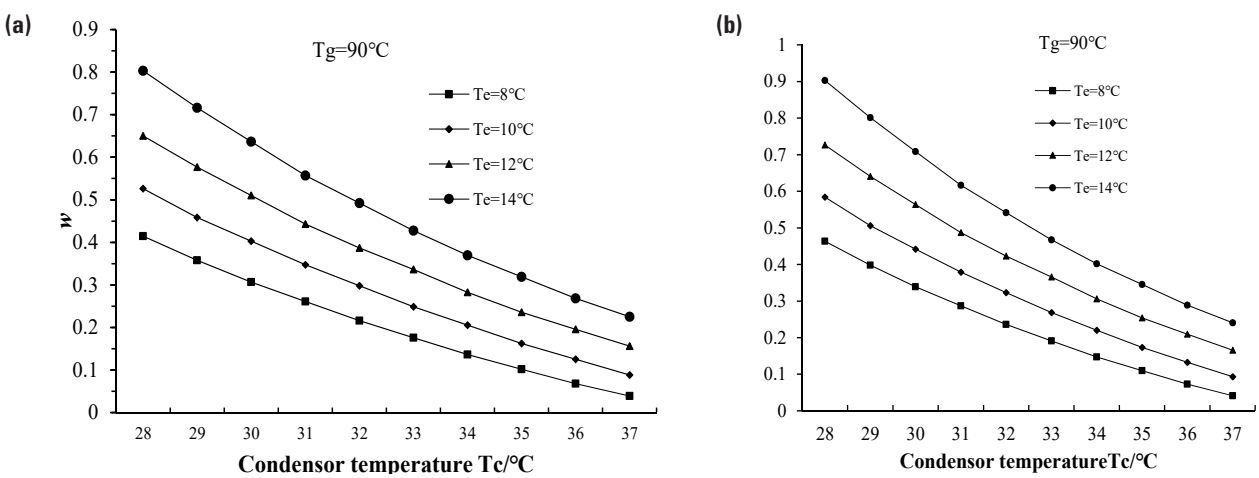

Fig.10 Effect of condenser temperature on the system performance for Tg=90°C

cooling is based on the evaporation of water in the intake air of the gas turbine. As water evaporates, the latent heat of evaporation is absorbed from the surrounding air. As a result, the air is cooled undergoes the constant enthalpy humidification process. Evaporative cooling is most suited to hot dry areas as it uses the latent heat of vaporization to cool ambient temperature from the dry-bulb to the wet-bulb temperature. Refrigeration cooling can reach a cooling temperature below the wet bulb, first the air temperature drops while the relative humidity continues to rise until its dew point temperature is reached (a-b). A further cooling process(b-c) continues removing the latent heat of the condensation of the water in the air until it reaches the desired temperature point c.

The total refrigerating cooling load includes the sen-

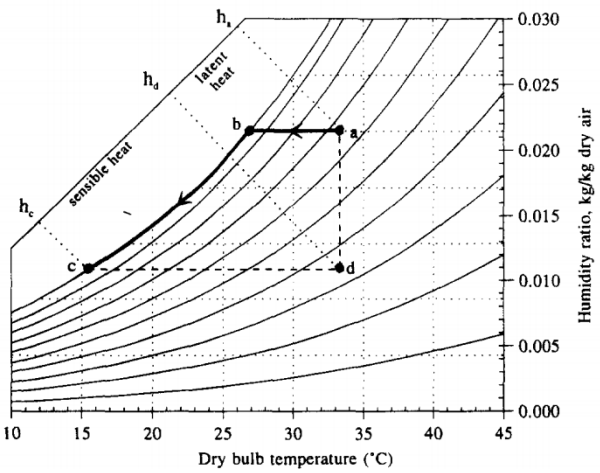

Fig.11 The air cooling process on psychometric chart

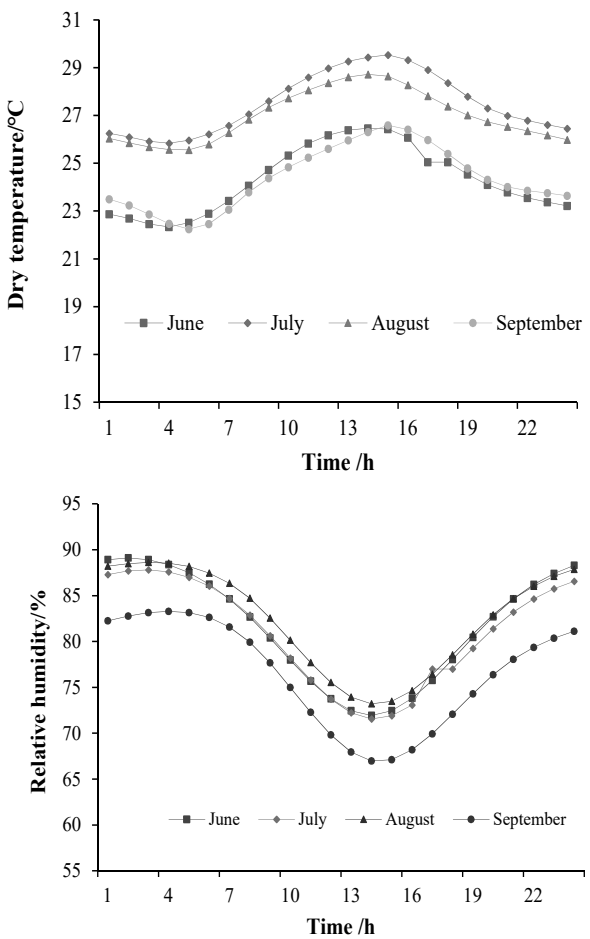

Fig.12 Hourly meteorological parameters from June to Septermber in Shanghai

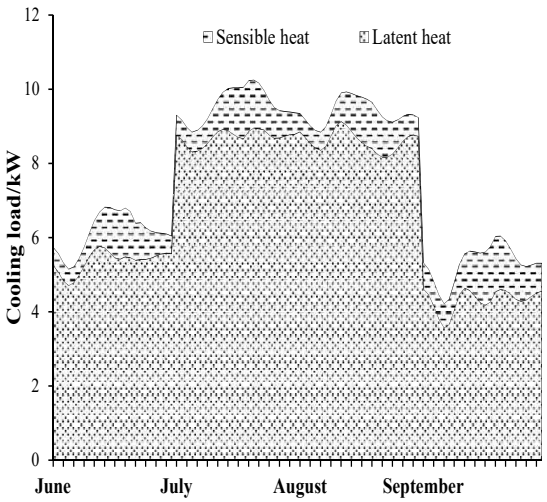

Fig.13 Cooling load variation from June to September

sible heat of air and the heat required to be removed, to condense the moisture contained in the air:

$$Q_t = m_a(Q_{sensible} + Q_{latent}) \quad (29)$$

$$Q_{latent} = h_a - h_d \quad (30)$$

$$Q_{latent} = h_a - h_d \quad (31)$$

h_a, h_c and h_d are the enthalpy of air at points a, c and d respectively.

The cooling load calculation procedure is as follows: the climate data [28] in Shanghai City of average day of each month (June-September) are calculated. Twenty-four pairs of data (temperature and relative humidity) represent an average day, Fig.12. Cool the inlet air temperature down to 18 °C, the cooling loads composed of sensible and latent heat in different months are presented in Fig 13. It can be clearly seen that the contribution of latent heat is comparable to sensible heat, especially in August. This is because the high relative humidity of the air in Shanghai during hot months.

Evaporative cooler effectiveness is given by:

$$E = \frac{T_{1DB} - T_{2DB}}{T_{1DB} - T_{2WB}} \quad (32)$$

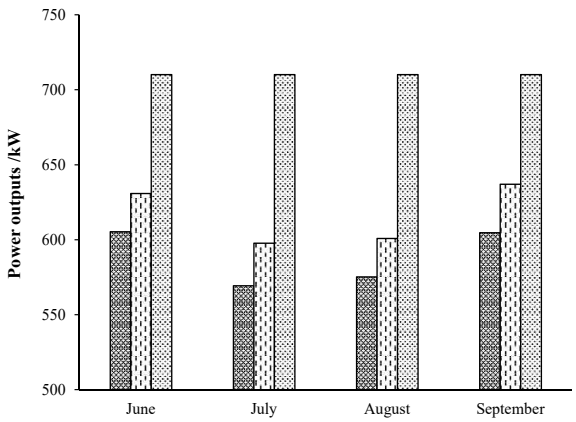

Fig.14 Comparison power augment performance with different cooling methods

Where T_1 is inlet air temperature, T_2 is exit temperature of evaporative cooler; *DB* is dry bulb, *WB* is wet bulb. A typical value for evaporative cooling effectiveness *E* is 85–90%[29,30,31]. The inlet air temperature drop assuming an effectiveness of 0.9, is given by

$$\Delta T_{db} = 0.9 \cdot (T_{1,DB} - T_{2,WB}) \quad (33)$$

Cooling load of MGT C30 variation from June to September can be seen in Fig.13. The average daily maximum hourly cooling load 10.23 kW occurs at 3:00 PM in July with average dry temperature 30°C. Recovering part heat from the waste gas driving the ejector refrigeration to work can really cover the cooling load under the design condition of evaporative temperature 10°C, generator temperature 85°C, the calculation *COP*=0.378. As the inlet air temperature increase, the experimental results analysis show that the power output of C30 drop 0.47 kW/K. Assuming the evaporative effective is 0.9, Fig.14 shows the technical results obtained with the application of evaporative and ejector refrigerating cooling methods.

Evaporative cooling method generally has a good effect during September due to the relatively low temperature and humidity weather condition and the total power augment can increase 5.4%. The power augment become slightly with the increasing of temperature and humidity with evaporative cooling. However, jet refrigeration cooling method shows a good inlet air cooling performance, the total power monthly augment capacity can reach 24.8%, 23.5% in July and August respectively. According to the results, the ejector refrigerating cooling method has a good advantage over evaporative cooling method on gas turbine power augment under higher temperature and humid weather condition.

6. Conclusion

A thermodynamic analysis of MGT C30 jet refrigeration inlet air cooling driven by recovering waste gas heat systems has been carried out. The results of the calculation suggest the following comments:

The performance of MGT C30 is particularly sensible to the ambient inlet air temperature whose increase determines a significant loss 0.47 kW in terms of experimental performance, even higher than that of large sized GTs as documented in several works. Modeling and simulation of C30 was developed with Matlab/Simulink, the power outputs of turbine reduce much greater compared with the work consumption of compressor, leading to the decrease of net power output, simulation results have a good agreement with experimental data.

The effect of some main parameters on ejector refrigeration performance with refrigerant R141b was investigated: COP increased with both increasing generator and evaporator temperature, and decreased with condenser temperature. Heat recovered from the exhaust gas drives the ejector refrigeration to cooling the inlet air, the performance of the ejector refrigeration is obtained through numerical calculation under different conditions, which can really cover the inlet air cooling load under design condition.

Cooling effect comparison between evaporative and refrigerated cooling methods was carried out in Shanghai city. Ejector refrigerating cooling method driven by waste gas has obvious advantage under high temperature and heavy humidity environment condition.

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Day Care Services and Programs for Farming Families in the Cordillera Administrative Region (CAR), Philippines

フィリピンの農村地帯でも公的保育・幼児教育サービスのニーズが高まっている。45 施設、500 人弱の幼児の実地調査から、その現状と課題を探る。

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Abstract The first six years of birth is the most crucial stage in the lives of children. It is during this stage that physical, mental and emotional developments take place. Thus, it is important for children to be provided with a stimulating environment to ensure their proper total development. Child rearing at this sensitive part in their lives should never be undermined.

Child rearing should be the sole responsibility of parents. However, due to the needs of the times, most parents in the Cordillera need to farm or look for piece work for a living oftentimes leaving their children in the care of substitute caregivers such as day care workers. Under the Early Childhood Care and Development (ECCD) Act (R.A. No. 8980, s. 2002), the Local Government Unit (LGU) s are mandated to provide the early education and development services, in collaboration with the Department of Social Welfare and Development (DSWD) and other stakeholders, thereby responding to the children's needs in a holistic way and achieve greater or sustainable impact. On the part of the LGUs, they give financial support to the children's programs.

This study analyzed the socio demographic profile of 489 day care children enrolled in the 45 selected day care centers in CAR for the school year 2014 – 2015. The result showed that most beneficiaries of the day care service programs are males. Most of them entered school at 4 years old. Majority of the parents are young adults in their 30's, high school graduates with farming as their means of livelihood. With this kind of situation, the day care program of the government is the solution through the support and caring hands of the day care workers. The day care workers considered the program very helpful and satisfying.

Keywords day care children, day care services, farming families, socio economic condition, day care workers

Introduction

Background of the Study

The first six years of birth is the most crucial stage in the lives of children. It is during this stage that physical, mental and emotional development take place. Thus, it is important that children are provided with a stimulating environment to ensure their proper total development. Child rearing at this sensitive part in their lives should never be undermined.

Child rearing should be the sole responsibility of parents. However, due to the needs of the times, most parents in the Cordillera need to farm or look for piece work for a living oftentimes leaving their children in the care of substitute caregivers such as day care workers.

Our day care workers are indeed a big help to

working parents. I commend their support and caring hands for parents taking active role in providing supplemental parental care to young children. (Soliman, C.J. 2002).

As embodied under this law, ECCD today attempts to integrate interventions in health, nutrition and early education so as to achieve greater impact and respond to children's needs in a holistic way. The day care worker monitors the child's immunization, growth and nutritional status.

Prior to the devolution, DSWD was the main government agency involved in psycho-social development efforts through early education through its Day Care Service and the Parent Effectiveness Program.

Since devolution, the local government units have been mandated to provide the early education services previously provided by DSWD. DSWD's role is now more in policy development, coordination, monitoring, training, technical assistance and accreditation. At the Central Office, DSWD's activities for children are divided among three Bureaus: the Bureau of Child and Youth Welfare which supports the Day Care Service Program; the Bureau of Family and Community which supports the Parent Effectiveness Service (PES); the Bureau of Emergency Assistance, which supports the nutrition service for malnourished children.

As of March 1994, there are 20,211 Day Care Center (DCC)s established all over the country, covering 17,211 barangays or 41% of all 42,144 barangays. These DCCs served 1,051,362 preschool children. Out of the 20,211 DCCs, 16,558 0r 81.92% were accredited by the Department of Social Welfare and Development.

In terms of training, 16,770 day care workers and 2,592 day care worker trainers and 17 supervisors; 2,517 PES volunteers/trainers; 3,000 direct service parents on proper child rearing principles and techniques and practices have been trained as of March 1994.

While efforts have generated positive results towards addressing children's basic learning needs, programs coverage remains limited. In 1991, out of the total 11.56 million 0–6 population, only 30.6% or 3.537M were reached by the various early childhood care and development services.

The department has strengthened its advocacy for the implementation of RA 6972–an Act establishing DCCs in every barangay and municipality resulting in the increased number of day care centers after devolution. The quality of the program and its curriculum needs to be upgraded, along with the quality of training of day care workers. We have recently included in our curriculum early detection of disability and child abuse as well as children's right education as part of our commitment to the UN Convention on the Rights of the Child. Further, the establishment of other forms of day care like home based/family day care, child minding and supervised neighborhood play, to expand the implementation of ECCD and the use of innovative methods to reach more children and their parents needs to be pursued.

Collaboration and coordination among government and non-government organizations as well as the private sector at the local level is imperative if we are to reach more preschoolers particularly in remote areas and depressed barangays. (Balanon, L. 1994)

Statement of the Problem

This study aims to present the implementation of the day care services and programs for farming families in Cordillera Administrative Region (CAR)–Philippines. It specifically seeks to answer the following problems/questions:

1. What are the levels of attainment of objectives of the day care services program relative to the socio demographic profile of day care parent's beneficiaries in CAR - Philippines?

2. Are there differences in the level of effectiveness of the implementing strategies used in the day care services program if the extent of attainment of the objectives is considered?

3. Are there differences in the degree of seriousness of problems encountered and solution employed if the level of effectiveness of implementation strategies used is considered?

Objectives of the Study

The study had the following objectives:

1. Describe the socio demographic profile of parent beneficiaries of the day care service program to their children attending.
2. Determine the extent of attainment of the objectives of the day care services and programs in CAR–Philippines.
3. Analyze the level of effectiveness of the implementing strategies of the day care services program.
4. Determine the relationship between the level of effectiveness of the implementing strategies of the day care services program and extent of attainment of objectives.
5. To evaluate the degree of seriousness of problems encountered by the implementers and identify solutions of the day care services program.

Importance of the Study

The results of the study can greatly contribute to the government agencies such as the LGU's and Non Government Organizations (NGO's). These agencies will benefit through the research by having knowledge on the implementation of the day care services program.

According to Republic Act No. 6972 which was begun and held in Manila in 1990, there is an act establishing a day care center in every barangay, instituting therein a total development and protection of children program appropriating funds therefore and for other purposes. In relation to the research, day care personnel will gain knowledge on how services can be provided according to the needs of the children.

The results of the study can be used in finding solutions to problems that may arise in handling a day care center and its personnel through the variables that will be studied.

From the response of the day care workers, parents and guardians of day care enrolled children whether it be positive or negative reaction shall serve as a basis for possible suggestions and recommendations on how to further improve and how to effectively implement the day care services program and also draw possible measures in order to increase employee participation in this program.

This study can be used by the Department of Social Welfare and Development (DSWD). They will have the necessary information and ideas on how to improve further the implementation of the day care services program. With respect to the government officials and local government units (i.e. city, province, municipal, barangay) they would be able to appreciate the importance of the day care services program in the physical, social, intellectual, psychological, and spiritual development of preschoolers such that it would be possible for them to assist the implementation of the day care services program. Also legislative support would add subsidies which would amount to the improvement and upgrading of the day care services as a whole.

Researchers and students interested in similar or related topics and areas of interest will directly be benefited by referring this research proposal in situations where it can be used as a reference.

Scope and Delimitation of the Study

This paper is confined to a study on the implementation of day care services and programs for farming families in the Cordillera Administrative Region (CAR)—Philippines for the school year 2014 -2015. The substantive content of this research includes

Fig.1 Day care children with day care worker

the socio demographic profile of the beneficiaries of the day care services program; the programs and services and the extent of implementation; the level of effectiveness and techniques and approaches used in the implementation; the problems encountered by the implementers and the beneficiaries and lastly the solutions and recommendations as suggested by the implementers and beneficiaries.

Conceptual Framework

"The kind and quality of care given to a child during the first six years of life determine what he will be as a youth and as an adult." (Steele, 1973)

The parents are the primary persons who are to take full responsibility of realizing this aspect in a person's total growth and development. It is at this stage when parents should be around to mold the physical, intellectual, emotional and psychological development of the child. As the child grows, the parents are there to see that his needs are met, his sense of right and wrong guided, his physical growth monitored, and his learning adequate.

But with the many changes happening especially on parenting and the role of the mother in the home, it is not possible that parents are always there to monitor a child's growth and development. One very important change is the role of the mother. In the past, as always, she took the role of housewife, mother, housekeeper all at the same time. At present, she not only is a wife, a mother, and a housekeeper, but also an income earner, that is, she also works to help out in the daily household expenses. Since both parents are working, the child's growth and development is not closely monitored on a full time basis anymore. When parents are not there, the child is left to the care of close relatives, the maid, or the neighbors. This being the case, the kind of caring parents want for the child is amiss. So even in their absence, parents wants an alternative entity or person to more or less fill up the "vacuum of caring" resulting from their absence. For they know that these years, the first six years of life, are very crucial in a child's growth and development

One alternative is the provision of day care service program through establishing a day care center in every barangay in order to cater to the needs of children. It is because a day care service is the provision of supplemental parental care to 0–6 year old child who may be neglected, potentially neglected during part of the day when parents cannot attend to his needs. (Steele, 1973) A day care center provides the following objectives: 1) physical development 2) development of personal abilities 3) ability to handle human relations 4) development of creative and analytical ability, 5) development of spiritual and social values and 6) provision of comfort and safety.

With all of the above objectives and provisions of day care services, parents feel comforted and safe that in their absence and in their temporary inability to physically provide immediate care to their children, they have the day care center to turn to.

The conceptual paradigm of the study is shown in Table 1.

The independent variable is the factor which is measured, observed and selected by the researcher to see its effects to an observed phenomena. (Steele, 1973)

The independent variables of the study are the Socio Demographic Profile of the parent beneficiaries of the day care services program.

Dependent variable is the factor which is manip-

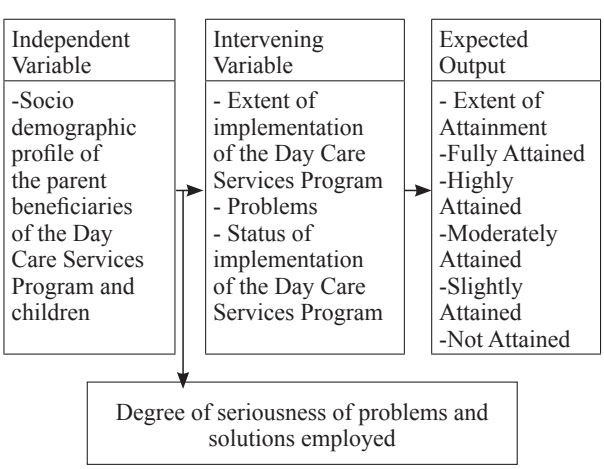

Table 1 Conceptual Paradigm showing the relationships of variables included in the study

ulated and observed to determine the effect of the independent variable to the observed phenomena. (Steele, 1973)

For this research study, the dependent variable is the extent of attainment whether fully attained, highly attained, moderately attained, slightly attained and not attained.

Intervening variable is the variable which theoretically affects the observed phenomena, but cannot be seen, its effects can only be inferred from the effects of the independent variable to the observed phenomena. (Steele, 1973)

The intervening variable for this research is the extent of effectiveness of implementation of the day care services program, problems and the status of implementation of the day care services program.

Objectives of the Day Care Services Program

- Comfort and Safety
- Inculcation of Spiritual/Social values
- Physical Development
- Human Relations
- Personal Abilities

Programs and Services

1. Day Care Service Program

It refers to the services that promote the conditions of care, socialization and education in the home or community that enhance a child's total development. It also includes the provision of health, nutrition, early education, psycho-social and other services that provide for the holistic needs of day care children.

Fig. 2 Day care children listen to a day care worker

2. Parent Effectiveness Service (PES)

This is the provision of expansion of knowledge and skills of parents and caregivers on parenting to be able to respond to parental duties and responsibilities on the areas of early childhood development, behavior management of younger and older children, husband-wife relationships, prevention of child abuse, healthcare and other challenges of parenting.

Fig. 3 Day care parents undergo training on effective parenting

3. Supplementary Feeding Program

It is the provision of food, supplement and energy and other nutrients missing from the diet of those

Fig. 4 Supplementary Feeding for Day Care children prepared and cooked by parents

who have special nutritional requirements to prevent malnutrition through the reduction of the nutrient gap between an individuals actual consumption in his or her requirement (WHO, 1997).

CAR Situationer

- Based on the 2005 Regional Situationer of Social Welfare and Development of DSWD-CAR, Baguio City, there are 34,901 or 84% enrolled in the different Day Care Centers in the different municipalities/city in CAR while 16% or 6,591 by public and private pre-schools. Out of the 1,176 barangays in CAR, there are 1,676 established day care centers be it permanent or temporary with 1,446 day care workers. As per record out of the 1,446 DCWs, there are 1,030 DCW's accredited by DSWD.

Fig. 5 Map of Cordillera Administrative Region

Benguet Situationer

- In the Provincial Local Development Plan for Children (2005–2025) of Benguet Province, it appears that for the school year 2002–2003, all the barangays in the thirteen (13) municipalities of Benguet have at least one or more day care centers in every barangay. Comparing the number of day care centers with the number of barangays, Itogon have the most with at least 5 in every barangay followed by Kibungan (4) and Mankayan, La Trinidad, Kapangan, which have at least 3 DCCs in each barangay. The rest of the municipalities have two each, except Buguias, Kabayan and Sablan which have only 1 day care center in each barangay.
- The province of Benguet has a total of three hundred sixty eight (368) day care care centers excluding the inactive centers as of the school year 2002–2003. These day care centers are either permanent or temporary in nature. Permanent structures are exclusively for day care centers. These were constructed either through special projects, Local Government Unit (LGU)'s initiatives and/or through Non Government Organizations or in most cases; these structures are built from national funds with counterpart of the LGU and parents concerned. On the other hand, temporary day care centers can be found in schools, barangay halls, clinics, churches or any available private houses.

Kapangan Situationer

- In the municipality of Kapangan, Benguet for the school year 2014–2015, there are 45 day care worker (DCW)s, out of the 45 DCW's, 43 DCWs are accredited by DSWD. There are 30 permanent day care centers established while the 15 DCCs are being conducted in schools, multipurpose hall and others. There were 489 day care children enrolled.

Methodology

The study was conducted in the 15 barangays of Kapangan, Benguet namely barangays: Balakbak, Beleng-Belis, Boklaoan, Cayapes, Central, Cuba, Datakan, Gadang, Gaswiling, Labueg, Paykek, Pongayan, Pudong, Sagubo and Taba-ao. The municipality of Kapangan has 45 day care centers with 489 enrolled day care children for the school year 2014–2015.

The respondents of this study are the 45 day care workers assigned in the 15 barangays of Kapangan, Benguet and the 489 parents of day care children enrolled in the 45 day care centers for the school year 2014 -2015.

A descriptive normative type of research questionnaire was used to gather data. The questionnaire made used of the open-ended and closed type of question. The copies of the questionnaire were distributed by the researcher personally after obtaining permission from the concerned authorities.

The 5–point Likert scale was used to describe the objectives of the day care service program.

Assigned Value	Descriptive Value	Description
5	4.50 and above	Fully Attained
4	3.50–4.49	HighlyAttained
3	2.50–3.49	Moderately Attained
2	1.50–2.49	Slightly Attained
1	1.49 and below	Not Attained

The 5-point Likert scale was also used to describe the implementing strategies in the day care service program.

Assigned Value	Descriptive Value	Description
5	4.50 and above	Very Much Effective
4	3.50–4.49	Much Effective
3	2.50–3.49	Moderately Effective
2	1.50–2.49	Slightly Effective
1	1.49 and below	Not Effective

The 5-point Likert scale was also used to describe list of problems in the implementation of the day care service program.

Assigned Value	Descriptive Value	Description
5	4.50 and above	Very Much Serious
4	3.50–4.49	Much Serious
3	2.50–3.49	Moderately Serious
2	1.50–2.49	Slightly Serious
1	1.49 and below	Not Serious

Fig. 6 Map of Kapangan, Benguet

Statement of the Problems

1. What are the levels of attainment of objectives of the day care services program relative to the socio demographic profile of day care parent beneficiaries in the Cordillera Administrative Region?
2. Are there differences in the level of effectiveness of the implementing strategies used in the day care services program if the extent of attainment of the objectives are considered?
3. Are there differences in the degree of seriousness of problems encountered and solution employed if the level of effectiveness of implementation strategies used are considered?

Objectives

1. Describe the socio demographic profile of parent beneficiaries of the day care service program to their children attending.
2. Determine the extent of attainment of the objectives of the day care service program in CAR.
3. Analyze the level of effectiveness of the implementing strategies of the day care service program.
4. Determine the relationship between the level of effectiveness of the implementing strategies of the day care service program and extent of attainment of objectives.
5. To evaluate the degree of seriousness of problems encountered by the implementers and identify solutions of the day care service program.

Importance of the Study

1. Contribution to the Government agencies and NGO's .
2. Result of the study can be used in finding solutions to problems that may arise in handling day care service program.
3. From the responses of the day care workers and parents whether it be positive or negative reaction shall serve as a basis for possible suggestions and recommendations on how to further improve and how to effectively implement the day care services program.
4. Researchers and students interested in similar or related topics in areas of interest will directly be benefited by referring this research proposal in situations where it can be used as a reference.

Results And Discussions

The results show that most of the beneficiaries of the day care service program are males and most of them entered the day care service program at the age of 4 years old. Almost of the day care children who entered the day care service program are right handed. While for the number of siblings, it was found out that an average of 4 siblings per family

Fig. 7 Day Care Children enrolled in the Day Care Center

and as to the nutritional status, most of the day care children are nutritionally fit.

For the parents of the day care children, majority of the fathers are in their mid thirty's or 35 years old while for the mother with more or less than 35 years old. While for the parent's educational background, majority of the fathers of the day care children were elementary graduates while their mothers were high school graduates. The parents occupation, majority of the father's are engaged in farming while the mothers are simply housewife and most of them are beneficiaries of the Pantawid Pamilyang Pilipino Program (4Ps).

Comfort and safety, one of the objectives of the day care service program was perceived by the respondents as the main reason why parents enrolled

Fig. 8 Parents of Day Care Children attending meeting

Fig. 9 Day Care Children playing with the guidance of the Day Care Worker

their children in the day care service program. In terms of relationship between the objectives of day care service program and the effectiveness of the implementing strategies, objective comfort and safety and the implementing strategy of the organization of day care service group and other activities related to the welfare of the day care children is very much significant.

Attending meetings and seminars hosted by the MSWDO were perceived by the respondents to be very much effective. Financial constraints seems to be the most pressing problem in the day care service program which coincides as to the remedial measures for the improvement of the day care service program is to increase the honorarium of the day care workers.

Fig. 10 Day Care Workers attending meeting facilitated by the MSWDO

Fig. 11 Day Care Parents attending seminar on Effective Parenting

The level of effectiveness markedly relates to the extent of attainment of the objectives and the organization of day care parents service group. The other activities related to the welfare of children greatly relate to the objective on comfort and safety.

Financial constraint is the most pressing problem in the Day Care Service Program. The low honorarium and the lack of funds suggest that the Day Care Workers are much unhappy of the situation.

Fig. 12 Day Care Center at Catiaoan, Gaswiling, Kapangan, Benguet funded by DSWD–CIDSS with labor counterpart by day care parents

Summary, Conclusions And Recommendations

Summary

The day care services program in CAR takes into consideration the following intentions: 1) to describe the socio demographic profile of parent beneficiaries of the day care services program in CAR; 2) to

determine the extent of attainment of the objectives of the day care services program in CAR; 3) Analyze the level of effectiveness of implementation of the day care services program; 4) To determine the relationship between the level of effectiveness of the implementing strategies of the day care service program and extent of attainment of objectives; 5) To evaluate the degree of seriousness of problems encountered by the implementers and identify solutions of the day care services program.

The 586 parents of day care children and 45 day care workers from the 15 barangays of Kapangan, Benguet are involved in the conduct of this study.

The descriptive survey method of research was used and the questionnaire was the main instrument used.

The followings are the salient findings:

1) For the socio demographic profile of the beneficiaries of the day care services program with regards to the distribution of day care children according to gender, it was found out that more than fifty percent of the day care children are male.
2) As to the distribution of day care children according to age, it was found out that most day care children entered day care service at the age of 4 years old.
3) Distribution of day care children according to child's handedness, it was found out that about 90% of the day care children are right handed.
4) While for the number of siblings, it was revealed in the study conducted that an average of about 4 siblings per family.
5) Distribution of day care children according to their nutritional status, about 98% of the day care children are nutritionally fit.
6) For the parent age distribution, majority of the fathers are in their mid-thirties or 34.5 years old, while the mothers are in more or less 35 years old.
7) For the parent's educational background, majority of the fathers of the day care children were elementary graduate while their mothers were high school graduate and were beneficiaries of the 4P's program.
8) The parents occupation of day care children revealed that majority of the fathers ware engaged in farming while the mothers are simply housewives
9) For the objectives of the day care service program, comfort and safety were perceived to be fully attained; while the inculcation of spiritual/ social values, physical development, human relations and personal abilities were perceived to be only highly attained by the day care workers in CAR.
10) In the level of effectiveness of the implementing strategies in the day care services program, the meetings and seminars hosted by the MSWDO and meetings hosted by the barangay and municipal officials were very much attended by the day care workers and parents hence these strategies are percieved by the respondents to very much effective.
11) In the relationship between the level of effectiveness of the implementing strategies of the day care service program and the extent of attainment of the objectives, the organization of day care parents service group and other activities related to the welfare of children is very much significant to the objective comfort and safety. While other implementing strategies and other objectives of the day care service program are not significant.
12) The problems in the implementation of day care service program revealed that financial constraints seem to be the most pressing problem in the day care service program. The average rating of low honorarium and lack of funds suggest that the day care workers are much seriously unhappy of the situation.

Conclusions

1) The respondents range in age from 18 years old to above 60 years. Majority of the male children enter the day care services program with mostly age 4 years old. Majority of the day care children are right handed. As to the number of siblings,

from 1 to more than 13 siblings with an average of 4 siblings per family. Almost 98% of the day care children are nutritionally fit. On the day care parents age particularly the father, majority are in their mid-thirties (34.5), while the mother is more or less 35 years old. Majority of the fathers of the day care children were elementary graduate and mostly their occupation is farming while their mother's were high school graduate with their occupation as simply housewives.

2) In the objectives of the day care service program, comfort and safety were perceived to be fully attained.
3) For the level of effectiveness of the implementing strategies in the day care services program, the attendance to meetings and seminars hosted by the MSWDO and meetings hosted by the barangay and municipal officials were very much attended by the parents of day care children and day care workers.
4) For the relationship between the level of effectiveness of the implementing strategies of the day care service program and the extent of attainment of the objectives, the organization of day care parents service group and other activities related to the welfare of children is very much significant to the objective comfort and safety.
5) In the level of seriousness of problems in the implementation of the day care service program, the low honorarium for day care workers and lack of funds were the very serious problems identified by the day care workers.

Recommendations

1) In order for the objectives of the day care service program to be fully attained, there should be continuous IEC on the day care service to the parents of children ages 3–5 in order for them to support and let their children enroll in the day care center. This is done through the collaborative efforts of the barangay officials, day care workers and the MSWD personnel.
2) In the implementing strategies in the day care service program, the involvement of the Barangay Council for the Protection of Children (BCPC) headed by the Barangay Chairman and consisted of the barangay kagawad, DCW, BNS, Dep-Ed Principal, Rural Health Midwife, President of the Parents of Day Care should formulate action plan and meets regularly in order to solve issues and problems on child welfare. Likewise, the Municipal Council for the Welfare of Children (MCWC) will do regular continuous monitoring and evaluation to the day care centers.
3) Advocacy and social marketing on day care service program on the part of the day care workers to lobby more funds for the increase of honorarium and provide budget for the day care centers to the barangay and municipal officials concerned. Likewise, the day care parents through their organization should help the day care worker such as payment of monthly parents counterpart, making resolutions and project proposals related to the improvement of the day care service program to be endorsed by the barangay and municipal officials and to be forwarded to the concerned agencies for funding and conducting fund raising with the aim/purpose of providing the needs in the day care center.

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Effective production of second generation bioethanol: Perspective study on wastewater pretreatment

インドネシアは世界最大のヤシ油生産国。その製造過程で出る有機廃棄物を利用し、食用資源と競合しないバイオ燃料を効率生産する方法を検証した。

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Abstract

Over the last ten years, there has been a dramatic increase in bioethanol production based on sugar cane and other vegetables. However, it faced a drawback as the high price of raw materials caused the production cost to be higher too. There is a need to explore alternative feedstocks such as lignocellulosic biomass because of its abundance in many countries but still neglected. Indonesia is the largest producer of palm oil in the world, and has high amount of oil palm empty fruit bunches (OPEFB) which could be utilized for bioethanol production. It consists of four main processes: pretreatment, hydrolysis, fermentation, and distillation of product ethanol. Pretreatment process used 600 kg OPEFB as a feed, and generated 76.46 kg bioethanol and 3,000 liters wastewater (called "black liquor") containing high COD and potentially toxic chlorinated compounds. Many researches regarding optimization process of bioethanol production and life cycle analysis of the process have been conducted. However, research concerning the wastewater pretreatment is still limited. Currently, we are developing technology for degradation of black liquor using combined treatment that consists of coagulation, Fenton, combination coagulation-Fenton. Each method has the ability to degrade black liquor in the range 50-98%. However, these systems also produce a sludge as new waste. Therefore, we are developing new technology to utilize this sludge as an environment-friendly activated carbon material based on Fe and Al. In our best knowledge, it is the first report regarding the utilization of black liquor sludge for activated carbon. This study was conducted considering the environmental aspect which should be applied through the development of an integrated engineering process for black liquor in production of the second generation bioethanol.

Keywords bioethanol, oil palm empty fruit bunches, wastewater treatments

Introduction

Bioethanol production based on sugar and starch has been getting familiar to substitute fossil fuels due to limited supplies and global warming issues. Unfortunately, this development has been retarded by the growing concerns of competition with food availability, actual net energy output, restrictions on land-use, and the high production cost[1]. On the other hand, lignocellulosic biomass from agricultural waste is available in abundance in many countries, but not well utilized. It does not need fertile land and can improve the emission balance of greenhouse gasses[2]. The bioethanol derived from non-edible lignocellulosic biomass is called the "second generation bioethanol."

This paper is a concise overview of the basic concepts in bioethanol production from oil palm empty fruit bunches. There are still some challenges which should be faced in wastewater treatment from pretreatment process of second-generation bioethanol. For this reason, three advantageous methods, regarding black liquor's efficient degradation, including PAC coagulation, Fenton, and Fenton-PAC were studied. At the end of this paper, the potential conversion of black liquor sludge to be activated carbon is also discussed.

Potential of agricultural wastes in Indonesia

In Indonesia, the commonly used agricultural residues for bioethanol production are mainly derived from oil palm(empty fruit bunches and fronds), rice (husk and straw), corn (corn cob), sugar cane (bagasse), and from forest-product waste[3]. Table 1 shows the summary for the potential of bioethanol production from agricultural wastes in Indonesia.

Bioconversion of oil palm empty fruit bunch to bioethanol

As the largest palm oil producer in the world, Indonesia produce crude palm oil which leaves oil palm empty fruit bunch (OPEFB) as a waste with comparison mass ratio 1:1.1[4]. As a lignocellulosic biomass, OPEFB contains cellulose (29.9-37.26%), hemicellulose (13.74-18.6%), and lignin (27.6-31.68%)[4,5,6]. Out of the three majority contents of lignocellulosic biomass only cellulose and hemicellulose can be converted to ethanol. Research Center for Chemistry, Indonesian Institute of Sciences has been developing the technological process for bioethanol production from OPEFB. The process itself consists of four steps: pretreatment to breakdown the main components, hydrolysis of cellulose to produce sugars, fermentation of sugars to ethanol, and distillation to obtain purified ethanol.

The primary purposes of pretreatment process are removing lignin and hemicellulose, increasing surface area and to fractionate amorphous cellulose[7,8,9,10]. The yield of cellulose hydrolysis is increased four-fold after pretreatment process[11]. There are several types of pretreatment process, including physical/ mechanical, chemical, biological, or a combination of these types[10,12,13,14,15,16]. The chemical pretreatment of lignocellulosic can use either dilute or strong acid, and sodium hydroxide (NaOH). For this study, we used alkaline pretreatment (NaOH). It was aimed to alter the structure of cellulosic biomass by removing lignin and hemicelluloses, so that the cellulose became more accessible to the enzymes that convert carbohydrate polymers into fermentable sugars[16]. The degree of polymerization and crystallinity will decrease which provokes lignin structure disruption[8]. During alkali pretreatment, lignin and hemicellulose are solubilized and/or decomposed in the aqueous phase result in a soluble fraction containing hemicelluloses and lignin degradation products, while cellulose remain in the solid fraction result in an insoluble cellulose-rich fraction[17,18,19].

However, the production of 76.46 kg bioethanol using 600 kg oil palm empty fruit bunches resulted in 3000 liters wastewater from alkaline pretreatment process. This wastewater is called "black liquor". It has black color with high COD (1,043 ppm) and also may consist potentially toxic chlorinated compounds, suspended solids, phenolics, and resin along with lignins.

Table 1. Production of agricultural wastes and bioethanol potential in Indonesia

Types	Year	Production (million tons) / year	Bioethanol potential (liter / ton)
Empty fruit bunches	2012	25.52	160.57
Palm oil fronds	2012	49	132.72
Rice straw	2012	0.02	99.43
Rice husks	2012	0.015	99.43
Corn cob	2012	1.94	0.13
Sugarcane	2011	0.3	75

Modified from Sudiyani et al. (2015)[3]

The second process is saccharification. The objective for this is to breakdown the pretreated cellulosic molecules into simple sugar by using enzymatic hydrolysis. Enzymatic hydrolysis is the key to cost-effective ethanol production[11]. The saccharification that we conducted in this study did not generate waste as it simultaneously carried out with the fermentation process.

The biomass is hydrolyzed by cellulolytic enzymes into fermentable sugars, which are directly fermented to ethanol. The main requirement for the microorganisms used in fermentation is it should utilize a broad range of substrates, high ethanol yield, titer and productivity, and high tolerance to ethanol, temperature, and inhibitors presence in hydrolysate[11]. The main advantages of simultaneous saccharification and fermentation process are comparatively lower costs, higher ethanol yields due to a removal of feedback inhibition on enzymatic saccharification[20]. Unfortunately, microorganisms for the different optimum conditions for enzyme hydrolysis in simultaneous saccharification and fermentation is rarely found[21]. Currently, we are developing the production of glutathione and yeast extracted from this wastewater.

Wastewater treatment in bioethanol production

Green product innovation is the interaction between technological innovation and sustainability that applied in industry. Wastewater treatment plays a vital role in people's daily lives regarding the purification of wastewater and the disposal of ready-for-reuse water to human society. For an industry, wastewater treatment is conducted to fulfill the obligations of environmental management and regulation and has become a branding as a green industry and product. The main focuses of the green industry are waste management, utilization of renewable energy as oil substitution, reduction of hazardous substances, and increase of environment-friendly materials with the minimum cost.

Considering how countries and international organizations compete to produce alternative energy, we tried to address this issue. The assessment of environmental and product dissemination as well as training, capacity building and monitoring which help achieving the sustainability criteria should be identified. Furthermore, planning and partnerships with public agencies and donors should also be integrated into the project design to support sustainability.

Unfortunately, waste issue in bioethanol production is often neglected. The United Nations declared the period of 2014 – 2024 to be the "Decade of Sustainable Energy for All", underlining the importance of energy access for sustainable development in developing countries. Therefore, to achieve a sustainable process, wastewater treatment should be integrated into designing the research for energy production. Hazardous waste generated from the bioethanol production should also be considered because it also poses a danger for environment sustainability. In this research, we integrated Indonesian clean energy technologies with waste management and life cycle assessment in second generation bioethanol production. By this, we reduced water pollution whose adverse impacts to human health and environment are expected to obtain.

Our research has successfully obtained ethanol with purity concentration of 99.5% (v/v) and production capacity of 10 litres per day. Many attempts have been mainly directed toward the improvement of the potential of lignocellulosic waste to produce bioethanol, however only a few studies have conducted researches regarding wastewater treatment. A great variety of physical, chemical, biological processes, and the combination of them, have been investigated for black liquor treatment in the paper manufacturing process. Even though black liquor only contributes 10-15% of total wastewater but it affected approximately 95% of the total pollution load of pulp and paper mill effluents[22]. Therefore, before released to the environment, the wastewater should be treated by removing or

Table 2. Wastewater treatment types and their unit operations

Methods	Unit operations
Physical	• Screening • Comminution • Flow equalization • Sedimentation • Flotation • Granular filtration
Chemical	• Chemical precipitation • Adsorption • Disinfection • Dechlorination • Coagulation • Advanced Oxidation Process (Fenton, photo-Fenton)
Biological	• Activated sludge • Aerated lagoon • Trickling filters • Rotating biological contactors

Modified from Zwain and Dahlan (2014)[22]

reducing certain harmful constituents using physical, chemical, and biological methods. Table 2 shows several methods for wastewater treatment and their processes.

Coagulation and Fenton methods are commonly used to treat organic pollutants including black liquor. Polyaluminium Chloride (PAC) has been found to be an effective coagulant to treat pulp and paper mill and dyes wastewater. It was able to reduce COD and color in pulp paper mill wastewater about 84 % and 92%, respectively, and precipitated about 99.5% suspended solid[23]. Fenton method has the ability to destruct the organic compound structure by using OH radical system[24]. Torrades et al.[25] reported that COD and color were removed 94% and 80%, respectively, by using this method.

Up to now, black liquor from the pretreatment process of bioethanol production in the pilot plant at Research Center for Chemistry, Indonesian Institute of Sciences, is discharged directly into the environment. It evaporates naturally with the hazardous compound still presence in this liquor. To minimize the amount of black liquor, we have reused black liquor in the pretreatment process[6,18]. However, black liquor treatment is still needed if black liquor will be discharged into the environment. Direct discharge of black liquor is prohibited by Indonesian Government Regulation No. 101 of 2014. Therefore, to fulfill this regulation, we have been developing black liquor wastewater treatment combining several technologies including coagulation using Poly Alumunium Chloride (PAC), Fenton method using $FeSO_4$-H_2O_2, and combination PAC-Fenton. Figure 1 provides the scheme for this research.

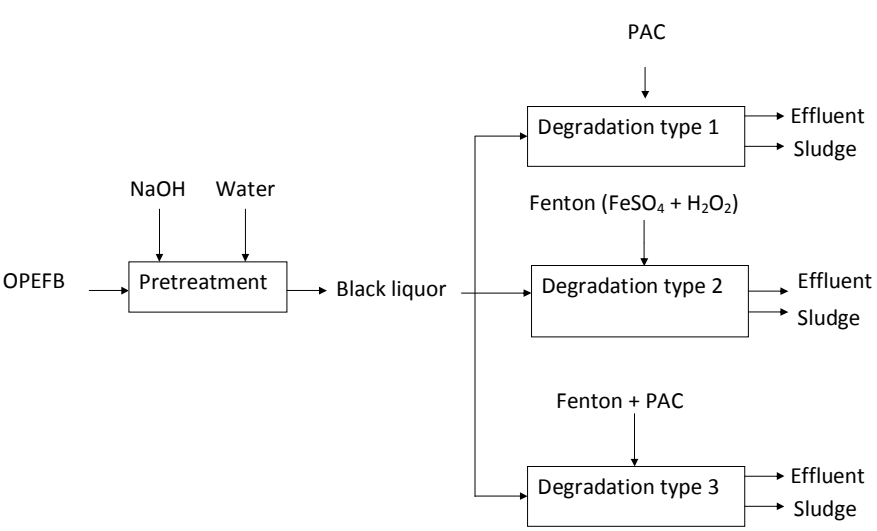

Figure 1. Research scheme of black liquor wastewater treatment

The coagulation and Fenton behavior's were evaluated regarding lignin removal, sludge weight, decolorization of black liquor, and COD. From all combination, the addition of PAC+Fenton gave the highest decolorization of black liquor and degradation of lignin. On the other hand, the maximum removal of COD and the lowest sludge weight were obtained from Fenton process. Fenton reagent is a reaction between hydroxyl radical and ion Fe^{2+}. Ion Fe^{2+} was commonly used as coagulant. The increasing of H_2O_2 also increase the black liquor decolorization due to the decomposition of $Fe^{2+/3+}$ions with free hydroxyl radicals at a higher rate. The action of Fenton reagent depends on the H_2O_2 concentration because it can induce the molecular degradation.

Since the amount of Fenton reagent used is lower than the amount of coagulant, the sludge produced was also fewer. The addition of PAC increased the performance of Fenton reagent, as the PAC could coagulate organic compound and decrease the pH[26]. Acidic condition after PAC addition was suitable for the precipitation of lignin. Lignin fragments with average molecular weight ranging from 880-1,200 can be broken into small fragments by using coagulation and Fenton method. However, the remaining of turbidity caused by the presence of 5-7 phenolpropane units could not be efficiently removed only by coagulation method[27].

Study for impact assessment of wastewater treatment

Further data in Table 3 can be used to perform a life cycle analysis in a larger scale. Hence, the performance of these technologies should be tested first at pilot-scale, before ready to be applied in industrial scale. Before conducting the Life Cycle Assessment (LCA), the first step to do is to set the system boundary. Figure 1 ilustrated the system boundary for the black liquor treatment. In this study, the pretreatment process of bioethanol production is not included inside the boundaries. Land use is not taken into analysis because this research was carried out in laboratory-scale. Another data that should be considered is the energy inputs (electricity provided for instrumentation). SimaPro 7.3.3 was used to select impact categories, characterization models, and optional (normalization, grouping, and weighting) elements of the life cycle impact assessment (LCIA) according to ISO 14040.

Table 3. Degradation efficiency ofcoagulation and Fenton process at optimal operating parameters

Parameter	Coagulation (PAC)	Fenton (FeSO4-H2O2)	PAC + Fenton
Decolorization of black liquor (%)	70.64	51.45	97.82
Degradation of lignin (%)	68.28	24.85	98.91
Removal of COD (%)	19.46	54.75	45.25
Sludge weight (gram)	2.76	0.69	3.97

Using three types of wastewater treatment, several parameters in black liquor were successfully reduced. The optimum result from each treatments were showed in Table 3.

Conversion of black liquor sludge to activated carbon

The next process is to convert the sludge generated from the coagulation and Fenton process to be a value added product. The important factors which should be considered in making these advanced materials are efficiency, low cost, and will not generate any new waste (zero waste). One of the alternatives is to convert to activated carbon. To our knowledge, this is the first study regarding the utilization of bioethanol black liquor after coagulation process to be activated carbon. This research proposed an alternative technology for developing activated carbon from black liquor sludge that can meet environmental sustainability criteria and also can be applied in pulp industry. This project is technically feasible to implement because the abundant availability of resources including black liquor, coagulant and Fenton reagent. Activated carbon is a potential

product which can be used directly and with appropriate maintenance, it could be used for long term. This technology establishes sustainable recycling process, consequently supported the environmental and practical value.

The generated dry sludge formed in prior process was subjected to carbonization-activation process which formed activated carbon. Carbonization is the pyrolysis process of raw material to remove non-carbonaceous elements. While, activation is a physical and chemical process that ensures the precursor has a porous structure so that it has a large surface area. This process enlarged micropores, which related to the development of the surface area which is necessary for adsorption.

In this experiment, the dry black liquor sludge was subjected to activation process with steam activation because using chemical activation could generate chemical waste which pose negative impact to the environment[28].

30 gram of activated carbon was obtained from 1 liter of black liquor sludge (Figure 2). The surface morphology of activated carbon from black liquor sludge was observed using SEM Hitachi SU300 at 1,00K x magnification. The SEM image of sample shows coarse surfaces, clumping, and some impurities. It was assumed that the impurities came from the presence of sodium in activated carbon. S_{BET} value for activated carbon from black liquor sludge was 164.45 m^2/g. This activated carbon was tested to use to adsorp methylene blue. Methylene blue is one of the most cationic dying materials for wood, silk, and cotton that commonly used for dye adsorption[29]. This dye can cause some harmful effects for water organisms and humans. In 0.5 g of PAC-based activated carbon, 100 ppm methylene blue was successfully decolorized up to 98% only for 30 min.

Lignocellulosic biomass has long been advocated as an essential feedstock for cost-effective bioethanol production in an environment-friendly and sustainable manner because of the abundance of lignocellulose-rich agricultural wastes/residues. Up to now research on utilization of agricultural residues for second-generation bioethanol production has shown very encouraging results worldwide. Our laboratory experiment and pilot-scale tests demonstrated promising result for bioethanol production from oil palm empty fruit bunches. There remains several challenges that should be overcome to make the process economically feasible, including: (1) handling of agricultural waste; (2) effective pretreatment technology; (3) effective cellulolytic enzymes; (4) use of the higher biomass loadings; (5) use of efficient fermentation process; (6) use of recombinant/metabolically engineered microbial strains; and finally (7) wastewater treatment.

2a 2b

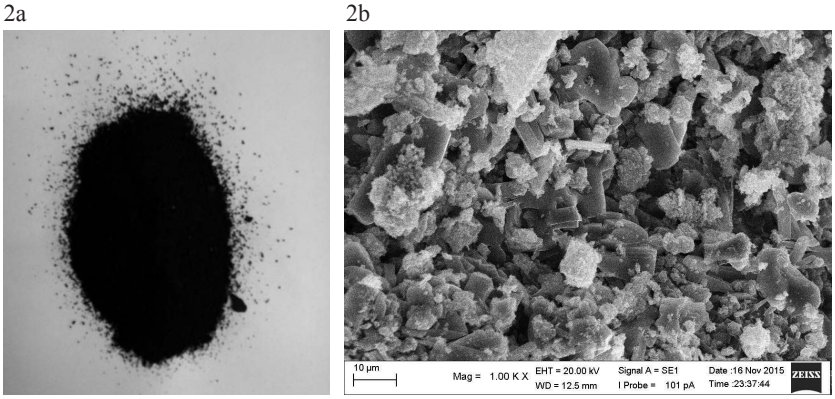

Figure 2. 2a: Appearance of activated carbon from black liquor sludge; 2b: SEM of activated carbon from black liquor sludge

When conducting research regarding bioethanol production which aims to be competitive and economically acceptable, the production cost should be considered[30]. The cost of feedstock and cellulolytic enzymes are the two critical parameters for low-cost ethanol production. The cost for biomass feedstock represents around 40 % of the ethanol production cost. The use of integrated approach which consists of an efficient pretreatment process, low cost enzyme, and super microbes for fermentation could also improve the ethanol production economically. The total cost of bioethanol production will be dropped to $0.2-0.5/l[31,32].

Conclusions

The utilization of agricultural wastes such as oil palm empty fruit bunches for bioethanol production is a cost-effective and environment-friendly approach to achieve sustainable process. Recent research progress in the fields of wastewater treatment to remove certain harmful constituents in bioethanol production from oil palm empty fruit bunches is indeed proved to be a feasible technology to support energy security in very near future. We have conducted Fenton and coagulation-flocculation process to treat black liquor wastewater obtained from the pre-treatment process of bioethanol production in Research Center for Chemistry-LIPI. Furthermore, we successfully developed the technology to generate an environment-friendly activated carbon material based on Al from black liquor sludge in bioethanol wastewater. This activated carbon was successfully decolorized methylene blue to a satisfactory result. This research resulted in an innovative product from black liquor sludge as an effort to fulfill a zero waste program. To our knowledge, activated carbon is still considered as a high-performance adsorbent which commonly used in wastewater treatment. So, this study was successfully contributed the environmental and practical value in the attempt to achieve a sustainable recycling process of wastewater from bioethanol production from oil palm empty fruit bunches in Indonesia.

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Impacts of urbanization on surface urban heat island in Beijing, China

急速な都市化によって多くの環境問題を抱えこんだ北京。最新の観測データを用い、都市化の進行に伴うヒートアイランド現象の深刻さを解明する。

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Abstract

As the capital of China, Beijing has become a world city after decades of development. Urbanization in Beijing has brought not only many benefits for the residents but also kinds of environmental problems to the city. It is necessary and meaningful to have a comprehensive investigation of the urban situation in Beijing. In addition, with the development and wide application in urban studies, the remote sensing technology was put into use as a significant tool in this study which including DMSP-OLS and Landsat TM/ETM.

This study was made up with two aspects: the urbanization investigation and the urban heat island effect survey. For the first part, the investigation was carried out by the correlation analysis with the official statistics and the night time light series images from DMSP-OLS. Another important aspect of this study is the urban heat island effect survey, the Landsat TM/ETM data in 1995 and 2009 was processed to provide the vegetation coverage and land surface temperature distribution in the study region. By using the correlation analysis and regression analysis, the comprehensive understanding of the phenomenon of urban heat island in Beijing can be got and come to a conclusion.

Keywords urbanization, urban heat island, DMSP/OLS, Landsat, land surface temperature

1. Introduction

With the rapid development of economies, the sustained growth of the population, the fast urbanization and modernization, a number of the metropolis have emerged in the world. As China's capital city, the scale and process of urbanization in Beijing is remarkable, especially after the Chinese economic reform in recent decades. Moreover, high rate of urbanization also contributes to the change of the living environment such as global warming, urban heat island, air pollution, etc. One of the major implications of urbanization is increase of surface temperature and development of urban heat island. For this research, the analysis was focused on the processing of urbanization and the situation of urban heat island in Beijing.

As mentioned before, this study was made up with two aspects: the urbanization investigation and the urban heat island effect survey. For the urbanization part, the investigation was carried out by analyzing the official statistics and the DMSP-OLS, the official statistics provide the development of urbanization situation from two representative aspects: population and the economics; the night time light was applied to stand for the urbanization level and the urban land-use by necessary data processing and classification. Another important aspect of this study is the urban heat island effect survey, remote sensing

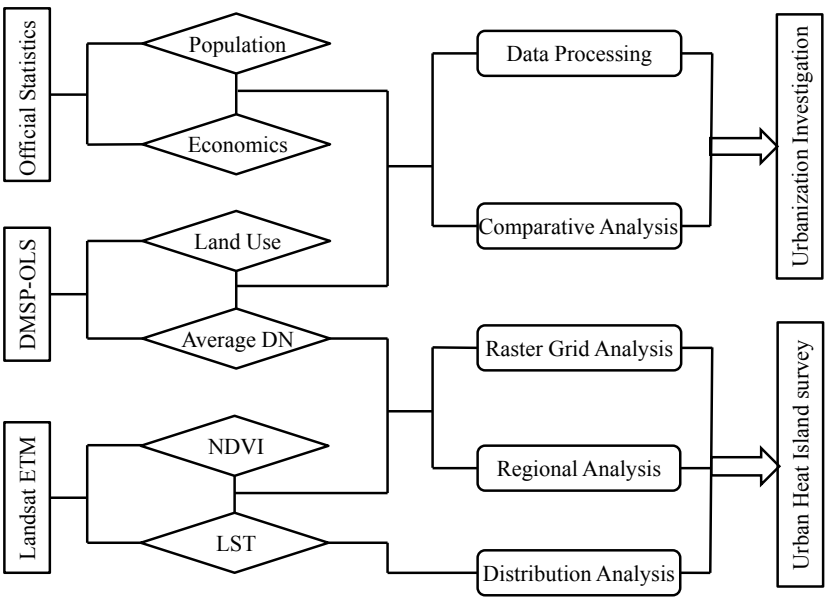

Fig. 1 Research Flow

data from Landsat TM/ETM image in 1995 and 2009 was applied to provide the situation of vegetation coverage and land surface temperature distribution in the study region. During the survey for the urban heat island, three different kinds of analysis methods were carried out to get comprehensive information from different scales which were: the raster grid analysis, the regional analysis and distribution analysis.

The objective of this research, the purpose of the investigation is to get a comprehensive understanding of what had happened to the city, propose suggestion and advice for more balanced and environmentally friendly development in the future.

2. Study area and research method

2.1 Study Area

In this research, the part of investigation of urbanization was proceed within the whole area under administration of Beijing; however, the part of urban heat island survey was proceed only within the urban area which was represented by the area within the 6th ring road to have a clear result in the downtown.

Synthetically, taken the statistical data collection and remote sensing data features into consideration, the study period in this research is from 1992 to 2012.

2.2 Research method

As the figure of research flow shows, the analysis was carried out step by step. The official statistics contain two aspects: population and economics; the night time light images from DMSP/OLS was applied to get the land use change information by classifying of the image and the urbanization level with average value of digital number; the Landsat imagery was used to get the land surface temperature (LST) and the normalized difference vegetation index (NDVI).

The analysis methods in this research include data processing, comparative analysis, raster grid analysis, regional analysis, and distribution analysis. The first two kinds of analysis methods were carried out for the investigation of urbanization in Beijing, while the remaining three methods were the important processes to get the urban heat island survey.

3. Investigation of the urbanization in Beijing

3.1 Introduction of DMSP/OLS

DMSP/OLS, whose full name is Defense Meteorological Satellite Program/Operational Line-scan System, the products from it were widely used in urban studies and energy or population research. One of the most frequently used data from DMSP/OLS is the version 4 of global night time light series, which provide annual global composited imagery from 1992 to 2012.

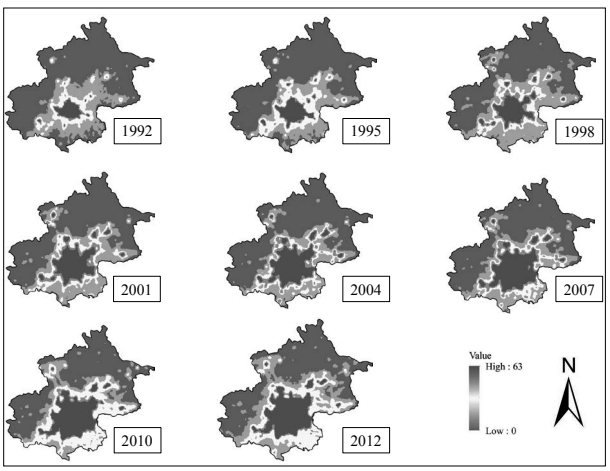

Fig. 2 Night Time Light Series Images from DMSP/OLS

3.2 Urbanization by average DN

The images from DMSP/OLS are composed of grid-based annual visible band digital number (DN) range from 0 to 63, which stand for the light intensity of the areas. The satellite-derived observations of stable anthropogenic light was used as an indication of varying degree of development, the average value of DN of all pixels within the scope was considered as an evaluation indicator of urbanization level of that year which the data was got. Figure 2 shows part of the result of the digital number in Beijing, in which the higher value of the digital number area was displayed into red and the color of blue stands for the area that hold a lower value of digital number. The change of average value of digital number was shown in the Figure 3 according to the statistical result.

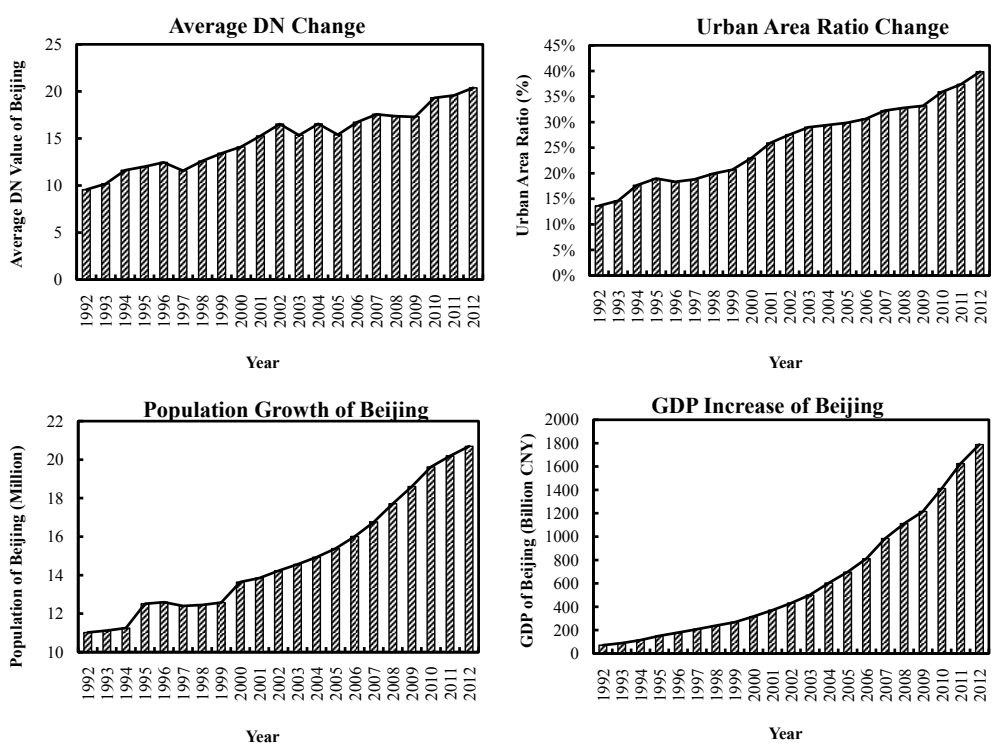

Fig. 3 Statistical Results

$$\text{Average DN}=\frac{\sum_{i=0}^{63} DN_i * N_i}{N_{Total}} \quad \cdots\cdots (1)$$

where Ni is the number of the pixels whose Digital Number value equals DNi; N_{Total} is the total number of pixels within the boundary of the study area.

3.3 Urban area extension from DMSP/OLS

ΩIt is well certified that the DMSP/OLS night time light images could be used to represent the spatial extent of human settlement of the study area, but the most important step of the land use analysis is to establish a correlation between the DN value and the different intensities of urban development, in this study, the area was divided into five types of land use classes using indices of urban compactness:

① 0≤DN<5 no-development area;
② 5≤DN<20 scattered development area;
③ 20≤DN<52 sub-urban development area;
④ 52≤DN<60 compact development area;
⑤ 60≤DN<63 central core area.

In addition, the part which DN value is greater than 20 was considered as the urban area, otherwise would be treated as the rural area. The statistics of the urban area ratio was shown in the Figure 3 which increased from 13.6% in 1992 to 39.9% after 20 years development.

3.4 Urbanization by statistics

As a matter of fact, a lot of indexes exist to describe the urbanization situation of a city, the most representative and intuitionistic among the all indicators are population and GDP. The statistics of the indicators are available from the home page of the National Bureau of Statistics of China.

Population is a clear expression of the whole process of urbanization. From 1992 to 2012, the population of Beijing increased from 11.0 million to 20.7 million, has increased 9.7 million by 1.88 times. Moreover, the economic development level to some extent can describes the standard of urbanization situation. The GDP of Beijing had an unbelievable

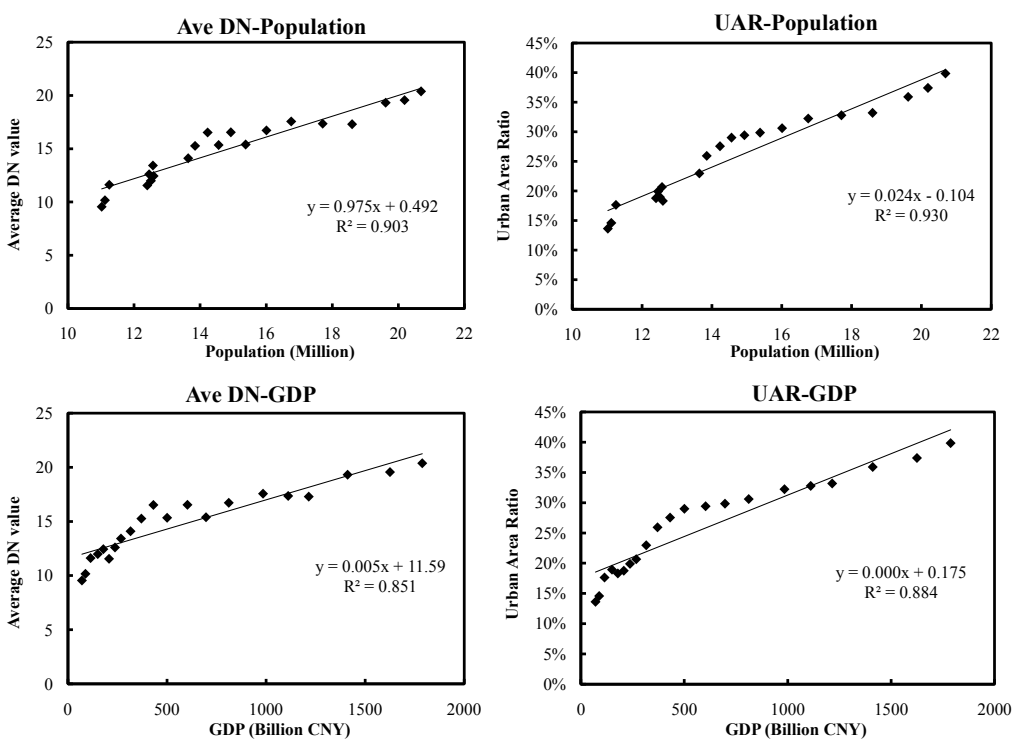

Fig. 4 Correlation Analysis of Urbanization

growth during the period by an increase of 25.21 times, from 70.91 billion CNY in 1992 but reached 1787.9 billion CNY at 2012.

Figure 4 shows the correlation analysis between the data from the remote sensing observing and the official statistics. With high value of correlation coefficient, the result proved a close relationship between the population, GDP and the urbanization condition provided by DMSP/OLS.

4. Urban heat island by Landsat

4.1 Introduction of the Landsat TM/ETM+

The Landsat Program is the longest running exercise in the collection of multispectral, digital data of the earth's surface from space. The images acquired by the instruments on the Landsat satellites, are unique resources for global change research and applications in agriculture, geology, forestry, regional planning, education and national security.

A Thematic Mapper (TM) is one of the earth observing sensors introduced in the Landsat 5. TM images consist of seven spectral bands with a spatial resolution of 30 meters for Bands 1 to 5 and 7. Spatial resolution for Band 6 (thermal infrared) is acquired at 120 meter resolution. The TM Image has become useful tool to study global warming, climate change and urban heat island. Enhanced Thematic Mapper Plus (ETM+), which is known as a successor of TM, was carried by the satellite of Landsat 7. Table 1 shows the detailed information of the collected data in 1995 and 2009 from the Landsat program.

Table. 1 Information of the Collected Data

	1995	2009
Landsatscene ID	LT512303219952 59HAJ00	LE7123032200922 5SGS00
Station ID	HAJ	SGS
Space Craft ID	Landsat-5	Landsat-7
Sensor ID	TM	ETM+
Data Acquired	1995/09/16	2009/08/13
Scene Center Time	09:55:25	10:43:41

4.2 Derivation of NDVI

The Normalized Difference Vegetation Index (NDVI) is a measure of the amount and vigour of vegetation at the Low Temperature Zone Medium surface. It is a simple graphical indicator that can be used to assess whether the target being observed contains green vegetation or not, as a result, the NDVI can be considered as the index which can reflect the situation of the vegetation of the target. Theoretically, NDVI values are represented as a ratio ranging in value from -1 to 1, it can be calculated by the pixel value of band 3 and band 4 of the Landsat imagery from the equation below.

$$\mathrm{NDVI} = \frac{(\mathrm{Band4} - \mathrm{Band3})}{(\mathrm{Band4} + \mathrm{Band3})} \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (2)$$

4.3 Retrieval Land Surface Temperature

Land surface temperature (LST) is a key variable in climatological and environmental studies, related to surface energy balance and the integrated thermal state of the atmosphere within the planetary boundary layer. With satellite technology, another type of LST, satellite-based surface temperature is becoming available recent years. As to this study, band 6 of the Landsat imagery was used for deriving the surface temperature. The skin temperature of the surface is inferred from the thermal emission of the earth's surface and is generally average effective radiative temperature of various canopy and soil surfaces.

During the processing of the Landsat imagery, ArcGIS was put into use which played an important role to get the land surface temperature by using the tool of retrieve LST. In addition, with the data statistics and calculation, the average value of the LST can be get from different regions.

4.4 Result and analysis

To get the detailed information of the urban heat island effect in Beijing's urban area, two kinds of zonal statistic and analysis methods were used for further investigation, one is the raster grid analysis,

the other one is regional analysis.

The raster grid analysis is a kind of analysis tool which divide the target area into raster grid. In this research, within the Beijing 6th ring road, the area was divided into 3 Km grid, and among every grid, the average value of LST, NDVI and average DN was calculated as an average level of the 3 Km grid. Figure 5 shows the processing result of the raster grid analysis in 1995 and 2009. From the images of the export, we can get the general information of the distribution of the three parameters which displayed grid by grid. Figure 6 shows the correlation analy-

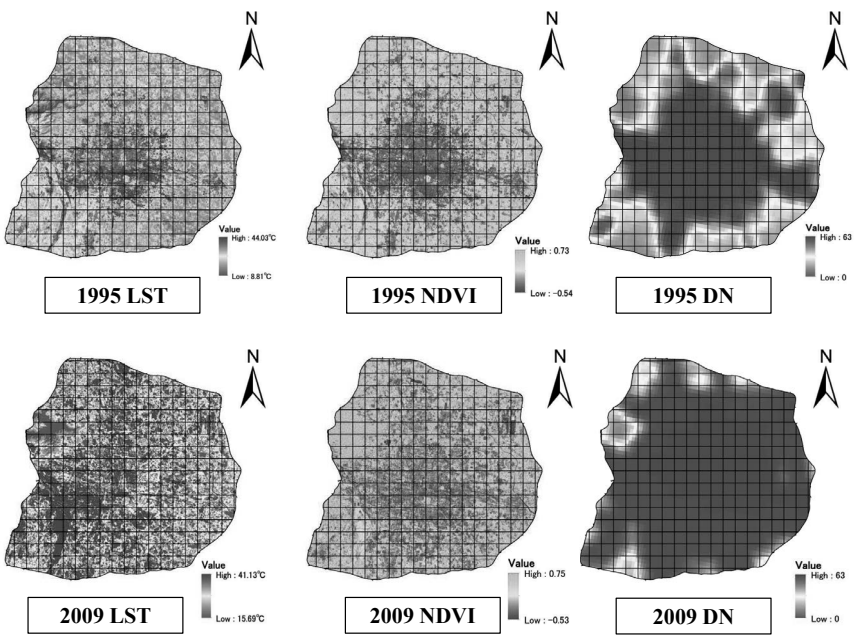

Fig. 5 Result of Raster Grid Analysis

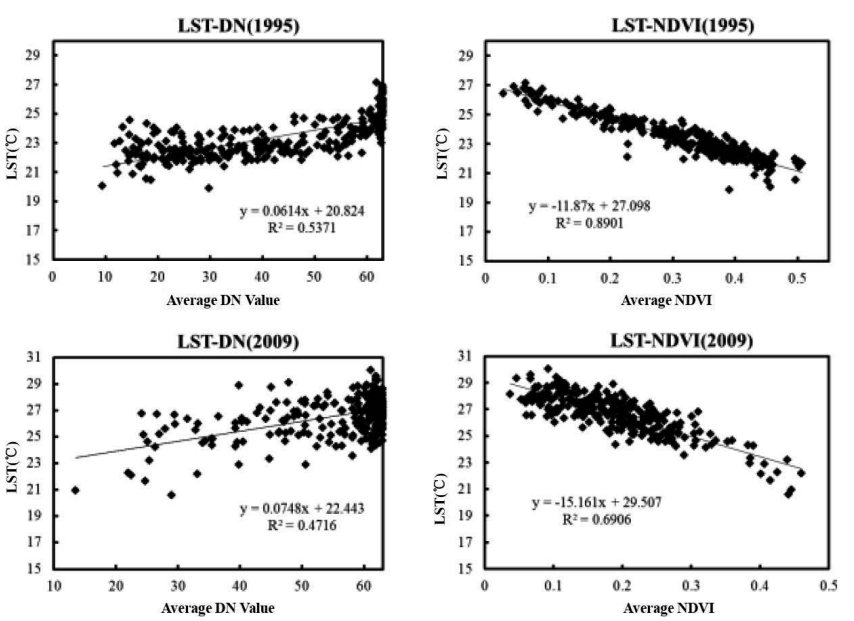

Fig. 6 Correlation Analysis of Raster Grid Analysis

sis result of the LST, NDVI and average DN which reflect the relationship between the temperature, vegetation and the average urbanization level.

The regional analysis was carried out from the ring roads scale with an obvious regional disparity. Carrying through the ring road grid analysis, we can find the distribution of the three parameters associated to the geographic distribution. Figure 7 shows the exported result of the regional analysis, in accordance with expectation, the results indicate an obvi-

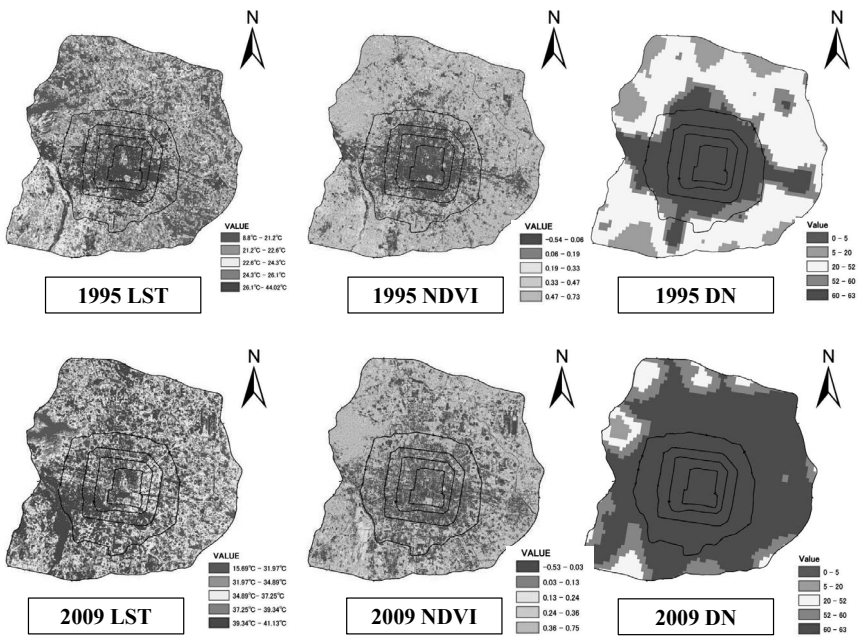

Fig. 7 Result of Regional Analysis

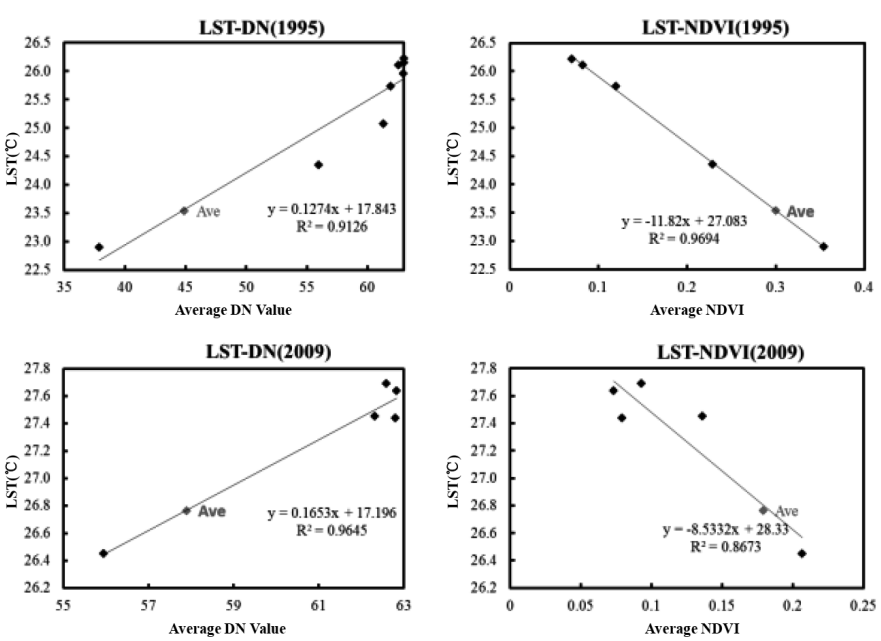

Fig. 8 Correlation Analysis of Regional Analysis

ous difference in different region, by using the zonal statistical tool, the average value of LST, NDVI and average DN was calculated and applied to correlation analysis between them, which was shown in Figure 8.

During the urban heat island study, the temperature distribution plays an important role during the research. By using the geostatistical and classification tool in ArcGIS, the isothermal diagram and zonal classification of the target area were output to draw the situation of the temperature distribution in the region. As the Figure 9 shows, by the application of an equal interval method, the area was divided into four different classes by different value of land surface temperature. The result of the classification in 1995 and 2009 was shown in Figure 10 and Figure 11. From the result, we can get a general understanding of the urban heat island phenomenon development and the situation change in the period. For the part of heat island zone and sub-heat island zone, the grid number had an increase during these years of development, the medium temperature zone and low temperature zone, to the contrary, the grid number had a reduction. In addition, the temperature difference between the heat island zone and the low temperature zone also had an increase from 4.7°C to 5.81°C.

5. Conclusion

The remote sensing data from the DMSP/OLS provided strong evidence that Beijing had gone through a markedly urbanization process during the study period by two aspects: the average level of the urbanization that represented by the average digital number and the urban area ratio that shows the urban land sprawl. In addition, the information from the statistics also proved the urbanization of Beijing by detailed figures. The result of the urbanization investigation shows the close relationship between the remote sensing observing and the official statistics

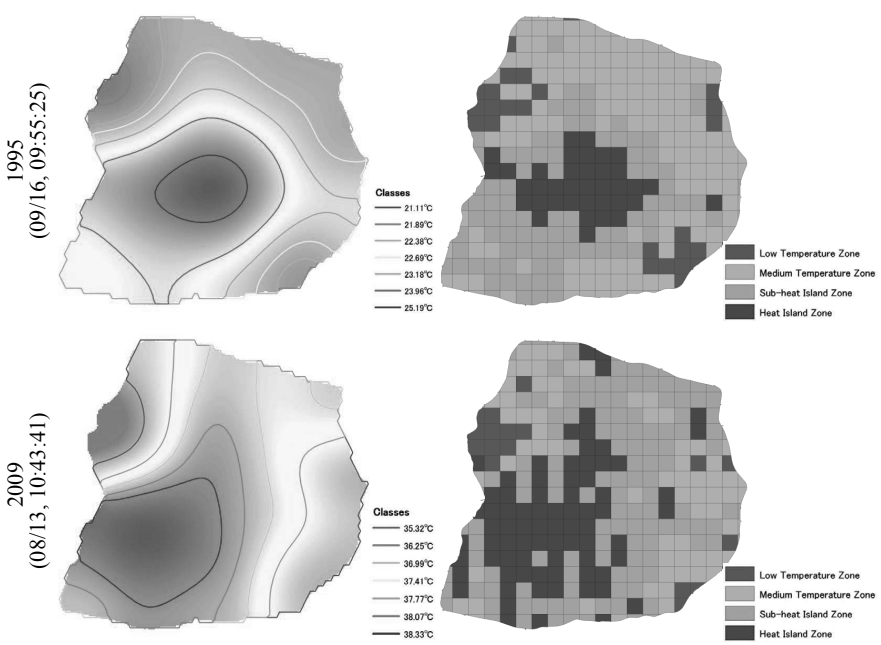

Fig. 9 Zonal classification of LST

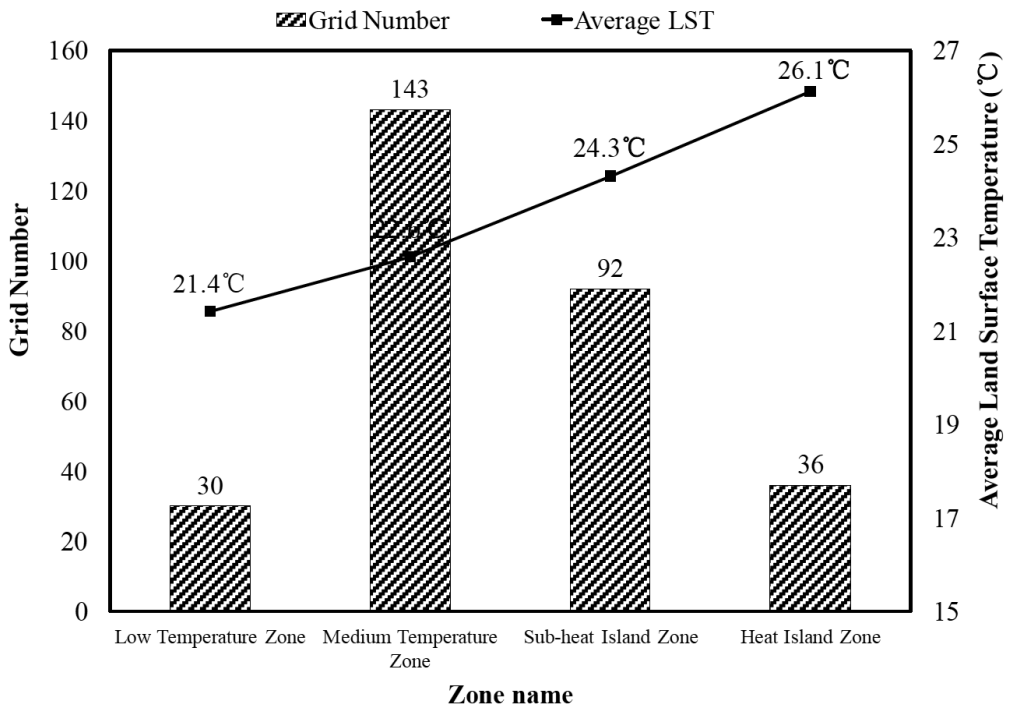

Fig. 10 Classification result in 1995

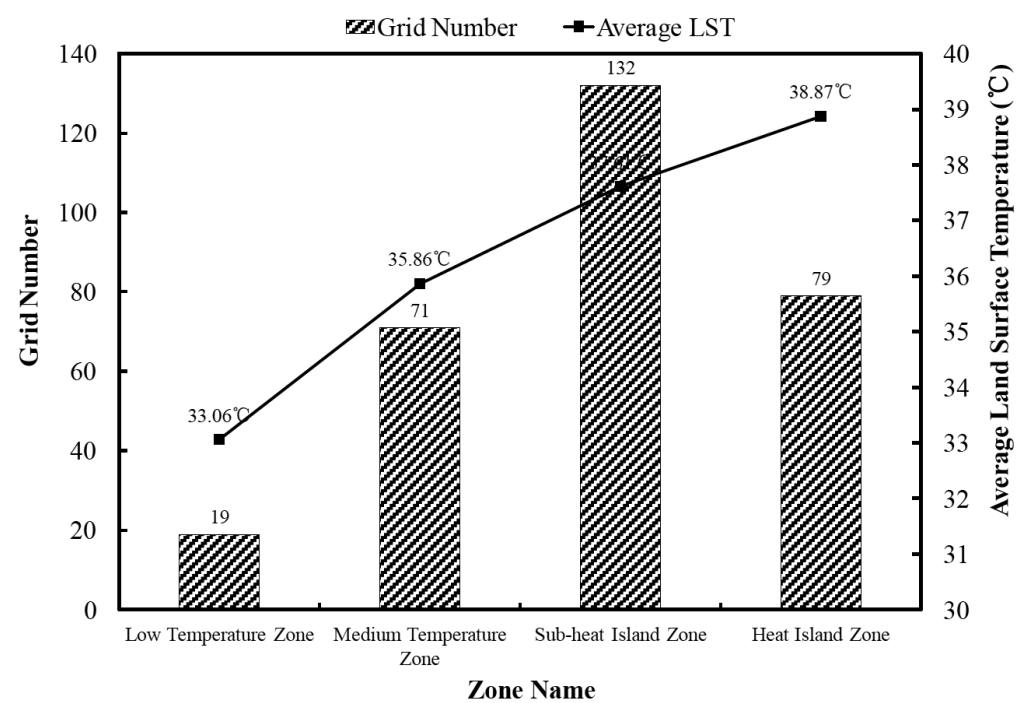

Fig. 11 Classification result in 2009

on population and economics.

The survey of urban heat island came to a conclusion that the phenomenon exist in the city with strong evidence. Moreover, by different methods, the correlation between the land surface temperature, the normalized difference vegetation index and average digital number were carried out which shown close relationship between the temperature distribution, the vegetation and the urbanization level of the region. What inspired us from the result is that the temperature distribution is closely related with the vegetation situation and the urbanization level. To get better thermal comfort in our homeland and to eliminate the heat island effect, the city should follow balanced development with more vegetation as possible.

Acknowledgements

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Preservation and Utilization Valuation System of Rural Historical Buildings —Taking Wencheng, Zhejiang Province as an Example

歴史的建造物の文化的ないし観光的な価値を正しく評価するにはどうすればいいか。中国における実践から、その価値評価のシステム形成を考察する。

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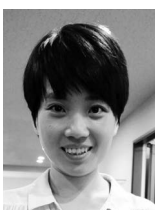


Abstract As the current Chinese government has paid unprecedented attention to the historical villages, thousands of ancient villages scattered in the countryside are gradually coming to light recently and meanwhile undergoing protection and utilization planning under the organization of local government. Rural historical buildings, which are mainly local-style dwellings and the ancestral temples, are the primary material carrier of traditional living environment, which are in urgent needs of classification, intervention, and revaluation for reusing and revitalizing. This paper puts forward detailed preservation and reutilization methods for more than 800 rural historical buildings individually in Wencheng County by revaluation factor scoring system and relevant analysis, which are based on latest on-the-spot investigation. Moreover, the work introduced qualitative analysis into rural architectural protection, thus reduced the interference of subjective factors.

Keywords rural historical buildings, revaluation factor scoring system, qualitative analysis

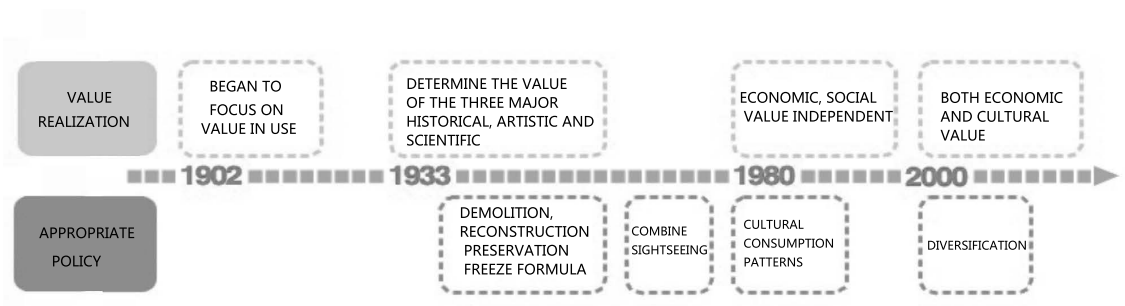
1. Background

Wencheng county is located in the southwest of Wenzhou city where is in the southern mountainous area of Zhejiang province and it covers an area of 1296 square kilometers. As the hilly region accounts for 82.5% of the total area, the natural ecology system in territory has been immune from excessive development and protected very well. With the transformation of national economic mode, local tourism, based on excellent ecological environment, has developed rapidly. As a result, a large amount of historic buildings scattered in different parts of the county have become an important resource to utilize and innovate. (According to the Third National Cultural Relics Census, there are 845 existing historical buildings, including historical structures, in Wencheng county).Under this background, our team was invited to make professional plans to preserve the historic buildings thoroughly and orderly.

2. The value system of historical buildings

Cognition of cultural heritage, especially historic buildings has improved significantly in recent years. On the one hand, along with the emergence of new types of heritages and the deeper discussions on material and immaterial items, the understanding on historical value and artistic value has become increasingly comprehensive. On the other

Table 1 Changes in Awareness and Strategies of Cultural value.

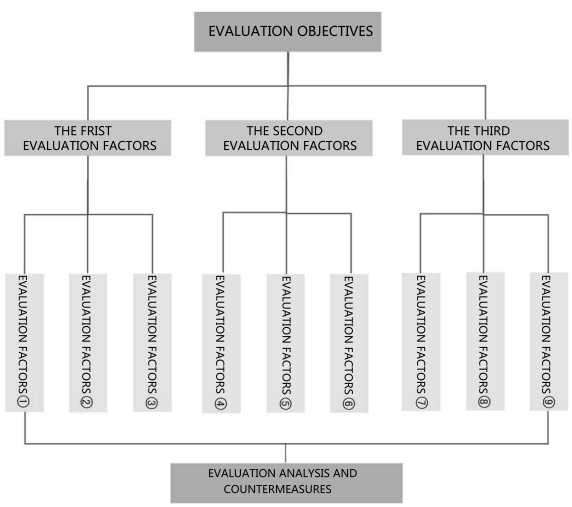


hand, along with the social economic development, the importance of value types has attracted more and more attentions. The dialectical and mutually complementary relationship between protection and utilization has been a consensus. Protection is the premise of any activities, while utilization is the aim, the motivation, and economic guarantee of protection. In this view, value assessment system of historical buildings in Wencheng was divided into two parts: the historical protection value evaluation system and the utilization value evaluation system.

3. Evaluation methods of value evaluation system

Analytic Hierarchy Process (AHP) is a simple method for solving complex problem. It is particularly applied to solve problems that are difficult to deal with only by quantitative analysis. It is a simple, flexible and practical method for multi-criteria decision-making which was put forward by a U.S. Operations Research Professor T.L.Saaty in the early 1970s. On the basis of analyzing the nature of complex problems, impact factors and their inner relationships, AHP provides a simple decision-making method for complex decision problems of multi-objective, multi-criteria and structurelessness, by using relatively less information to mathematize the decision process. AHP is quite suitable for problems whose answers are hard to count directly and accurately.

Table 2 Schematic Diagram of the Analytic Hierarchy Process



4. Value grading system and its limitations

According to the domestic and international experience and construction features of local old buildings, we divided the historical protection value evaluation system into four parts, including historical value, architectural technology value, social value and artistic value. Similarly, we divided the utilization value evaluation system into three parts, internal conditions, external conditions and management conditions.

The evaluation results were reached mainly on the basis of the Third National Cultural Relic Census data and the records data and first-hand infor-

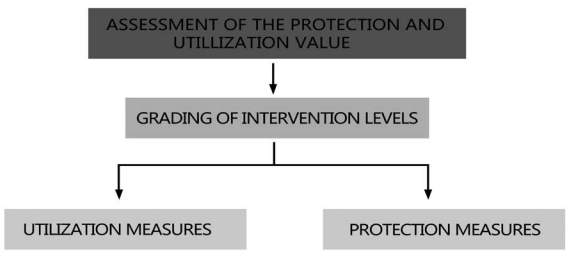
Table 3 The Historical Protection Value Evaluation System

EVALUATION FACTORS	ASSESSMENT FACTORS	EVALUATION BASIS	EVALUATION CLASSIFICATION	MAXIMUM LIMIT	WEIGHT
HISTORICAI FACTORS 25%	LONG HISTORY OF HISTORY	THE LENGTH OF THE CONSTRUCTION OF THE REACTION	BEFORE THE MING DYNASTY(5 POINTS), QING DYNASTY(4 POINTS), THE REPUBLIC OF CHINA(3 POINTS) BEFORE THE REFORM AND OPENING UP AFTER THE FOUNDING OF PRC(2 POINTS) AFTER THE REFORM AND OPENING UP(1 POINT)	5	10%
	HISTORICAL CONNECTION DEGREE	ASSOCIATED WITH HISTORICAL EVENTS OR HISTORICAL FIGURES	IS CLOSELY RELATED TO A MAJOR HISTORICAL EVENT OR AN IMPORTANT PERSON(5 POINTS) DIRECTLY RELATED TO A MAJOR EVENT OR IMPORTANT PERSON(3 POINTS) INDIRECTLY RELATED TO HISTORICAL EVENTS, HISTORICAL FIGURES, OR HISTORICAL EVOLUTION(1 POINT)	5	10%
	HISTORICAI INFORMATION ABUNDANCE	RETAIN THE HISTORICAL OBJECTS ASSOCIATED WITH THE BUILDING (PAINTING, ARCHITECTURE OR PLAQUE ETC.)	2 PLUS 1 POINTS, 2 PLUS 1 POINTS PER INCREASE	5	5%
CONSTRUCTION TECHNOLOGY VALUE 20%	THE PIONEERING AND TECHNOLOGICAL ADVANCEMENT OF TECHNOLOGY	WHETHER THE CONSTRUCTION TECHNOLOGY AND TECHNOLOGY REPRESENT THE ADVANCED SCIENCE AND TECHNOLOGY	BUILDING TECHNOLOGY AND TECHNOLOGY REPRESENTS THE ADVANCED SCIENCE AND TECHNOLOGY(5 POINTS), ONE OF THE EARLIEST EXAMPLES OF A TECHNOLOGY, CAN BE USED AS A CASE STUDY OF ONE OF THE CASES(3 POINTS), THE GENERAL TECHNOLOGY(1 POINTS)	5	10%
	STRUCTURAL INTEGRITY AND FIRMNESS	SAFETY DEGREE OF BUILDING STRUCTURE	THE INTEGRITY OF THE STRUCTURE OF THE BUILDING IS GOOD, STRONG(5 POINTS), PREFERABLY(3 POINTS) , GENERA(1 POINT)	5	10%
SOCIA VALUE 25%	VALUE OF CULTURAL RELICS	PROTECTION LEVEL OF CULTURAL RELICS	COUNTRY(5 POINTS) PROVINCE(3 POINTS) CITY / COUNTY(1 POINT)	5	5%
	EMOTIONAL RELEVANCE	THE MEMORIAL SIGNIFICANCE OR REVOLUTIONARY EDUCATION SIGNIFICANCE OF THE REACTION ARCHITECTURE, AND THE DEGREE OF SOCIAL CONCERN	AS A MONUMENT OF A HISTORICAL EVENT, HIGHLIGHTING THE EXTENT OF SOCIAL CONCERN(5 POINTS); THE ARCHITECTURAL STYLE OF THE STREET OR BECOME PROMINENT LOCATION MARKERS, HIGHLIGHTING THE EXTENT OF SOCIAL CONCERN(3 POINTS);GENERAL SOCIAL CONCERN(1 POINT)	5	5%
	NEW ARCHITECTURAL FEATURES AND CONTINUITY	WHETHER THE BUILDING FUNCTION IS COMPLETE, TO THE EXTENT OF THE USE OF	THE BUILDING FUNCTION IS ALL READY, SO FAR THE FLEXIBLE DEGREE IS HIGH(5 POINTS); THE FUNCTION TEACHING IS COMPLETE, THE PRESENT A LITTLE TRANSFORMATION CAN BE CONVENIENT TO USE(3 POINTS); THE USE FUNCTION NEEDS TO CARRY ON THE BIG TRANSFORMATION(1 POINT).	5	10%
	ENVIRONMENTAL VALUE	WHETHER THE BUILDING IS IN HARMONY WITH THE SURROUNDING ENVIRONMENT	WITH A HIGH DEGREE OF INTEGRATION WITH THE SURROUNDING ENVIRONMENT, AND BEAUTIFUL LANDSCAPE ENVIRONMENT(5 POINTS); INTEGRATION WITH THE SURROUNDING ENVIRONMENT IN GENERAL, THE LANDSCAPE ENVIRONMENT IS GENERALLY(3 POINTS); IN THE ENVIRONMENT IS ABRUPT, AND THE LACK OF LANDSCAPE GREENING(1 POINT)	5	5%
ARTISTIC VALUE 30%	ARCHITECTURAL SPACE LAYOUT DESIGN	WHETHER THE INTERNAL SPACE OF THE BUILDING CAN REFLECT THE MAINSTREAM OF THE DESIGN AT THAT TIME, WHETHER IT IS REPRESENTATIVE	THE SPACE LAYOUT COMPLETE AND RICH, VERY FEW SIMILAR SURROUNDING(5 POINTS); PRESERVES THE SPATIAL LAYOUT IS COMPLETE, THE GENERAL SCALE(3 POINTS); SPATIAL LAYOUT OF A SINGLE(1 POINT)	5	10%
	ORIGINAL TRUTH DEGREE	COMPLETE PRESERVATION OF ARCHITECTURAL APPEARANCE, STRUCTURE, FACILITIES, ETC.	THE OVERALL STRUCTURE, THE STYLE IS WELL PRESERVED MORE THAN 90%(5 POINTS); BASICALLY MAINTAINED THE ORIGINAL ARCHITECTURAL STYLE MORE THAN 70%(3 POINTS); THE ORIGINAL STYLE OF THE BUILDING, STRUCTURAL DAMAGE IS MORE SERIOUS, ONLY RETAINED MORE THAN 50%(1 POINT)	5	10%
	BUILDING DECORATION PERFECT DEGREE	THE EXCELLENT DEGREE OF BUILDING INTERIOR DECORATION, WHETHER IT IS IN HARMONY WITH THE ARCHITECTURAL STYLE	INTERIOR DECORATION AND THE OVERALL ARCHITECTURAL STYLE OF UNITY AND HARMONY(5 POINTS); GENERAL(3 POINTS); THE DIFFERENCE IS LARGE OR EVEN UNEXPECTED(1 POINT)	5	10%

Table 4 The Utilization Value Evaluation System

EVALUATION FACTORS	ASSESSMENT FACTORS	EVALUATION BASIS	EVALUATION CLASSIFICATION	MAXIMUM LIMIT	WEIGHT
OWN CONDITIONS 40%	SAVED STATE	TO MAINTAIN THE INTEGRITY OF STATE BUILDING	BASICALLY INTACT TO RETAIN MORE THAN 90% (5POINTS); REMAINED MORE THAN 70% (3POINTS); LEAVING ONLY 50% OR LESS (1POINT)	5	10%
		IMPORTANT CONSTRUCTED SOUNDNESS	SAVE IMPORTANT MEMBER OF THE EXTENT OF GOOD (5POINTS); SAVE IMPORTANT MEMBER OF THE EXTENT OF SO-SO (3POINTS); SAVE IMPORTANT MEMBER OF THE EXTENT OF BAD (1POINT)	5	5%
		THE SIZE OF THE EXISTING BUILDING	BUILDING SIZE MORE THAN 500 SQUARE METERS (5POINTS); BUILDING SIZE MORE THAN 400 SQUARE METERS (4POINTS); BUILDING SIZE MORE THAN 250 SQUARE METERS (3POINTS);BUILDING SIZE MORE THAN 100 SQUARE METERS (2POINTS); BUILDING SIZE OF LESS THAN 100 SQUARE METERS (1POINT)	5	5%
	UTILIZATION	EFFICIENCY OR UTILIZATION	HIGH EFFICIENCY, THE USE OF SUBSTANTIALLY COMPLETE (5POINTS); BETTER UTILIZATION, MOST USE (3POINTS); UTILIZATION OF LOW OR NO USE (1POINT)	5	5%
		UTILIZATION OF RATIONALITY (WHETHER IT IS A CONTINUATION OF THE ORIGINAL FEATURES AND WHETHER IT CAUSED DAMAGE TO THE BUILDING AFTER CHANGE)	GET A REASONABLE USE AFTER CONTINUITY OR CHANGE OF USE (5POINTS); HAVE DESTRUCTION OF A CERTAIN SIZE WHEN UTILIZE (3POINTS); IRRATIONAL USE OR NOT USE (1POINT)	5	5%
	SUPPORTING THE CASE	INFRASTRUCTURE (BUILDING INTERNAL DRAINAGE, HVAC, ELECTRIC POWER AND TELECOMMUNICATIONS, DISASTER PREVENTION, ETC)	COMPLETE INFRASTRUCTURE (5POINTS); A NUMBER OF INFRASTRUCTURE (3POINTS); NO INFRASTRUCTURE (1POINT)	5	5%
		BUILDING SURROUNDING ROADS AND PARKING SPACE	BUILDING SURROUNDED BY ROADWAYS AND PARKING (5POINTS); NO PARKING LOT AROUND THE BUILDING, THERE IS STREET PARKING (3POINTS); NO PARKING LOT AROUND THE BUILDING AND THE ROADWAY(1POINT)	5	10%
EXTERNAL CONDITIONS 45%	REGIONAL TRAFFIC, GEOGRAPHIC CONDITIONS	THE DEGREE OF ASSOCIATION WITH THE NATIONAL HIGHWAY AND LOCATION ADVANTAGES	CLOSE TO THE HIGHWAY AND THE NATIONAL ROAD,GEOGRAPHICAL ADVANTAGES AND STRONG (5POINTS); HIGHWAY AND THE NATIONAL ROAD A LITTLE DISTANCE,THERE COUNTY ROAD ARRIVE,USUALLY A GOOD LOCATION ADVANTAGES (3POINTS); ONLY TOWNSHIP ROAD IS NOT EVEN ACCESSIBLE,POOR LOCATION ADVANTAGE (1POINT)	5	10%
	ASSOCIATED WITH SCENIC (LANDSCAPE, CULTURAL VILLAGES, ETC.)	ASSOCIATED WITH THE COUNTY IMPORTANT SCENIC, HISTORICAL AND CULTURAL VILLAGES / NEIGHBORHOODS, TOURIST ROUTES, SUCH AS THE BEAUTIFUL COUNTRYSIDE CRUISE LINE	ASSOCIATED WITH HIGH SCENIC CONTACTS ,JUST INSIDE THE RESORT (5POINTS);USUALLY ASSOCIATED RESORT CORRELATION, AT ITS PERIPHERY ,IN 15 MINUTES OR LESS OF DRIVING(APPROXIMATELY 10KM~15KM) (3POINTS); DISTANT,MORE THAN THE ABOVE RANGE (1POINT)	5	10%
	INDUSTRIAL LEVEL OF DEVELOPMENT	ECONOMIC DEVELOPMENTS IN THIS VILLAGE	GOOD ECONOMIC DEVELOPMENT (5POINTS); BETTER ECONOMIC DEVELOPMENT (3POINTS); GENERAL ECONOMIC DEVELOPMENT (1POINT)	5	5%
	VILLAGE FACILITIES BELONGS	PARRANGEMENT OF UBLIC SERVICE FACILITIES, MUNICIPAL FACILITIES IN THIS VILLAGE	SURROUNDING FACILITIES ARE GOOD (5POINTS); SURROUNDING FACILITIES ARE SO-SO (3POINTS); NO SURROUNDING FACILITIES (1POINT)	5	10%
	HOW GOOD THE NATURAL SURROUNDINGS	NATURAL ENVIRONMENT OF THE SURROUNDING ROADS, RIVERS, MOUNTAINS AND FARMLAND	SURROUNDING NATURAL ENVIRONMENT IS BEST (5POINTS); SURROUNDING NATURAL ENVIRONMENT IS SO-SO (3POINTS); SURROUNDING NATURAL ENVIRONMENT IS BAD (1POINT)	5	5%
MANAGEMENT CONDITIONS 15%	PROPERTY	PROPERTY CONDITION BUILDING	PROPERTY BELONGS TO THE COLLECTIVE (5POINTS); PROPERTY BELONGS TO INDIVIDUAL (3POINTS) PROPERTY IS NOT CLEAR (1POINT)	5	10%
		PROPERTY AND USAGE MEETS	PROPERTY MATCHES (5POINTS) ; PROPERTY DOES NOT MATCH (1POINT)	5	5%

Table 5 Intervention Resolve Icon



mation collected from field research in Wencheng. The deficiency of knowledge about certain situations and changes may lead to some errors of the grading results, which mainly turned out to be underrating of some historical buildings. In addition, as the understanding of cultural value is not completed in a short time, but is deeper with the development of economics, social science and technology, the evaluation results of the actual value may be underestimated under the current understanding.

5. Intervention levels based on the value evaluation

5.1 The definition of intervention

The intervention in this planning included the protection for historical buildings and the influence by various technologies and policies on historical buildings. The intervention of historical buildings was not only the previous research and value judgments, but also the technical guidance to historical building protection and utilization. This plan mainly intervened historic buildings on several aspects from the value evaluation, intervention classification, protection and utilization strategies.

5.2 Study on intervention levels

Based on the status of the historic buildings and the techniques used in historical building maintenance put forward by Daniel F. MacGilvray, the intervention level can be divided into four levels of keep, change, destroy and return. Keep can be regarded as no intervention level. In this level, the historic buildings are not added with new additives but are paid great attention to the preservation and maintenance, such as preservation and protection strategies. The change means adding new elements to the historical buildings and focuses on strengthening, intensifying and reusing, such as recycle, rebirth and reuse. Destroy involves with large-scale change in historic buildings. Return means to re-construct the historical buildings in accordance with the original appearances. The historical building preservation intervention mentioned in Local Cultural Heritage Value Maintenance Charter is classified into seven levels; non-intervention, maintenance, stabilization, repair, restoration, reconstruction and adoption. Non-intervention means not accepting any project implementation beyond preservation. Maintenance refers to having a set of exclusive maintenance plan to continue to preserve the historic buildings. Stabilization refers to strengthening or giving support to the historical buildings to slow down the structural damage rate. Repair means keeping the remaining building materials from history or trying to consider adopting original building methods and construction techniques when using the new building materials, to emphasize its authenticity. Restoration refers to preserving the historical buildings in a way of reconstructing the building materials, after obtaining a general understanding of the original materials and styles. Reconstruction refers to infusing new building materials into the main body of old structure to complete the space function. Adoption refers to using historical buildings in other purposes to meet their space continuity and the possibility of survival, but it may be involved with the changing in space. The non-intervention, maintenance, stabilization and repair in the charter have no significant changes on historical buildings, while the repair and reconstruction may lead to the authenticity problems. So when we are in the choice, we must carry on a careful evaluation and consideration.

Despite the different foothold for intervention levels in foreign countries, we still could reach cer-

tain hierarchical relationship, roughly through the attitudes for historical buildings ontology. The first level was about the main protection strategies to keep, maintain and protect, namely without intervention. The second level was the strategies for maintenance.

And stability that were reinforcement and strengthening. The third level was to maintain, remove or increase the body of the historic buildings that intervened structure of the building. The fourth level was to remove and reconstruct that means in general to apply old building materials to re-build the space. The intervention in this plan includes the protection for historical buildings and the influence on historical buildings brought by various technologies and policies. To intervene with the historical architecture requires early researches, value judgement, and the technical guidance on historical building protection and utilization. This plan was mainly from the value evaluation, intervention classification, and protection

Table 6 Relationship between Intervention levels and Intervention degrees.

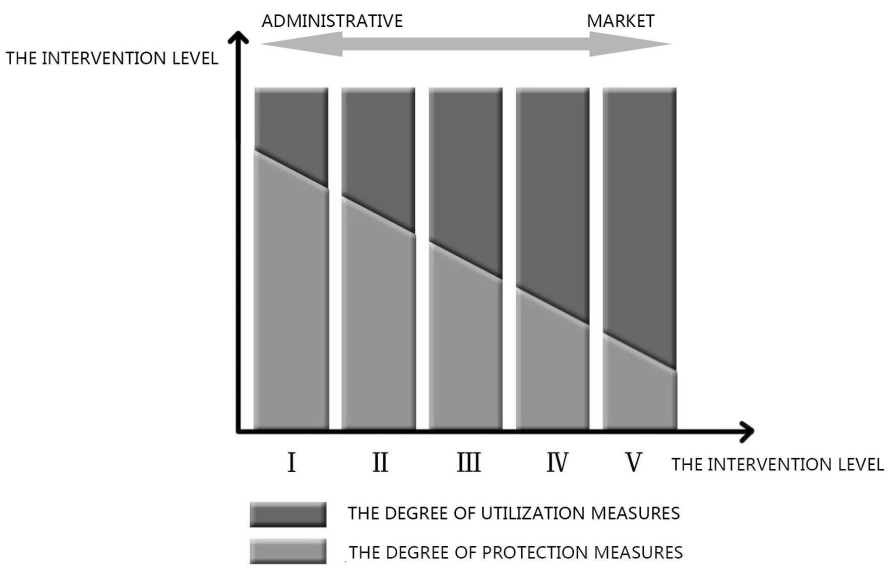


Table 7 Intervention Strategies at all Levels

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
DEFINITION	NON-INTERVENTION	REINFORCEMENT	OVERALL REPAIR	INTERNAL TRANSFORMATION	LARGE-SCALE TRANSFORMATION
KEY INTERVENTIONS	MAINTENANCE,KEEP	MAINTENANCE, STABILIZATION	RESTORATION, REPAIR	RECONSTRUCTION, REPAIR	RESTORATION, RECONSTRUCTION
CORRESPONDING HISTORICAL BUILDINGS	STRUCTURES AND NATIONAL HERITAGE CONSERVATION UNITS	ANCIENT TOMBS, GUTTING, BRIDGES, ETC., AND PROVINCIAL UNITS	ANCIENT TEMPLES AND THE HIGH PROTECTION RATING OF ANCIENT TEMPLES AND OTHER ANCIENT HOUSES	THE USE OF A HIGHER SCORE, BETTER LOCATION OR ANCIENT TEMPLES AND OTHER ANCIENT HOUSES	THE USE OF LOW SCORES OR POOR LOCATION OF THE ANCIENT HOUSES
HISTORIC BUILDINGS PHOTO	 THE WELLOF YANG WEI MOUNTAIN	 THE TOMB OF BAOYANEN	 BOTTOM NET TEMPLE CITY	 BRICK TOP ZHAO ANCESTRAL HALL	 THE FURNACE HOUSES OF MINGYANGZHOUDU

Table 8 Protection Policy at all Levels of Historic Buildings

UTILIZING MEASURES	THE SPECIFIC CONTENT	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
THE FUNCTION OF SETTING	CONTINUATION OF THE ORIGINAL FUNCTION	SUITABLE	SUITABLE	SUITABLE	SUITABLE	APPROPRIATE
	THE INTRODUCTION OF NEW FEATURES	CANNOT	INAPPROPRIATE	SURE	SURE	SURE
	IDLE	CANNOT	CANNOT	CANNOT	SHOULD	INAPPROPRIATE
THE INCREASE OF RELATED INFRASTRUCTURE	INFRASTRUCTURE	PROHIBITED CONSIDERATION, ATTENTION CONCEALMENT	POSSIBLE, PAY ATTENTION TO CONCEALMENT	SURE	SHOULD	SHOULD
	HEALTH FACILITIES	PROHIBITED CONSIDERATION, ATTENTION CONCEALMENT	POSSIBLE, PAY ATTENTION TO CONCEALMENT	SURE	SHOULD	SHOULD
	FIRE FACILITIES	SHOULD REDUCE THE APPEARANCE OF INFLUENCE	SHOULD REDUCE THE APPEARANCE OF INFLUENCE	POSSIBLE, PAY ATTENTION TO CONCEALMENT	SURE	SURE
	HVAC EQUIPMENT	INAPPROPRIATE	SERIOUS CONSIDERATION	POSSIBLE, PAY ATTENTION TO CONCEALMENT	SURE	SURE
	ELEVATORS AND OTHER EQUIPMENT	CANNOT	CANNOT	INAPPROPRIATE	POSSIBLE,PAY ATTENTION TO REDUCE THE IMPACT	POSSIBLE,PAY ATTENTION TO REDUCE THE IMPACT
CONSTRUCTION - IN THE FORM OF MORE	THE APPEARANCE OF MORE BIAN	CANNOT	CANNOT	INAPPROPRIATE	INAPPROPRIATE	APPROPRIATE
	FOR CHANGES TO THE STRUCTURE OF THE SYSTEM	CANNOT	CANNOT	SHOULD NOT	INAPPROPRIATE	APPROPRIATE
	FOR MORE BIAN LAYOUT	CANNOT	INAPPROPRIATE,ENSURE REVERSIBLE	CAN ENSURE REVERSIBLE	SURE	SURE
	FOR INTERIOR DECORATION BIAN MORE	CANNOT	INAPPROPRIATE,CAN BE INCREASED	CAN INCREASE	CAN CHANGE APPROPRIATE	SURE
KEEP ON RELEVANT INFORMATION	RETENTION OF HISTORICAL INFORMATION	MUST	MUST	SHOULD	SHOULD	SURE
	FOR SPECIAL ART FORM RESERVED	MUST	MUST	MUST	SHOULD	SUITABLE

and utilization strategies, to conduct interventions for historic buildings.

5.3 Definition and the corresponding strategy of intervention levels

According to the present situation of Wencheng historic buildings, the intervention levels were divided into five levels in our plan :

Level one, mainly aimed at buildings in smaller volume and historical buildings focusing on planar effects, such as the well, road, etc., as well as the national cultural relics' protection units.

Level two, mainly aimed at buildings in smaller volume and historical buildings with three dimensional space, such as pavilions, bridges, door platforms, etc., as well as the provincial cultural relics protection units.

Level three, mainly aimed at the palace, the temple buildings and the ancestral hall, folk houses and other buildings with the protection value scored ≥48, utilization value scored ≥ 42, and quite good comprehensive location (the location score + scenic spots correlation score ≥ 4).

Level four, mainly for the ancestral hall, folk houses and other buildings with utilization value scored ≥ 42 and good comprehensive location (location score + scenic spots correlation score ≥ 4) .

Level five, mainly for residential buildings with utilization value scored < 42 or poor comprehensive location (location score +scenic spots correlation score ≤ 4).

Table 9 Historic buildings at all levels of Utilization Policy

PROTECTION MEASURES	CONCRETE CONTEN	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
MAINTENANCE	DAILY MAINTENANCE OF BUILDINGS	NECESSARY	NECESSARY	OUGHT TO	OUGHT TO	APPROPRIATE
	FOR THE REGULAR MAINTENANCE OF PERISHABLE MATERIALS	NECESSARY	NECESSARY	OUGHT TO	OUGHT TO	APPROPRIATE
	THE PREVENTION OF DAMAGE	NECESSRAY AND NOTICE THE CONCEALMENT	NECESSRAY AND NOTICE THE IDENTIFIABLE	NECESSRAY AND NOTICE THE IDENTIFIABLE	OUGHT TO	APPROPRIATE
	TO ELIMINATE THE HIDDEN TROUBLE	NECESSRAY AND NOTICE THE CONCEALMENT	NECESSRAY AND NOTICE THE IDENTIFIABLE	NECESSRAY AND NOTICE THE IDENTIFIABLE	OUGHT TO	APPROPRIATE
RESTORATION	LOOSE COMPONENTS TO SHIFT, TO PLACE	PRIORIT	PRIORIT	PRIORIT	PRIORIT	AS FAR AS POSSIBLE
	TO DAMAGE, THE DEFORMATION OF STRUCTURE PARTS FOR REPAIR	PRIORIT	PRIORIT	PRIORIT	PRIORIT	AS FAR AS POSSIBLE
	THE NECESSARY REPAIR DAMAGED COMPONENTS	PRIORIT	PRIORIT	PRIORIT	PRIORIT	AS FAR AS POSSIBLE
	TO REPLACE BADLY DAMAGED COMPONENTS	COPY EXACT AND IDENTIFIABLE	COPY EXACT AND IDENTIFIABLE	AS MUCH AS POSSIBLE	AS MUCH AS POSSIBLE	AS MUCH AS POSSIBLE
	MAKE THE NECESSARY SUPPLEMENT OF THE MISSING COMPONENT	SERIOUS RESEARCH AND GUARANTEE THE AUTHENTICITY	SERIOUS RESEARCH AND GUARANTEE THE AUTHENTICITY	ENSURE THE RATIONALITY AND INTEGRITY	ENSURE THE RATIONALITY AND INTEGRITY	ENSURE THE INTEGRITY
	TO ELIMINATE ADDITIVES	CAREFUL JUDGMENT AND ELIMINATION	APPROPRIATE RETENTE THE LITTLE EFFECTIVE AND VALUABLE.	APPROPRIATE RETENTE THE LITTLE EFFECTIVE AND VALUABLE.	PROPERLY RETAINED	PROPERLY RETAINED
RELOCATION AND RECONSTRUCTION	MIGRATION FRAME	CANNOT	SHOULD	SHOULD	SURE	SURE
	CARRIDE OUT MIGRATION	CANNOT	SHOULD NOT	AS MUCH AS POSSIBLE	SURE	SURE
	REHABILITATION	CANNOT	AS MUCH AS POSSIBLE	SURE	SURE	SURE
	OTHER PLACES TO REHABILITATION	CANNOT	AS MUCH AS POSSIBLE	AS MUCH AS POSSIBLE	SURE	SURE
ENVIRONMENTAL RENOVATION	ELIMINATE HISTORICAL BUILDING SAFETY AND HEALTH FACTORS IN ENVIROMENT	NECESSARY	NECESSARY	OUGHT TO	OUGHT TO	APPROPRIATE
	ELIMINATE THE ENVIRONMENT OF THE HISTORICAL BUILDING SAFETY AND HEALTH RISKS	NECESSARY	NECESSARY	NECESSARY	NECESSARY	OUGHT TO
	IMPROVE THE QUALITY OF THE EXISTING ENVIRONMENT	OUGHT TO	OUGHT TO	SURE	SURE	AS FAR AS POSSIBLE
	TO IMPROVE AND ENHANCE THE QUALITY OF EXISTING ENVIRONMENT	OUGHT TO	OUGHT TO	SURE	SURE	AS FAR AS POSSIBLE

6. Conclusion

In order to establish a long-term feasible and effective working mechanism of historical building preservation, the plan scored and classified the 832 items in Wencheng, which will help local government make and carry out protection and utilization measures in place. Through the value evaluation system, the differences between historical architecture characteristics were demonstrated definitely by a relatively objective and intuitive way, the meaning of the system was to provide an operational method for dynamic evaluation on the historical architecture. And furthermore, we put forward corresponding measures of protection and utilization in order to prompt appropriate development for the ancient remains in Wencheng.

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2) Bo LangQin, (2002) International Historic Preservation and expected to maintain the text of the Charter Declaration resolution,1(1),12-18

Contemporary *Wayang* in the Digital Story Telling: Bring the Enviromental Sensitivity to the Classrooms

インドネシア伝統の人形劇ワヤン。この民族的遺産をデジタル世代の子どもたちに伝え、かつ環境保護に活かす教育現場の取り組みを紹介する。

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Abstract

Wayang – a traditional theater in Indonesia and Southeast Asia, refers to puppet theater performance. Historically, as it was used to spread religious-and-social values to society, it has a potential to be applied in educational field to insert characters values as stated in Indonesian *Kurikulum* 2013, preserving nature as well as local culture. Technology literacy, at the same time, becomes the concern of 21st century education. Digital storytelling, then, could be the bridge of the local and the modern ones, and the media to educate the characters building. The core of digital storytelling is from the idea of combining the art of telling stories with a variety of multimedia. It can be practiced in many different content areas across grade levels, and is able to facilitate students with various learning styles. Regarding to those rationales, it is possible to insert the local values of *Wayang* with some modification and the modern technology of digital story telling in order to educate as well as to increase students' awareness toward social issues. This current study, further, was based on the practice of digital story telling in CLC Jeroco, Sabah - Malaysia. On the basis of students' social background which is the children of migrant workers in the oil palm plantation, the theme of the stories was related to the issue of oil palm plantation and its impact toward environment. The insertion of this theme in the classroom setting was expected to increase students' environmental sensitivity and critical thinking.

Keywords Wayang, digital story telling, environment

Introduction

Globalization leads to the pace of social changes in various aspects of life, among others are information and technology (IT), culture, and environment. In terms of IT, the growth of the Internet globally has eased people to easily access and/or share numerous information without substantial barriers. One can update the latest news in far parts of the world only in seconds and spread it automatically to all over the globe. In other word, everything can be done in merely one or two clickings of fingertip. A number of social media, *inter alia* Facebook, Twitter, Instagram, YouTube, and so forth, have also essential roles in spreading culture products from one country throughout the world. This phenomenon brings the issue of cultural globalization. The cultural globalization has power to minimize cultural boundaries among nations. It also enables individuals to mingle in broader socialization as well as brings interconnection among different populations and cultures. Thus, the impact of IT advancement immensely affects various life sectors.

Cultural globalization, further, also brings the new issue of cultural homogenization which potentially impact national identity and culture. Global culture has made people more familiar with Hollywood than the culture of their own country. Hollywood blockbusters have been popular throughout the globe and 70% of its revenue comes from international markets (Brook, 2014) which means that most of its viewers are from the countries outside USA: In fact, Indonesia is categorized as a promising market for Hollywood movies. As the world turns to Hollywood, the shaping views of Americans (Americanization) cannot be overlooked. Indonesia as a nation-state with a pluralistic society, which consists of approximately 1,128 racial/ethnic groups (BPS, 2010), is vulnerable to social unrest and intragroup tension in terms of race, ethnicity and religion (Sugiharto, 2009), needs to be alert on the profound impact of this globalization towards the future existence of Indonesian local culture. If the richness and diversity of local culture is not well preserved, the cultural globalization and/or homogenization surely would fade and swap the position of local culture.

One of the issues of global-culture impact which this paper concerns is that the case of degrading of *Wayang* as the Indonesian great noble indigenous culture product. *Wayang* is a traditional theater in Indonesia and Southeast Asia referring to puppet theater performance. The characters consist of inanimate figures made of and moved by human effort before audience (Stein, 2010). The varieties of Indonesian *Wayang* can be categorized into *Wayang Beber, Wayang Purwa, Wayang Gedog, Wayang Golek, Wayang Krucil, Wayang Madya,* and *Wayang Pancasila* (Moerdowo, 1982). Furthermore, Moerdowo added that as the native culture of Indonesians, *Wayang* reflects exquisite art, philosophy, moral, thought, and education values. It does not function merely for entertainment purposes, yet is used for exorcism, invocation of ancestral spirits as well as spreading religion. Historically, it is developed based on the cultural and social patterns of Indonesia. It, firstly, adopted classical Hindu Javanese religious mythology. As the era of Islamic culture in Java, Islamic values were inserted within the narrative as the media to spread its religious values. At the time of 1945, the year of Indonesian independence, contemporary *Wayang* called *Wayang Perjuangan* was created in order to commemorate the revolution. To be emphasized, *Wayang* retains its position as high level and breathtaking art form at all levels of society as well as embraces esthetical, educational, mystical and philosophical elements. In 2010, then, Indonesian *Wayang* got UNESCO recognition as one of the Masterpieces of the Oral and Intangible Heritage of Humanity.

In this current globalization era, however, the position of *Wayang* has been shifted by modern popculture which makes it less popular now than some decades ago. It is such a crisis that the organizing committee of *Festival Wayang Indonesia* stated that most Indonesian youths lost interest in *Wayang* and were even blind to *Wayang* (Jakarta Post, 2015). Regarding this case, it is absolutely a big challenge for Indonesian to introduce and maintain the existence of *Wayang,* as the great honour heritage and the mirror of Indonesian characters, to the youth because the future of *Wayang* lies in the hands of them.

Besides the challenge on the local native culture preservation, another issue in the present undeniable globalization era which Indonesia has to face is environmental problems. As the world's largest archipelago country encompassing over 17,000 islands, Indonesia is endowed with rich natural biodiversity and resources. However, these have not been managed in sustainable manner which has led to overexploitation and depletion. Besides, as the fourth populous country on the earth after China, India, and USA with over 237 million inhabitants, Indonesia also faces a big problem; the total population is expected to grow to 271 million by 2020 (World Population Review, 2015). Moreover, that number of residence is not evenly distributed among thousands of islands situated from Sabang to Merauke. 58% of the total population reside in Java islands which leads to various environmental problems, not merely in Java, but

also over the Indonesian sovereign areas. Besides, Indonesia has also deforestation problems whose rate reaches 1.8% annually due to agricultural clearance, forests fires, illegal logging, and illegal mining (World Bank, 2008). Based on the data obtained from the World Bank, this is significantly higher than other two tropical-forested countries, Brazil (0.6%) and Democratic Republic of Congo (0.3%), and the global mean deforestation rate (0.5%). The scale of forests fire, presently, has increased with the expansion of oil palm and timber plantations, particularly in Sumatera and Borneo islands. This exploitation contributes to flood, landslide, water shortage, soil erosion, land degradation, water pollution, loss of biodiversity, as well as pressures and stresses on the whole ecosystem of the Earth.

Regarding the environmental problems, Indonesian government actually has made some attempts by establishing environmental regulation, yet its implementation and enforcement is weak (Wingqvist & Dahlberg, 2008). In order to achieve the goals, it is obligatory to have grassroots' active participation that can be started by making use of education, as it is considered as one of the most powerful and effective means in raising human awareness, shaping the world, changing the attitude to face the future challenge (UNESCO, 1997; Howe, 2009). Therefore, it is indispensable to include environmental sensitivity within education through environmental education which is integrated in curriculum. Students as the young generations who will be the future leaders need to be adequately equipped as well as prepared for the numerous world challenges, including environmental problems they will inherit. This will help them become well educated and thoughtful leaders of tomorrow (American Forest Foundation, 2010). Jacobson, McDuff, & Monroe (2006) state:

> Environmental education is objected to provide students with the opportunity to gain the sensitivity to the environment, to have knowledge and experience of the problems surrounding the environment, to acquire a set of values and positive attitudes, to obtain the skills required to identify and solve environmental problems.

In addition, environmental education also brings benefits to students, such as opportunities for rich, real, and relevant learning across curriculum which is relevant towards the context of Indonesian national education goals which aim to build critical thinking, problem solving, and foster active, independent, and cooperative learning through the content area integration (Archie, 2003).

As the aforementioned globalization-era complex problems has pivotal concern, one of the educational alternatives to bridge the three challenging dimensions which are the advancement of IT demands, the Indonesian *Wayang* existence degradation, and the environmental problems in Indonesia, is by utilizing digital story telling using *Wayang* characters with the specific topic of narrative about environment. Digital story telling, based on a number of resources, (Vinogradova, Linville, & Bickel, 2011), refers to a distinct nonlinear narrative genre that uses new media of technology to produce narratives using multimodal means (sound effects, voice, music, and images) to convey meaning. In other word, students use a variety of multimedia tools to narrate the story in an innovative, creative and engaging project. Furthermore, it also provides interactive activities for building communities, fostering students' collaboration and multiliteracies, and creating opportunities for global audience. Digital story telling, then, could be a potential medium to bridge the local and modern ones, and also as a medium to teach the skill of character-building.

In specific, this current writing would elaborate the use of modified modern Indonesian *Wayang* (henceforth contemporary *Wayang*) which is used in the setting of education and performed using the medium of digital story telling to deliver environment related materials. It is considered as the pivotal to insert *Wayang* in the educational field to build characters values. The term of contemporary *Wayang,* in this present piece of writing refers to the oral

art performance using Indonesian *Wayang* characters with some modification, such as, the naming of the figure which uses modern name closely to students' daily life instead of the classical name of each figure, the use of modern-themed stories telling about environmental issues, the application of various modern music instruments or sound effects instead of *Gamelan Jawa*, and the use of *Bahasa Indonesia* as the medium of communication instead of using traditional-high-level of Javanese (*Krama Inggil* or *Kawi*). Those were applied as part of the up-to-date efforts to make *Wayang* more appealing to young generations. Regardless the modification laying here and there, each character of *Wayang* is visualized and formed as closely as to its original form as the efforts to keep the sense of classical and traditional values of *Wayang*.

The practice of digital story telling as the delivering medium of contemporary *Wayang,* further, is expected to have triple functions: (1) to introduce and preserve the Indonesian local culture of *Wayang*, (2) to instill the environmental sensitivity values, (3) and to prepare the Indonesian youths to cope with the demands of 21st century and global communities where everything is digitalized and require everyone a certain technology literacy. Eventually, it is expected that the use of contemporary *Wayang* shapes national characters in the global world and keep the existence of Indonesian native culture while the environmental narrative as the topic within the *Wayang* performance can reinforce the future generations to be proactively aware of the sustainability of the Earth in which they live.

Method

This current article is developed under the umbrella of qualitative research design in which the researchers seek a deeper truth of a phenomenon in natural setting, understand as well as interpret it from multiple perspectives on the basis of activities conducted at Community Learning Center (CLC) SMPT Jeroco, Sabah-Malaysia. To be more specific, the researchers employed a retrospective study design since it is objected to investigate past activities on utilizing contemporary *Wayang* through the medium of digital story telling within the teaching and learning process (Hess, 2004; Starman, 2013). Theoretically, there are three general types of retrospective study: case report, case series, and case-control study. A case report is a report of one unusual and instructive case, a case series is a report of multiple similar unusual or instructive cases, and a case-control study is similar to a case series and includes control group as the comparation. Regarding the previous explanation, it can be concluded that this article belongs to case report.

The subject of this present retrospective study is the 58 Junior High School students levels on grade of VII, VIII, IX and Package A at CLC SMPT Jeroco. CLC Jeroco is one of the schools out of 48 CLC SMPT in Sabah – Malaysia which was established in 2013 under the supervision of *Sekolah Indonesia Kota Kinabalu (SIKK)*. Its establishment is one of the efforts of Indonesian government to broaden the access of education for Indonesians regardless the area they inhabit (UU No 20 year 2003 about National Education System), including Indonesian children who reside in Malaysia. It is absolutely urgent for giving the education access for *TKI-Tenaga Kerja Indonesia* (Indonesian migrant workers) children in Malaysia regarding the fact that Malaysia has the highest number of Indonesian migrant workers compared to Taiwan, Arab Saudi, Hongkong, and Singapore (BNP2TKI, 2015). There are approximately two million Indonesian workers in Malaysia. 80% of them work in the oil palm plantation, particularly in the Eastern part of Malaysia, Sabah. Based on the data from Uni Social Democrate, the number of legal and ilegal migrant workers in Sabah reaches 538,180 and 329,388 respectively (Handadhari, 2015). In addition, Nusron Wahid (the head of BNP2TKI) stated that recently there are around 15,000 school-aged Indonesian children in Sabah—Malaysia who are learning at the CLC with free educational services.

Particularly in CLC SMPT Jeroco, the students'

age ranges from 12 to 19. Based on the observation of the teacher, the students in the Jeroco oil palm plantation prefer working to studying at the formal school. Some others are working in the morning and going to school in the afternoon. So, it could be said that the ones who go to school are categorized as the motivated learners. As the highlight, the social environment of oil palm plantation does not give adequate support for school aged children to pursue the education.

Having school at CLC in Malaysia, for sure, is different from what Indonesians have, especially in terms of academic and socio-cultural atmosphere. For instance, the school starts in the afternoon (1 p.m – 5 p.m.), some students in CLC SMPT Jeroco have not passed primary school so that they do Package A program at the school, students are more fluent using Malay language with special local dialect rather than Bahasa Indonesia which impact on the students understanding towards the subject materials which were delivered in *Bahasa Indonesia*. Despite those differences, CLC still needs to apply the Indonesian curriculum and attain the goals plotted in four domains, spiritual, cognitive, social, and skills (Kemdikbud, 2013). In addition, the social challenge that most of CLCs in Malaysia faces is that most of their students are not only living in but also born in Sabah, and they do not see Indonesia as their origin country. Regarding this socio-cultural condition, there is urgent need for inserting nationality towards Indonesian students.

Concerning on the challenges and demands of globalization, the goals of national education, the need of environmental-problems sensitivity of the young generation, the Indonesian students special socio-cultural background in Sabah-Malaysia, the result of comprehensive review on the potential of contemporary *Wayang* using digital story telling, and the critical analysis on the urgency of inserting Indonesian characters, the two researchers collaborated to apply contemporary *Wayang* within the package of digital story telling in the process of instruction at the CLC SMPT Jeroco Sabah—Malaysia. As the two researchers have different domicile (Indonesia and Malaysia), for the practicality and feasibility reason, the one who conducted the process of field execution was the one who live in Sabah—Malaysia.

In order to obtain the data on the implemention of the digital story telling, some instruments employed were field notes, documentation, students' script, and edited video product of contemporary *Wayang*. All the instruments utilized in the data collection, then, were analyzed narratively to have big picture about the events and to reveal underlying values on the implementation of contemporary *Wayang* using digital story telling in the educational field and its wider effects. It is also expected that the findings are viable to inspire broader number of educators, practitioners, scholars, and/or researchers for developing similar media in different educational settings to spread the environmental values and sensitivity to young generation, not merely in the scope of Indonesia but also all over the world.

Findings and Discussions

Implementing Contemporary Wayang in the Digital Story Telling

The current Indonesian national curriculum (K13) requires the interrelation between one subject to other subjects vertically as well as horizontally on the basis of accumulative, reinforced, and enriched principles (Kemdikbud, 2013) to create a productive, creative, and inovative future generation (UU No 20 year of 2003). To be more specific, it aims at building students environmental sensitivity, increasing nationality, preserving local culture, and developing IT literacy. Regarding those goals, it is a challenge for the teachers to build nationality and/or bring Indonesia inside the classroom as the setting of the school is oil palm plantation in Sabah - Malaysia. Further, raising students' awareness about a number of cases related to the environmental problems in Indonesia (generally) or land clearance or forest fire for new oil palm plantation (particularly) where they live is obligatory to apply. The real example of

environmental disturbance which the students had was the haze disaster in 2015 caused from forest fire in Sumatera and Kalimantan, Indonesia. Of course, as the ones who live in the oil palm plantation surrounding, students should not be apathy, but need to be well known of this case. It is also expected that students become the agent of change who will be responsible for the future of the earth.

Wayang, with some modification, then, is believed to be effective means to achieve the goals and cope with the aforementioned challenges – environmental, national identity, and technology. The use of contemporary *Wayang* in the classroom came out as the result of discussion and analysis between the researchers. After critically reviewing related and relevant theories, then, the researchers came to the hypothesis that contemporary *Wayang* using digital story telling might be the answer for the present challenges and to reach the goals set in the national education system of Indonesia. The combination among contemporary *Wayang,* digital story telling, and environmental sensitivity character, in conclusion, meets the equilibrium point of a number of 21st century education goals which are local culture preservation, technology literacy, and future environment awareness.

In the process of executing the project of using the media, some stages were conducted, *inter alia* preparing, applying, reflecting, revising and reapplying, and reporting. The flow of the stages is shown in the Figure 1.

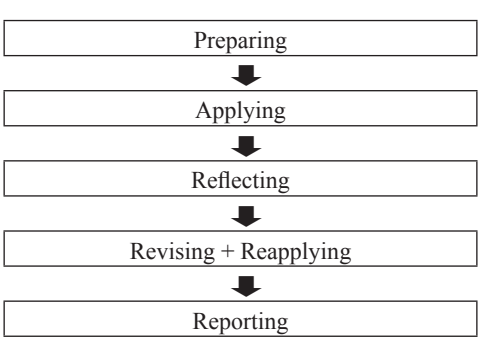

Figure 1. The Flow of Project Stages

In the preparing stage, the researchers set the goals of the project to focus on; in this term is promoting students' critical thinking and problem solving related to the present socio-cultural and environmental problems. The researchers also prepared the topic of environmental problems, particularly forest fire in Indonesia (Sumatera and Borneo islands) which in fact has created haze disaster over the country and spread to Malaysia and Singapore (BBC, 2015). This topic of haze disaster was meaningfully chosen as it is urgently needed to open the students' eyes about the issue of oil palm plantation. The topic chosen was also authentic as authentic materials are a useful means to bridge the gap between classroom and the real world (Kelly, Kelly, Offner & Vorland, 2002). This is also part of brainstorming activity since having students thinking about different ideas would help to get the process started as well as to lead the students to focus in certain areas (Alba, 2014). As part of brainstorming, the teacher-researcher prepared a hand drawing entitled "Putri Jerebu" or "The Haze Princess" to explain about the haze disaster as shown in the Figure 2. The drawing was aimed to visually attract students' attention during the process of explanation on the materials.

The other preparation prior to the project application, the researchers prepared materials that provide students with the general knowledge of Indonesian *Wayang* characters and how to play with *Wayang* in

Figure 2. The Drawing entitled "Putri Jerebu" Used to Introduce Haze Disaster

the conventional way. In this stage, students were able to create the characters as well as do the performance in front of the class as shown in the Figure 3.

In the stage of applying the project, the researchers started to hook students' understanding about environmental problems happened on the earth by implementing questioning technique. After that, students were challenged to create a story and perform it in the form of *Wayang* performance, not in the conventional way as they had previously, but in the form of digital story. First, students created the narrative in group consisting of six students. Then, based on the narrative, students discussed the characters and background to be used in the filming process. Lastly, they performed a story of environment using their *Wayang* characters and record it digitally using handphone camera. In the first cycle, all the *Wayang* characters which students made were modern ones (most of the characters visualization were students in their age). The story that students created were very attractive and amusing ranging from the disposal classification, haze disaster, flood, and water pollution. In the first stage, it was very interesting due the students used the real natural background and effect as shown in the Figure 4. The story and language used by the students were very novel and close to their daily life. Yet, the technique of characters movement and clip filming had not been good. The process of filming did not have the editing stage,

Figure 3. The Introduction to *Wayang* Play

so that students directly show their film in front of the class after recording process.

After the filming process, students come to the stage of presentation in which their digital stories were shown to the class and received feedback from other students. During the session of presentation as shown in the Figure 5, students gave written as well as spoken comments on each film presented. During the presentation, there were a large number of laughs. All the students were very attentive to watch their friends' work.

After that, the researchers came to the reflection stage, and found out the values of local culture had still not been maximal as the characters of *Wayang* students made were too modern. As the researchers concerned on preserving, introducing, and emphasizing Indonesian local culture toward students of Indonesia in Sabah-Malaysia, the researchers decided to go to the second cycle with some revision. In the second cycle, the researchers revised some aspects and reapplied the project of digital story telling using

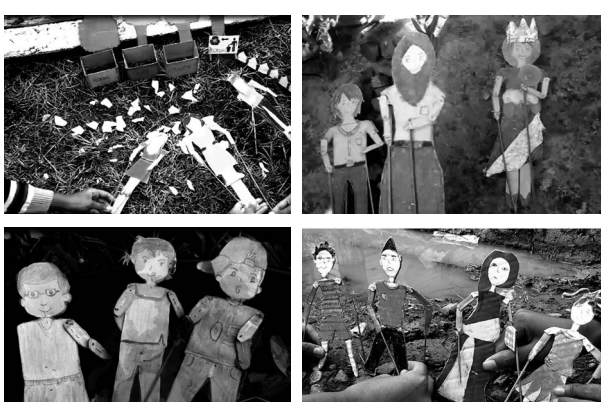

Figure 4. Characters of Contemporary *Wayang* in the Step 1

Figure 5. Digital Story Telling Presentation

contemporary *Wayang*. The researchers reintroduced Indonesian *Wayang* characters to the students through PowerPoint presentation as it was the simplest and practical visual medium to use before the classroom. The introduction of *Wayang* characters (Punakawan, Pandawa, Rama Shinta, and so on) was considered very crucial to be conducted to refresh students' knowledge on *Wayang*. Even though students had been introduced to *Wayang* prior to the project, the repetition on the *Wayang* materials was important as the students never knew the original Indonesian *Wayang* characters previously for most of them were born and grow up in Sabah - Malaysia. Thus, this introduction was objected to be part of bringing Indonesia to the Indonesian children.

After being given sufficient introduction, students were asked to create the characters of Indonesian *Wayang* as shown in the PowerPoint presentation they were interested in. The creation of Indonesian *Wayang* characters in the project of digital story telling was included as part of a weekly project program called "Program Tugas Mingguan" which has been conducted for over two semesters on the basis of Project Based Learning (PBL). This project has been proven to effectively promote students' positive characters, *inter alia* creative, innovative, disciplined, motivated, responsible, independent, open-minded, socio cultural and environmental sensitive (Kurniawan, 2015). In creating the *Wayang* characters, students did it individually so that each of them can be more imaginative, explorative, freely expressive, and creative. As the classic form of Indonesian *Wayang* characters is very difficult to create exactly as its original forms, then, students were given a freedom to do some modifications. Some characters that students created were Gatotkaca, Punakawan (Semar, Gareng, Petruk, Bagong), Srikandi, Arjuna, Bima. The results of *Wayang* characters are shown in the Figure 6.

After finishing creating the characters, the students submitted their art product to be assessed. The assessment included internal and external parties. The internal examiners were students and the teacher- researcher. It resulted that there were four best characters. Those big four, then, was polled by external assessors using the social media, Facebook. There were nineteen external respondents who voted for the students' works. This phenomenon is the real evidence that social media can be used to support the process of teaching and learning. The teacher-researcher also believed that uploading the work of students, is also part to show to public (particularly Indonesian) that migrant worker children exist and they are also part of NKRI *(Negara Kesatuan Republik Indonesia)*. So far, the students' works have got positive responses which are expected to motivate students as they know that their works are seen and appreciated by broader people from other areas outside oil palm plantation. Furthermore, uploading the students' works are also proven to be able to inspire the other educators to apply the similar activities in their own contexts and settings.

After that, the students were given a project to work in a group consisting of six students to create a narrative under the main topic of environment issues, particularly in Indonesia, utilizing the characters of contemporary *Wayang* they have made. After the idea of narrative has been selected, students cre-

Figure 6. Characters of *Wayang*

ated the draft of the narrative to help them organize the characters, the setting, and the sequence of the movie (Alba, 2014). After creating the narrative, students came to the stage of creating the background picture of the story manually on a piece of drawing paper. The pictures would help the students to give better background of the story they recorded. Then, in the process of filming and dubbing in creating digital story telling, students recorded their *Wayang* performance using handphone camera. Fortunately, all the students were equipped with a sophisticated handphone so that the technology was not barrier in the process of recording the performance as shown in the Figure 7.

In addition, the setting of Indonesia was objected to enclose the students to be more aware of their country. Students developed and produced their stories under the topic of environmental issues that are of genuine interest to them so that the range of the stories will be varied. Topics chosen by the students during the project were disposal problems, forest fire, water pollution, wildlife protection, and global warming. After that, the students came to the process of editing video in which they can insert a title page, write captions, add musical instrument, provide neat transitions between clips, and have credits at the end. Unfortunately, as the limitation of computer facilities, there was no computer for students, the teacher-researcher was the one who did the editing process using Windows Movie Maker (WMM). WMM was selected as it was the simplest program. The result of edited videos is presented in the Figure 8. The decision to involve teacher as the video editor was due not all students come with knowledge of digital video editing technology regardless the modern smart phone they had, yet there are still lack of ability to operate the computer application related to the video editing.

The last step in the project of contemporay *Wayang* using digital story telling project was the session when students presented their digital stories before the class and received feedback from other students. Particularly, the presentation of the digital storytelling product would foster students' presentation and discussion skills as students need to present their work to the public (classmates) and give constructive feedback in the form of both oral and written comments to others' work as well as receive feedback for the future betterment. These activities would build students' character, such as communicative, confident, open minded, honest, polite, respect, and appreciative. One of the video products was also uploaded by the teacher-researcher in the social media of Facebook to invite external viewers to give constructive feedback and/or appreciation. It will, further, increase students' motivation when they know that their product will be published on the Internet (Karchmer, 2001). It was also a means of promoting and introducing students towards the global world.

Figure 7. Students Do Recording Using *Wayang* Characters

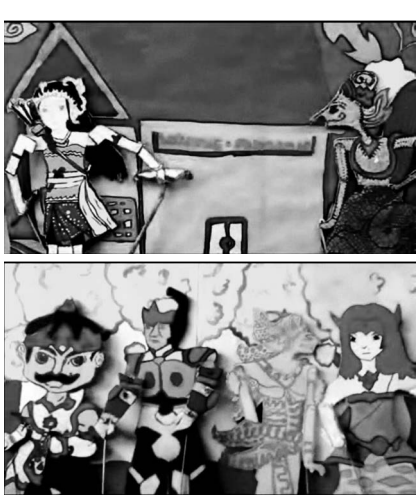

Figure 8. The Samples of Digital Story Telling Videos

There were 26 viewers for the uploaded video. However, the respond toward the uploading video product was not as good as the uploaded photos. The less responds were due the viewers need to spend more internet credit for watching the video so that they were reluctant to click it. In addition, among three video of the contemporary *Wayang,* only one could be uploaded due to the technical problems on the internet connection. The video product, then, could be downloaded publicly using this following link: https://www.facebook.com/franky.asshodiq/videos/vb.100000491948354/1283996584960061/?type=2&theater.

During the implementation of the project of contemporary *Wayang* using digital story telling, the researchers did evaluation by observing the process, making notes, and documenting all of the process of activities to have further investigation to generate theories and/or evaluation. The teacher-researcher also asked the students to give a comment on the activities of creating the digital story telling. It was found out that students were motivated to do the project, for instance to create a character, to draw background, and to do filming and dubbing). Thus, it could be concluded that contemporary *Wayang* can be a means to insert and spread environmental values and sensitivity to the young generation.This activities also promote students' critical thinking to find the environmental problems, its causes and effects, how to prevent it from happening, minimize and/or solve the negative impact. In conclusion, it is essential to make young generations realize that they are part of the problems, and therefore they have to be part of the solution.

Accomodating 21st Century Educational Goals and Increasing Environmental and Socio-Cultural Sensitivy through Contemporary Wayang Using Digital Story Telling

A number of goals the students in the 21st century have to achieve are having social, cultural, global, and environmental awareness. It is supported by the 'Belgrade Charter—A Global Framework for Environmental Education' whose objectives are as follow:

> to foster clear awareness of and concern about economic, social, political, and ecological inter-dependence in urban and rural areas; to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment; to create new patterns of behavior of individuals, groups and society as a whole towards the environment.
>
> (UNESCO, 1975)

On the basis of Belgrade Charter above, it is critically concluded that environmental education is not merely about science-based, but it can be in the form of inter-disciplinary approach across disciplines. A report of Environmental Education published by the Scottish Education Department in 1974 recommends that young people should be introduced to environmental concepts and values, be trained to assess critically the many views on current environmental issues, to permeate environmental education to the whole curriculum.

In the process of creating the narrative in the project of digital story telling, students need to think critically on what have happened in and around their environment by observing and questioning why they happened. Then, in order to find the answer of their curiosity, students need to collect the data from various resources, then analyzing and synthesizing the data they obtained to get the way to solve the problems raised. After those processes, they created a storyboard of flow of the narrative to communicate their ideas to the world. In the process of finishing the digital story telling project, the students creatively created *Wayang* characters, did the video recording and dubbing to perform the story created, and finally finished and presented the project in front of the audiences. In conclusion, the projects follow the principles of scientific approach which are observing, questioning, associating, experimenting, and networking (Kemdikbud, 2013) and the 4C's

skills of 21st educational skills - critical thinking and problem solving, communication, collaboration, creativity and innovation (NEA, nd) along with technology literacy.

Based on the analysis, the process of developing digital story also supports student learning and Higher Order Thinking Skills (Nelson, 2006) and has been found to be an important tool for the improvement of student writing, language, and literacy skills. In addition, during the process of digital story telling using the characters of contemporary *Wayang*, learners worked collaboratively to finish the product. Digital storytelling also acts as a motivator to sustain student engagement throughout the project (Burn & Reed, 1999). Digital story telling which utilizes multi media means not only address different learning styles (Alameen, 2011). In its process, students can develop multiliteracies; writing - by drafting the narrative, visual - by creating and modifying the character of Indonesian *Wayang*, communicative - by delivering, presenting, and discussing the stories, and electronic literacies - by creating and sharing the stories in the form of digital instead of conventional way. Therefore, it is both theoretically and empirically proven that contemporary *Wayang* using digital story telling could accomodate students' different learning styles, audio, visual, as well as kinesthetic.

However, there were some barriers during the implementation of digital story telling using contemporary *Wayang.* First, as the knowledge of *Wayang* characters that the teacher-researcher had was limited, the students were not explained in detailed, for instance the biography of each characters, the ornament used in the characters, and so forth. The teacher researcher also did not give explanation on the story of classical *Wayang.* In addition, the materials of *Wayang* were only given at glance. Second, the students' competence on using computer and specific software related to audio and video editing was still very limited so that the one who was in charge of combining and editing video was the teacher- researcher. It was a note from the teacher-researcher that ideally the students, themselves, had to conduct the editing clip, yet there were neither computers for students nor the human resource who would help students doing the editing. To be highlighted, there were more than 50 students (the number is increasing over time) in CLC SMPT Jeroco. Ironically, there was only one teacher who had to deal with that number of students and was in charge of teaching all subjects. To teach the students the editing software, of course, would be hard and time-and-power consuming.

Conclusions and Suggestions

To sum up, we need moral education to instill environmental sensitivity as well as social cultural awareness to future generation. Further, in this current 21st Century, students have to acquire knowledge and skills in technology. In mediating those challenges of environment, culture, and technology literacy, digital story telling, then, is a potential answer as it can bridge among them well. The result of this implementation of digital story telling in the CLC Jeroco is the empirical proof toward its effectiveness within the instruction. However, it is required to be highlighted that undoubtedly there are challenges associated with the application of contemporary *Wayang* in the digital storytelling production, particularly in CLC Jeroco which location is oil palm plantation. Regardless the limitation, it is pivotal for both students and instructors to be able to learn to make use of available and limited resources to achieve the great result from the digital story telling.

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Biological Activity of Oligomer Chitin Hydrolysate Produced Using Chitinase Enzymes from SSA2B4.1 (*Bacillus cereus* SW41) Isolate on Lymphocytes and Cancer Cell Lines

カニやエビなどの甲殻類の殻に含まれる成分には抗癌作用があるとされる。そうした水産資源の多いインドネシアで、抗癌剤開発の可能性を探った。

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Abstract

Local chitin waste from crab industries can be used as a source for production of oligomer which has important biological activity. The aim of this study was to evaluate the activities of oligomer produced by enzymatic hydrolysis upon proliferation of lymphocytes and cancer cells. The chitinase enzyme was obtained from thermophilic bacterium *Bacillus cereus* SW41 isolated from South Sulawesi. The reaction products were analyzed and fractionated using HPLC. Cytotoxic assay to determine the lethal concentration 50 (LC_{50}) used the BSLT method. The effect of oligomer hydrolysates on lymphocyte proliferative activity and inhibition of cancer cells was determined by MTT method. The oligomer hydrolysate processes with or without lyophilization at concentration of 62.5 and 125 µg/ml were able to increase lymphocytes proliferation (3-22%). Antiproliferation activity of oligomer chitin hydrolysate was detected in all tested cancer cell lines with the highest activity occurring in MT2 cell ranging from 17-48% followed by Raji cell (17-43%), and HeLa cell (5-33%). Based on these results, we conclude that oligomer chitin hydrolysate could be used as an anti-proliferation of cancer cell but a further study is needed to develop before commercial use.

Keywords oligomer chitin hydrolysate, cancer cell, lymphocyte

Introduction

The issue of food security and safety in Indonesia requires a solution and integrated effort in exploiting all of the potential existing local resources.

Invertebrate marine crustaceans such as shrimps and crab have hard shells that contain a compound known as chitin. Chitin in crustacean is of high content ranging from 20-60% depending on the species (Rochima et al., 2004).

Many studies have shown that kitooligomer compounds from chitin waste have the potential to be developed as an anti-cancer material. Therefore, this study is considered very important to carry out in efforts to increase the added value of chitin waste through the production of bioactive kitooligomer compounds that can be used as a functional food and nutraceutical immune system (Sanford, 2003).

Given this background, this study was conducted on the production of bioactive chitin oligomers by using chitinase enzyme produced by SSA2B4.1 iso-

lates (*Bacillus cereus* SW41) which had been previously characterized wholly, and a bioactivity test to observe the pharmacological activity of a compound. Further, this study was intended to produce the oligomer compounds of chitin which have the bioactive activity of cancer cell anti proliferation, thus making it possible to provide information on alternatives for increasing the value and usability of local marine waste into products of high economic value, and the information provided can be used for industrial development efforts, particularly food and marine-based nutraceutical products, which are likely to become export products.

Research Methodology

Time and Study Site

The study was conducted at the Laboratory of Microbiology and Biochemistry of the Research Center of Biological Sciences and Biotechnology of IPB and Tissue Culture Laboratory, Pathology Section, Department of Reproduction Clinics and Pathology (KRP) Faculty of Veterinary Medicine of IPB. The study was conducted from June - December 2011.

Study Materials

Chitin hydrolysate oligomers of 1% FBS for 6 hours and 1% EM for 12 hours. HeLa cervical cancer cells (ATCC CCL-2), lymphoma Raji cancer cell (ATCC CCL-86), and lymphoma cancer cells T (MT2) from the Stem Cell Cancer Institute of Jakarta. Other materials include among others the culture purposes such as Dulbecco's modified eagle's medium and 3-(4,5-dimethyl-2-thiazoly) -2.5-diphenyl-2H-tetrazolium bromide (MTT).

Research Method

This study consists of four main parts: 1) enzymatic production of bioactive oligomer compounds of chitin hydrolysate, 2) fractionation compounds of oligomers in hydrolysates resulting from enzymatic reaction, 3) cytotoxic testing of Lethal Concentration 50 (LC_{50}), 4) Testing of lymphocyte proliferation activity and inhibition activity of cancer cells.

Study on the production of oligomer compounds of hydrolyzed chitin

The production of chitinase enzyme and manufacture of colloidal chitin used the method of Arnold and Solomon (1986), the production of enzymes FBS and EM adopted the method of Wahyuni (2010), the testing of chitinase enzyme activity and concentration of N-acetyl glucose-amine used the method of Ueda and Arai (1992), the measurement of protein content was based on the method of Bradford (1976) and the electrophoresis followed the method of Bollag and Edelstein (1991).

Fractionation of Oligomer Components of Chitin hydrolysate

Identification and fractionation by HPLC used carbohydrate column (waters) as the stationary phase, and the solvent is 60% acetonitrile in water as the moving phase. Detection is based on the retention time, with a UV detector of 440 model dual lambda, using an injection volume of sample as much as 20 µl and flow rate of 1 ml/min. As standard, an oligomer compound was used, a mixture of Seikagaku Japan with the monomer unit to hexamer at a concentration of 20 mg/ml, and chitosan as standard (Jeon and Kim, 2000).

Cytotoxic testing of Lethal Concentration 50 (LC_{50}) by the Brine Shrimp Lethality Test (BSLT)

BSLT is a test of toxicity on the larvae of *Artemia salina* L. It was carried out on a sample extract of chitin hydrolysate oligomers with a concentration of 0, 100, 125, 150, 200, and 250 (µg / ml). Data were then processed by a probit analysis to obtain LC50.

Testing of hydrolyzed chitin oligomer samples on lymphocytes

The test on lymphocytes is to see the ability of oligomer samples in enhancing the immune system. Suspension of lymphocyte cells (2 x 10^6 cells / ml) in complete medium (RPMI plus fetal bovine serum

10%, 100U/ml penicillin and 100 µg/ml streptomycin) was incubated for 72 hours with or without treatment of oligomer samples of chitin hydrolysate N-acetyl glucosamine, 1% FBS for 6 hours and 1% EM for 12 Hours (Zakaria, 1997). Sample concentration is the concentration of some dilution levels adjusted to the results of LC50 measurement. Cell viability was calculated with the help of trypan blue dye. Lymphocyte cell proliferation activity test was based on the method of 3- (4.5-dimethyl-2-thiazoly) -2.5-diphenyl-2H-tetrazolium bromide (MTT).

Testing of hydrolyzed chitin oligomer samples against cancer cells of HeLa, Raji and MT2

Testing on cancer cells was to see the inhibitory activity of oligomer against cancer cells. Cancer cells (1-2 x 106 cells/ml) in complete medium (DMEM plus 10% fetal bovine serum, 100U/ml penicillin and 100 µg/ml streptomycin) were cultured for 24 hours. After the cell density reached about 50%, the culture was further incubated for 48 hours with or without the treatment of oligomer samples. Sample concentration is the concentration of some dilution levels adjusted to the results of LC50 measurement. Testing of the inhibitory activity against cancer cells was based on ELISA reader at λ 595 nm by using the method 3- (4.5-dimethyl-2-thiazoly)-2.5-diphenyl-2H-tetrazolium bromide (MTT). (Kawaii, 1999).

Results and Discussion

Enzymatic Production of Oligomer Compounds

The testing of hydrolysis ability of some chitinase enzyme on 1% colloidal chitin resulted in some potential enzymes for use in producing the oligomer compounds. The activities of several enzymes are presented in Table 1. Based on these activities, some enzyme concentrations (0.005, 0.0085, and 0.10 units per milligram of chitin) were used to produce the oligomer compounds. The selected enzyme concentrations were based on estimates of the enzyme ability to produce reactions of oligomer compounds in a certain amount of units previously reported by Jeon and Kim (2000).

The results in Table 1 show that pure enzyme appears to have a good percentage of rendemen and specific activities – a low rendemen but with higher specific activities compared with other enzymes including AS because the magnitude of the specific activity is an indication of enzyme purity.

To monitor the reactions of some prepared enzymes with various parameters of enzyme concentration values, substrate concentration and incubation time of enzyme and substrates, as an initial stage a measurement of the N acetyl glucosamine concentration that could predict the formation rate of oligomer compounds in various reactions was carried out. The various production patterns of N acetyl glucosamine are presented in the graph below.

Table 1. Activities of Some Enzymes.

Types of enzymes	Activities (U/mL)	Protein (mg/ml)	Specific activities (U/mg)	Rendemen
Cell-free filtrate (FBS)	0,056	0,203	0,279	1,011
Hot cell-free filtrate 60°C, 20 minutes (FBSp)	0,050	0,175	0,286	0,893
Enzymes with lyophilized ammonium sulfate (AS)	0,068	0,108	0,629	1,213
Purified enzymes (EM) (UV method)	0,096	0,043	2,215	1,713
Purified enzymes (EM) (Bradford method)	0,096	0,022	4,363	1,714

Figure 1 shows differences in the production of N acetyl glucosamine from various enzyme preparations with the same enzyme concentration (0.0085 units per milligram chitin) and the same substrate concentration (1%). More monomer chitin of N acetyl glucosamine will be produced on the enzyme preparations of greater units per milligram of chitin (enzyme concentration) than those of smaller units per milligram of chitin in the same incubation time. The production of chitin oligomers is through an optimized production of specific size/type of chitin oligomers based on the kinetics study of enzyme-substrate reaction. This study includes that of enzyme concentration of 0.0085 U / mg of chitin and substrate concentration of 1% for the optimal production of chitin oligomers.

From the graph above of N acetyl glucosamine production, it can be seen that higher substrate concentrations (within certain limits) will produce higher amount of N acetyl glucosamine with faster incubation times than a smaller concentration of substrate.

For the production of oligomers derived from the purified enzyme, the enzyme was purified by using cell-free filtrate that had previously been treated with saturated ammonium sulfate of 30%, and column chromatography of HIC (Hydrophobic Interaction Chromatography) using a matrix butyl separose as the stationary phase and ammonium sulfate buffer as the mobile phase.

By detection of enzyme purity, the fraction of the highest activity was taken and measured as the basis to be used in the reaction production of oligomer compounds with the targeted enzyme concentration of 0.0085 units per milligram chitin.

Hydrolysate Fractionation of Oligomer Compounds

Oligomer compounds resulting from various reactions of enzymes and substrates were monitored by analyzing the composition and concentration of the compounds in the hydrolysate oligomers from mono to hexamer by using the chromatographic techniques HPLC. Calculation of the concentration of oligomer compounds on each hydrolysate after being analyzed with HPLC is presented in Figure 2.

Resulted composition analysis of the oligomer compounds from some hydrolysates in Figure 2 shows that only the purified enzyme hydrolysate (12 hours) has a composition of monomer to pentamer, while FBS (6 hours) has the composition of only the monomer to tetramer but with the highest level of tetramer, thus it is concluded that the hydrolysate of enzymatic reaction used should contain a tetramer (FBS of 6 hours) and pentamer (EM of 12 hours) which would be further confirmed by a further test of bioactivity. The different composition and concentrations of oligomer compounds can answer the different responses of various hydrolysates bioassay on the proliferation testing of lymphocyte cell culture and cancer cells.

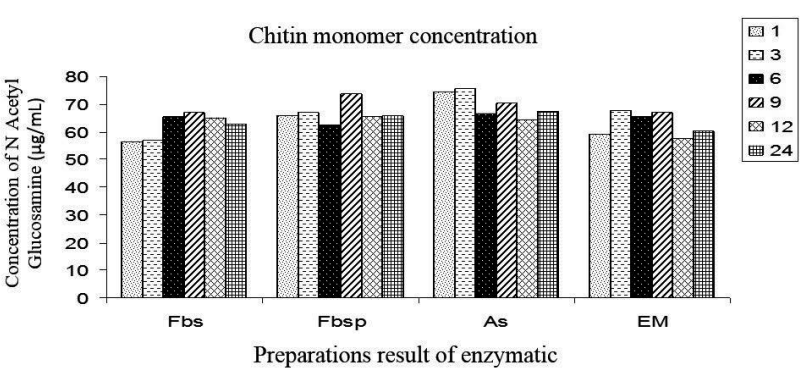

Fig. 1. Concentration of N Acetyl Glucosamine in Various Enzymatic Hydrolisate.

Fbs: cell-free filtrate,
Fbsp: hot cell-free filtrate,
AS: enzyme resulting from a concentrated ammonium sulfate,
EM: purified enzyme
1,3,6,9,12,24 : incubation time (in hours) of enzymes and substrates in oligomer production

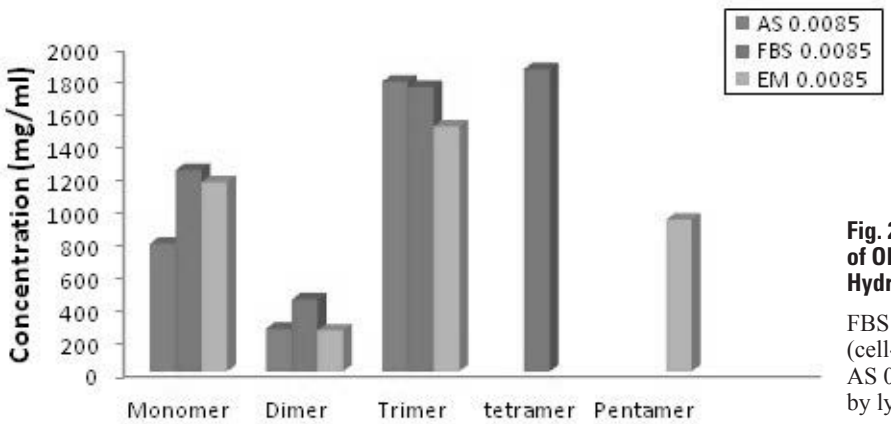

Fig. 2. Composition and Concentrations of Oligomer Compounds in Various Hydrolizates.

FBS 0.0085 6j = Result of enzyme reaction (cell-free filtrate) at a concentration of 0.0085
AS 0.0085 12j = Result of enzyme reaction by lyophilization of ammonium sulfate at a concentration of 0.0085
EM 0.0085 12j = Result of purified enzyme reaction at a concentration of 0.0085

Table 2. Resulted Data of BSLT for Hydrolysate Extract of Chitin Oligomers.

Types of extracts	Concentration (µg/ml)	Log concentration	Mortality (%)	Probit (y)	LC50 (µg/ml)
N-acetyl glucosamine	100	2	25	4.33	153
	125	2.09	38.9	4.72	
	150	2.18	52.6	5.05	
	200	2.3	63.2	5.33	
	250	2.4	76.5	5.71	
FBS 1% 6J	100	2	5.4	3.36	199
	125	2.09	12.9	3.87	
	150	2.18	26.9	4.39	
	200	2.3	47.8	4.95	
	250	2.4	71.4	5.55	
EM 1% 12J	100	2	41.2	4.77	107
	125	2.09	70	5.52	
	150	2.18	88	6.18	
	200	2.3	96.9	6.88	
	250	2.4	100	8.09	

Toxicity Test with BSLT Methods

BSLT test is used as an initial test to determine the activity of a substance or compound contained in an extract or a purified isolates.

The data shown in Table 2 is the mortality data by a probit analysis to get the value of LC_{50} (lethal concentration of 50%). The data showed LC_{50} extracts of chitin oligomers produced from each of calculated amounts: 153 µg/ml, 199 µg/ml and 107 µg/ml. This value indicates that the chitin oligomer extract is included in the toxic category because of LC50 <1000 µg/ml, which has potential bioactivity (Meyer et al, 1982).

Activity of Oligomer Compounds against Lymphocyte Cell Proliferation of Spleen

Enzymatic hydrolysates containing a mixture of enzymes and oligomer compounds used to test the proliferation of lymphocyte cells and cancer cells are FBS and EM with a concentration of 0.0085 units /mg of chitin. In the preliminary study on the enzyme produced, hydrolysates were at an early stage screened at several levels of dilution to see the proliferative activity of lymphocyte cells. The resulted screening showed that hydrolysate with a chitin concentration of 125 µg/ml solution turned out to have shown a quite good proliferative activity

of lymphocyte cells compared to the use of hydrolysate with lower concentration (Wahyuni, 2010). This is consistent with the study by Agustine (2005), with a positive effect on lymphocyte proliferation in vitro at the chitin oligomer concentration of 125 µg/ml. The concentration was then adjusted to the results of LC_{50} measured at a concentration of 125 µg/ml.

One of the parameters to see the immunomodulatory activity of a component is the ability to stimulate the proliferation of lymphocyte cells. The lymphocyte cell proliferation is the process of maturation and multiplication of cells through cell division or mitosis. The proliferating activity of lymphocytes cells T and B can be measured with the stimulation index (SI). Mitogen was used to trigger a non-specific proliferation of lymphocyte cells, in which mitogen lipopolysaccharide (LPS) and Concavalin A (Con A) are used as controls for the stimulation of B cells and T cells.

The resulted observation indicates that the oligomer samples of hydrolyzed chitin have immunomodulatory properties that could stimulate lymphocyte cells. The increased stimulation index of chitin oligomer sample was 3-22%. The oligomer samples of FBS 1% in 6 (six) hours lyophilized at the sample concentration of 125 µg/ml had the highest lymphocyte proliferation of 121.51% or a stimulation index score (SI) of 1.22 (increase of 22%), almost equivalent to mitogen LPS with the SI of 1.28 (28% increase). This result implies that there was an increase in the number of cells up to 1.22 times from the initial cell count of 1 x 10^6 cells/ml. The increased ability of lymphocytes to proliferate or establish clones showed that lymphocyte cells have the ability of immunologic respond or levels of immunity.

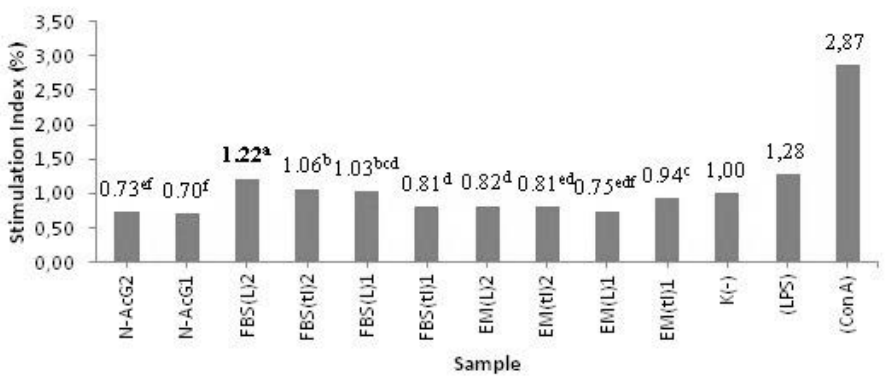

Fig. 3. Stimulation Index of Mice Lymphocyte Proliferation *In Vitro*.

N-AcG2: N acetyl glucosamine at a concentration of 125 µg/ml
N-AcG1: N acetyl glucosamine at a concentration of 62.5 µg/ml
FBS *(l)* 2: FBS 1% lyophilization at a concentration of 125 µg/ml
FBS *(tl)* 2: 1% FBS without lyophilization at a concentration of 125 µg/ml
FBS *(l)* 1: FBS 1% lyophilization at a concentration of 62.5 µg/ml
FBS *(tl)* 1: FBS 1% without lyophilization at a concentration of 62.5 µg/ml
EM *(l)* 2: EM 1% lyophilization at a concentration of 125 µg/ml
EM *(tl)* 2: EM 1% without lyophilization at a concentration of 125 µg/ml
EM *(l)* 1: EM 1% lyophilization at a concentration of 62.5 µg/ml
EM *(tl)* 1: EM 1% without lyophilization at a concentration of 62.5 µg/ml
K (-): negative control
LPS: Positive control with mitogen LPS
Con A: Positive control with mitogen Concanavalin A
Numbers followed by the same letters show no significant difference at the level of 5%

Activity of Oligomer Compounds in Proliferation Inhibition of Several Cancer Cell Lines

The data in Table 3 shows the anti-proliferation of some cancer cells in the oligomer samples of chitin hydrolysates. The inhibitory activity in the oligomer samples of chitin hydrolysate in cancer cells shows significant differences: inhibiting the proliferation of HeLa cancer cell (5-33%), Raji cancer cells (17-43%), and MT2 cancer cells (17-48%). The largest inhibitory activity by oligomer samples of chitin hydrolysate was on MT2 cancer cells, which were derived from the human cell culture T isolated from the stem cells of blood lymphocytes and sub-cultured from the cells of adult patients suffering from T-cell leukemia. The inhibition of cancer cells MT2 (48%) was found in the samples of N-acetyl glucosamine (62.5µg/ml). This correlates with the chitin structure with the monomer N-acetyl glucosamine. Chitin and its derivatives such as chitin oligomers have the ability to inhibit and form cationic (polyelectrolyte), which is predicted to be caused by the bio-functionality of amine group in its structure.

The test results indicated that the use of oligomer compound samples had inhibitory activity against the proliferation of cancer cells. Enzymatic hydrolysate containing monomer unit of chitin oligomers would better inhibit the proliferation of epithelial cells of HeLa type and the suspension cells of MT2 type than those of tetramer and pentamer units of chitin. Each type of cancer cells have different active sides, so the sample or compound that can inhibit or kill cancer cells also differs (Primadona et al, 2006). Cancer cells in a proliferative cycle of cells are sensitive to the effects of cytotoxic compounds.

Conclusions

1. Oligomer compounds can affect the proliferation activity of lymphocyte cells, with an SI increase of 3-22%.
2. The inhibitory activity by the oligomer compounds against cancer cell proliferation in the enzymatic hydrolysate is greater on the suspension type cells (Raji and MT2) rather than the type of one-layer cells (HeLa).

Table 3. Testing of Inhibited Proliferation in Several Cancer Cell Lines.

Samples	Concentration (µg/ml)	Proliferation Inhibition Index (%)		
		HeLa	Raji	MT2
N-Acetyl Glucosamine	125	-11,4bc	32.1a	35.4abcd
N-Acetyl Glucosamine	62,5	**33,2d**	22.9a	**47.9d**
FBS 1% of 6 hours *(l)*	125	16,1cd	**42.7ab**	27.5abc
FBS 1% of 6 hours *(wl)*	125	5,5bcd	35.8a	32.5abcd
FBS 1% of 6 hours *(l)*	62,5	6,7bcd	35.5b	22.5bcd
FBS 1% of 6 hours *(wl)*	62,5	-3,1bc	17.0a	43.3cd
EM 1% of 12 hours *(l)*	125	-2,9bc	29.6a	45.4cd
EM 1% of 12 hours *(wl)*	125	-41,3a	20.2a	23.8ab
EM 1% of 12 hours *(l)*	62,5	-18,5ab	24.8a	43.3cd
EM 1% of 12 hours *(wl)*	62,5	9,4bcd	19.3a	17.9a
Positive controls	5	78	94.5	89.6

Notes: *(wl)*: without lyophilization or without a concentration process
(l): with lyophilization or concentration process
Numbers followed by the same letters show no significant difference at the level of 5%

Suggestions

1. It is necessary to do a study on the mechanisms of lymphocyte cell proliferation and anti-cancer at the cellular and molecular levels such as receptors on cells associated with oligomer compounds.
2. A further study is required to identify and clarify the mechanisms of cancer cell apoptosis and cell membrane damage as a result of oligomer compound treatment.
3. A further study in vivo is also needed in terms of anti-cancer activity in experimental animals.

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Smart Highway: Near Future System in Jakarta

今や東南アジア有数の大都市となったジャカルタ。その深刻な交通渋滞を解消するための「スマート・ハイウェイ」実現に向けた課題を検証する。

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Abstract The growing number of vehicles on the road and the resulting traffic jams are deemed to increase severe accidents. This is due to the fact that the current transportation infrastructure and current mass technology applied to vehicles are unable to cope with the influx of vehicles on the road. Traffic management poses many critical challenges in most modern cities. To alleviate the aforementioned problems, the smart highway car control system concept was submitted. With the implementation of the smart highway control concept, traffic jam and vehicular accident can be avoided and the car users are more comfortable with a hassle-free autopilot system on their vehicles. This system provides both practically important traffic data collection and control information and can trace criminal or illegal vehicles such as stolen cars or vehicles that evade toll tax. The basic system architecture will be consisted of ACC sensor, RFID reader, and GPS navigation. Based on the latest technology, the system collects and calculates average speed and traffic information on every highway in the world. Then, it shares and synchronizes live traffic data by upstreaming transmission of messages about the current traffic situation and adjusts the speed of a specific car via communication program to the cars around it. Through a flooding algorithm, each server in a distinct center exchanges and updates information with all neighboring servers in other distinct centers so that the servers in various distinct centers can get all the latest traffic data in a highway. In this paper, we analyze and compare the latest developments of several different intelligent transportation systems' fundamental components. We elaborate some proposed suggestions to those components and analyze the potency and challenges of its implementation in Jakarta transportation.

Keywords smart highway system, intelligent transportation system, traffic jam

Introduction

In 2013, there were 104,118,969 registered vehicles in Indonesia, compared to the year 1999 when there were only 18,224,149 vehicles, a roughly 571% increase in a span of 16 years [1]. Referring to the aforesaid statistics provided by Statistics Indonesia (BPS) [1], the current transportation infrastructure and car technology are deemed insufficient in sustaining the influx of vehicles that can make problems such as traffic congestion and vehicular accidents. About 100,106 cases of highway accidents were reported by BPS on 2013 [2]. Various measures have been taken in the attempt to overcome the traffic problems. On the other side, transport accounts for 26% of global CO_2 emissions and car use is one of the principal contributors to greenhouse gas emissions. Traffic congestion is one of many causes of increased emissions [3]. Although

the problem can be addressed via many methods, this paper focuses on the smart highway car management system.

Jakarta City, as other metropolitan cities in the world, faces problems such as traffic jam, complicated urban development issues, crime, etc. [4]–[6]. This study will explain and elaborate the concept of intelligent transportation management technology and analyze its feasibility to be implemented in Jakarta City.

Related Works

Some of recent relevant studies on intelligent transportation have been proposed in related literatures. Table 1 shows some of those relevant researches.

Our review of those relevant studies reveals one important gap in them; there is no comprehensive study that can explain the future transportation system.

Theoretical Background

Smart highway system is a system specifically made for cars that are on a highway system. This system helps make them more sustainable transportation and helps alleviate the traffic congestion especially on highways.

The smart highway system can be implemented on cars, especially in Indonesia where Jakarta is one of the most jammed cities in the world [6]. With its deployment in the field of car technology, it is hoped that it would solve the aforementioned problems faced by the government within the highway.

A. Transportation system in Jakarta

Metropolitan cities like Jakarta have population more than 20 million and keep rising on. Jakarta is also known as one of the most crowded cities in the world [11]. District developments in Jakarta are quite rapid, especially in areas around its central business district, *Golden Triangle,* such as Jalan Sudirman-Thamrin and Sudirman main lane. Mature areas such as Cikini, Menteng, Kuningan, and Kebayoran Baru grow flourishingly into developed resident area. Most of the time, district development is also correlated with the development of transportation's infrastructure. For example, the development of outer ring roads around Jakarta and new highways that connect suburban areas, Bekasi, Bogor and Tangerang. Unanimously with resident and main street developments, business districts such as shopping center, hotel, and office complexes also grow rapidly [11].

Those rapid developments also have negative effect on transportation, such as traffic congestion,

Table 1. Related relevant works

Authors	Literature	Result
Martinez et al., (2010)	Emergency services in future intelligent transportation systems based on vehicular communication networks	By combining V2V and V2I communication, new intelligent transportation system will improve the response time and efficient resource usage of roadside emergency services [7]
Taniguchi & Shimamoto (2004)	Intelligent transportation system based dynamic vehicle routing and scheduling with variable travel times	Dynamic vehicle routing and scheduling model (VRPTW-D) shows that it can alleviate congestion problems as well as reduce total costs [8].
Zhang et al., (2011)	Data-driven intelligent transportation systems: A survey	Data driven intelligent transport systems is a very promising field that can provide more functions and services to further improve our transportation system [9].
Zhao, (2000)	Mobile phone location determination and its impact in intelligent transportation systems	TOA, TDOA, and assisted- GPS solutions are the leading contenders for current communications used in intelligent transportation systems [10].

especially in Golden Triangle area. These problems lead on other problems like air pollution and noise pollution. Several main road projects are expected to solve these problems [11].

Urban structure in Jakarta has two faces; one is located near the main roads and the other is located behind the urban space. Those transportations are bus, train, *angkot/angkutan kota*, *bajaj,* bike taxi, and bicycle *ojek* [12].

Road development to provide enough space for private vehicle mobility has triggered high rate of vehicle ownership drastically, making roads on Jakarta often heavily congested and make inefficiency of the fuel consumption, of course the air pollution is high and road safety is compromised. To deal with transportation problems above, the government has made some new initiative like Bus Rapid Trans System Project, also known as Trans Jakarta, and Jakarta Monorail Project or also known as Mono Rail Train (MRT), but this Monorail project is still undeveloped. Trans Jakarta has been formed since 2004, it serves the 1st corridor route running from Jakarta Kota to Blok M. The 2nd and 3rd routes have been operated since 2006 and serving route from Pulogadung to Kalideres. The monorail train was planned and being built in two lines, the green line will serve from Semanggi-Casablanca-Kuningan-Semanggi, and the blue line serve from Kampung Melayu-Casablanca-Tanah Abang-Roxy. But this project is dogged by financial problem [12]. Another kind of train in Jakarta is Light Rail Train (LRT), this project is the same as the MRT one, undeveloped. LRT has been planned based on Jakarta 2005 Transportation Plan, and total investment on this project is estimated at 1.3 billion dollars. The first LRT will be built to connect the new town of Bumi Serpong Damai, Bintaro Jaya, and other large scale of residential area of southwestern area of Jakarta. The LRT will be built on the second level of triple decker structure, since it has toll road at first level and arterial road underneath [13].

B. Advantages of smart highway system implementation in Jakarta

The smart highway system is considered beneficial for car drivers and highway police as well as in ecological conservation. For the drivers, the all-in- one integrated system could help them feel more comfortable with autopilot system that can simply drive them reach their destinations. And information gathered via the implementation of the smart highway system can be obtained to predict the traffic pattern and the time needed to reach a destination. These are very useful for drivers too. In terms of ecological conservation, the level of pollution can be reduced by decreasing vehicle emission. The smart highway system uses Adaptive Cruise Control (ACC) that automatically accelerates or decelerates a vehicle to a desired velocity and prevents collision between vehicles [14]. This can be showed by the fact that vehicle travel and time-on-road are reduced. As fuel consumption is directly related to vehicle kilometers travelled, it will reduce as well. With the information provided,drivers are able to avoid.

Government is also able to take benefit from smart highway system implementation as it can help reduce traffic congestion on the highway and exploit drivers' data, e.g., Global Positioning System (GPS), fuel consumption, travel distance, etc., as the cars always connected to a global control network that unify the smart highway system via Wireless Local Area Network (WLAN).

C. Categories of smart highway system

The smart highway system can be divided into three categories: smart toll payment, smart drive, and smart geo. Further discussion on the implementation of each category with examples of its implementation will also be provided.

Smart drive

The smart drive is implemented on car in the effort to overcome the traffic congestion problems by equipping interconnected auto pilot system. Auto pilot system is a system that drive car automatically in

self- drive mode. This system will be synchronized with every car in that highway system to decide route and cruising speed, assisted by ACC sensor [14]. When a car passes through highway ingress, smart drive will send information to the control system and the egress, so the synchronization will be established. When the car is nearing to the egress, the system will inform the driver to switch to manual drive mode. If the system is unresponsive, it will stop the car in the roadside near the egress. By using this method we can minimize traffic jam in highway that was caused by congestion shock wave [8]. Information exchange is also important in implementing smart highway system. In those days, data fusion has been applied in diverse fields in civilian and military applications. Several methodologies have been proposed in the literature to function multi-sensor fusion and aggregation under heterogenous data configurations. With the modern deployment of smart transportation system and needs of real-time and accurate data, several technologies have been developed such as Floating Car Data, that this data will be uploaded to Traffic Management Center (TMC). One of the advantages we could find is this smart geo feature. This technology can help the user to find out the traffic conditions that prevail on urban road using new measurement device such as cameras, GPS and cell phone tracking [15].

By using this kind of wireless sensor that deployed in the roads, we could drastically improve the collection of traffic information and enhance traffic control. With the increasing number of vehicles on the roads, it becomes important to monitor and manage the roads for abnormal behavior that can cause delay or congestion. This sensor is also power efficient, as an example, by integrating low-power RF chips, high speed/low power design and ultra-low power wireless sensor networking protocols in vehicle can be installed in less than 20 minutes and have 10-year battery life [16].

Not only helping driver to avoid congestion, this wireless network can also be used to control traffic light effectively. Research conducted by Tubaishat *et al.* (2009) shows that real-time adaptive sensor used on traffic lights that use simple algorithm and sensor can increase 30-50% improvement on average trip waiting time [17].

Smart toll payment

The smart toll payment system is implemented to overcome the limitation of the conventional toll payment method electronically. This is because the conventional method causes delay and inconvenience for the highway driver as they have to deal with cash. The smart highway system will use Radio Frequency Identification (RFID). This tool will be placed on car door, so when the car passed in front of the gate, it will automatically detect and pays the toll tax. The main concern hindering the implementation is the privacy and security issues. This is due to fact that confidential data of the drivers are being dealt with threats such as spoofing, replay attack, and sniffing [18]. There is also another alternative using the Dedicated Short Range Communication (DSRC) founded by Bera *et al.* (2006). He said in his paper that this new technology can be applied as a media for road to car communication. This technology can make a communication up to 200 meter geographically between a mobile user and a fixed base station. DSRC using wireless frequency near 5.8GHz. The problems of this method is there will be an interference between DSRC devices. But this interference only happened at some frequencies. Based on experiments conducted by Bera *et al.*, the optimum frequency to operate DSRC is between 5.76-5.84GHz [19].

Smart geo

The smart geo system is implemented to overcome the limitation of the driver navigation. It connects to GPS system around the world via satellites. This system can find driver's destination easily and can track the car when it's stolen. This system also can help the government as alternative to improve navigation and maps development that uses the driver or citizen as a volunteered geography. Sites such as Wikima-

pia and OpenStreetMap are empowering citizen to create a global patchwork of geographic information [16]. Feng & Law (2002) says in their paper that positioning plays an essential role in smart transportation system [20]. The global positioning system (GPS) is reliable to be used in difficult environments such as urban canyons, inside building, etc. But GPS alone can't provide enough positioning accuracy. Usually GPS is assisted alongside other technologies like mobile phone. The assisted GPS (A-GPS) has a lot of advantages in smart transportation system. It uses various devices to make a typical positioning system for vehicle. There is a distance sensor, either an odometer that provides distance directly, or an accelerometer that provides distance indirectly [20].

The reason why the typical positioning system uses many sensors is that no single sensor can provide adequate information for navigation. So the best solution is to combine them all. The comparison of those methods are shown in Table 2.

D. Smartness transportation index of Jakarta

The followings are modified indicators of the smartness transportation level in Jakarta. There are total 60 indicators and the data source was taken from our previous study. The smartness index is assessed by the following formula. If the smartness capabilities are existed, then give a value of 1, and if there are no or not yet developed or there is no proof, then give a value of 0 [21].

Table 2. Comparison of the three methods

Method	Advantages	Disadvantages
Smart drive	With the help of Traffic Management Center, could drastically improve the collection of traffic information and enhance traffic control.	Need big resources that are not cheap Data fusion and TMC still need to be tested
Smart geo	Can help to find driver's destination easily and can track the car when it's stolen.	Single sensor is not accurate enough to determine the position.
Smart toll payment	Makes the toll payment easier	There may be still an interference happened when using the DSRC technology.

There are 6 major category of the scoring, (1) sense; (2) process and control; (3) communicate; (4) predict; (5) heal; and (6) prevent; and 3 subcategories for each: private, public, and commercial and emergency.

For the sense category, in private section, Jakarta has 1 point on en-route detection, detect at parking facilities, detect at intersections and detect for enforcement. In public section, it has 1 point en-route detection, detect at terminal/depot, detect at stations/stops, passenger detection and detect for enforcement. In commercial and emergency section it has 1 point on en-route detection, detect at terminal/depot, detect at checkpoints, container/cargo detection and detect for enforcement.

Look into the process and control category. In private section, it has 1 point on each, control signal, automated parking systems, in-vehicle safety management, infrastructure safety and security, toll/parking charge payment. In public section, it has 1 point on each, signal priority driver-less transit vehicle, infrastructure safety and security, inter-modal and e-fare payment, but in-vehicle safety management gets 0 point. In commercial and emergency it also has 1 point on each of signal priority, dynamic route guidance, in- vehicle safety management, infrastructure safety and security, payments at port interface.

In the communicate category, in private section, it also has 1 point on vehicle-driver, driver- infrastructure, and vehicle-vehicle, but infrastructure- vehicle gets 0 point. In public section, it has 1 point on, operator-user, user-authority, and operator-operator, but authority-vehicle gets 0 point. In commercial and emergency section, it has 1 point on authority-operator, operator-driver, but driver-authority, vehicle-vehicle gets 0 point.

The predict category almost the same, private section with traffic flow prediction, but responsive supply and early disaster warning has no point. Pub-

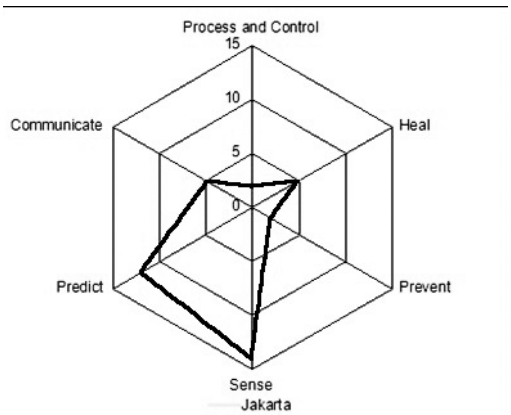

Fig 1. Performance Analysis of Jakarta Transportation [21]

lic section with demand prediction has 1 point, but responsive supply and early service failure warning has no point. Commercial and emergency section with demand prediction, responsive supply and early disaster warning, all that three items get 0 point.

In the heal category, the private section consisted of tunnel recovery and incident recovery, and both have 1 point each. In the public section, track/service recovery and incident recovery has the same point. In commercial and emergency section, incident recovery has 1 point, but asset item get 0 point.

Lastly, the prevent category. In the private section, integrated land use planning gets 1 point. Public section consisted of special event planning and public transport planning get 1 point too. In commercial and emergency section, commercial transport planning and special event planning gets 0 point.

The final calculation of smartness index (IS) for Jakarta is 63.49% [19]. One point that Jakarta needed to improve its smartness is special event planning on public prevention.

Methodology

In this research, we conducted the following procedure, as shown in Figure 2: literature review, resume analysis, synthesis, proposed idea, and conclusion. In literature review, several researches related to

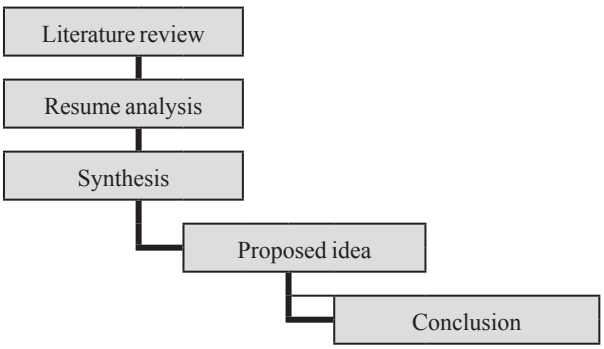

Fig.2 Procedure of Work

transportation system and vehicle management were collected and reviewed. The result of the review was used to make resume analysis and to formulate synthesis. After synthesizing suggestions, proposed idea was produced. The final step was to generate conclusion of this research.

A. Literature review

Over the next few years, drivers will become more informed with the advent and deployment of the intelligent transportation system. This technology can help the driver to save the trip cost by showing the most efficient path to reach a destination and help to prevent being congested in roads. Kennedy *et al.* (2005) said that process of becoming sustainable transportation needs four essential components: (1) establishment of effective bodies for land use planning; (2) the creation of fair, efficient and stable funding mechanisms; (3) strategic investments in major infrastructure; and (4) the support of investments through local design. The development of the sustainable transportation is a challenge to human technology development [22]. Besides that, the organizational capacity also has important site to form urban governance for successful regional land use and transportation planning.

According to a research conducted by Levinson (2003), uninformed driver capacity is reduced by 33-50% for the percentage of time saved peaks for incidents on the road [23]. This research shows that by using smart transportation, we can save our time

on the road by following the shortest path informed by smart highway system to reach our destination [23].

B. Resume

Based on our literature review, we formulate 6 categories of Intelligent Transport System (Fig.3). The analysis of each category is described in Table 3.

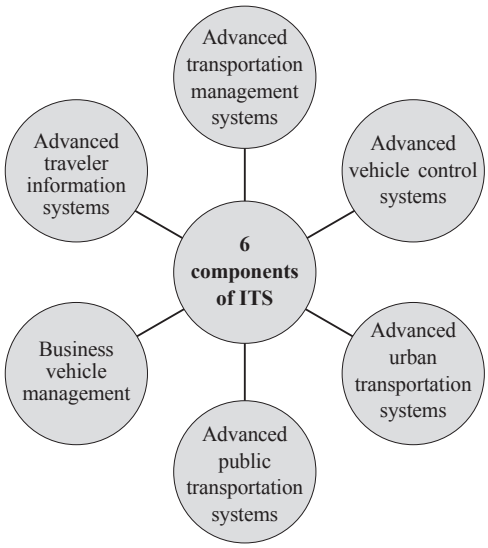

Fig.3 Mindmap of the six fundamental components of Intelligent Transportation Systems [9]

Table 3. Comparison of Recent Development State of Six Fundamental Components

No	Category	Paper	Advantages	Disadvantages
1	Advanced transportation management systems	Towards the intelligent transportation systems (Figueiredo, 2001)	With this still-in-development technology, we can decrease congestions on roads and highways and improve road system productivity [24]	Requiring complex task that uses high economical resources and a large variety of technologies [24]
2	Advanced vehicle control systems	Review of the State of Development of Advanced Vehicle Control Systems (AVCS) (Shladover, 1995)	Advanced vehicle control system (AVCS) in terms of overall system capacity (vehicles per hour), fault tolerance, and total system cost outweigh that concern. [25]	There are still limits to the performance that can be achieved at each level of feedback information, and higher levels of performance generally require more information [25]
3	Advanced urban transportation systems	Urban public transportation systems (Vuchic, 2007)	In small cities the role of transit is predominantly social, in medium-sized cities, transit becomes an important factor in providing an efficient alternative to driving. In mega cities, represents the most efficient transportation system for large volumes of passenger travel [26]	Trolleybuses system require higher investment in lines as well as in vehicles. Lines cannot be rerouted if this is needed for temporary changes [26].
4	Advanced public transportation systems	Review of the Applications of Agent Technology in Traffic and Transportation Systems (Chen, 2010)	The integration of new technologies, such as mobile agent technology, should enhance the flexibility of systems and the ability to deal with uncertainty in dynamic environments [27]	The design implementation, and application of agent based approaches in the area of traffic and transportation are still immature and need to be further studied [27]
5	Business vehicle management	Smart card data use in public transit: A literature review (Pelletier et al., 2010)	Smart card systems can be useful for providing data to both planners and researchers so that we can enhance the strategic, tactical, and operational performance of transit authorities [28].	The research and development cost is high. The cost of implementation is high. Social acceptance is slow [28]
6	Advanced traveler information systems	Travel information as an instrument to change drivers' travel choices: a literature review (Chorus et al., 2006)	Modal shifts towards transit and adaptations of departure time and route choices would reduce passenger transport externalities such as congestion, fossil fuel exhaustion, noise, etc. [29]	The variation in behavioral response to information, a substantial part of this variation will always remain unexplained: traveler behavior, and particular travelers' response to knowledge limitations and information provision [29]

C. Synthesis

Based on the resume analysis, we synthesize suggestions for each component of Intelligent Transportation System (Table 4.).

D. Proposed idea

This paper set out to provide literature review show that smart highway system should give benefits to users and society overall. The amount of time saved under recurring congestion in metropolitan cities. After analyzing the literature, the concrete idea to make this happen is developing and implementing the most needed components above, the advanced traveler system, because it is the main point that awareness of each individual can reach. Like the aforementioned sentences above, the uninformed road users have their capacity reduced by 33-50% without the help of that technology. The development of the smart transportation system involves a large number of areas, the first one we maximize, refine, and implement its technology and its usage, the smart geo. After that, the second direction is mass production and implementation of smart highway system, the all-in integrated smart driving system. And the third possibility consists of development and refinement of model of roads, vehicles, and humans, so the last thing, we can plan out the future of smart highway transportation system. In the future, there will be no more congestion, no more inefficient fuel consumption, and no more wasted time on roads to reach a destination. All of these technologies will make sustainability in the bright future.

E. Consideration

Among the six suggestions, we consider the advanced traveler information systems is the fundamental of the intelligent transportation system, because the individual driver have unique variation in behavioral response to the information, and because of the limitation of the knowledge among the drivers.

Table 4. Proposed Suggestions for Six Fundamental Components

No	Category	Paper	Suggestion
1	Advanced transportation management systems	Towards the intelligent transportation systems (Figueiredo, 2001)	Continuous development of road-vehicle system (navigation system, board computers, real time traffic transmission) and public fully automated individual cars for public use [7]
2	Advanced vehicle control systems	Review of the State of Development of Advanced Vehicle Control Systems (AVCS) (Shladover, 1995)	The highest layer of the fully automated control system is the network layer. Earlier communication technology considered obsolete because of the dramatic change in computer hardware and software and communication technologies that have occurred since then [25].
3	Advanced urban transportation systems	Urban public transportation systems (Vuchic, 2007)	Transit must be planned at the same time as streets and highways, and given the necessary priorities to achieve a desirable balanced use of transit, cars, bicycles, pedestrian and other modes of transportation [26].
4	Advanced public transportation systems	Review of the Applications of Agent Technology in Traffic and Transportation Systems (Chen, 2010)	Make an integrated cross sectors (transportation, land use, energy, etc) and scale (urban, regional and global policies). Must be advanced through integrated studies of environmental conditions within these cities [27].
5	Business vehicle management	Smart card data use in public transit: A literature review (Pelletier et al., 2010)	Developing smart card data for strategic, tactical, and operational purposes will help to improve the public transportation system and increase its role in sustainable transportation [28].
6	Advanced traveler information systems	Travel information as an instrument to change cardrivers' travel choices: a literature review (Chorus et al., 2006)	A useful and less costly alternative data-collection method is to construct a multimodal travel simulator-experiment. Considering the provision of travel information as a travel demand tool among car-drivers [29].

Result and Discussion

A. Potency of Smart Highway system in Jakarta

Congestion is a cause of increased emissions and there is a strategy to increase road capacity, but it is not the answer. Active traffic management system can significantly reduce congestion. The smart highway concept appears on the rationale to resolve traffic congestion problem in Jakarta. This literature research shows clearly the potential of using smart highway system to improve the performance of traffic and transportation system. In general, the design, implementation and application of smart highway system in the area of traffic and transportation are still immature and need to be further studied. The integration with other technologies, such as mobile agent technology, should be considered to enhance the flexibility and the ability to deal with uncertain conditions in environment. One day this system may become the future of transport system on sustainable development in general. In this case, a broader range of sustainability indicators may be considered. Changes in the transport sector may induce changes in various other sectors, which in turn may affect sustainable development. For example, it may induce macro- economic changes (e.g. lower production costs, and higher production values in trade and industry), resulting in changes in Gross Domestic Product (GDP) and employment levels.

B. Challenges of Smart Highway system in Jakarta

A number of challenges can be identified, such as demand, costs, effort and continuing research for smart highway system. The first challenge is the funding to do a research to make a prototype of this system, and the continuing research to make better system. Costs will not be cheap. But if the demand for the system is high, the production costs will automatically be reduced. So, a help from government to make an adoption of this system to every car in Jakarta is necessary.

This means there is an opportunity to cooperate with policy makers, and the implementation will become incremental at best. There needs to be a collective rediscovery of confidence in strategic and long term planning for traffic congestion in Jakarta and ecological conservation. A consistent progress should be made toward this system as one of many solutions for aforementioned problems, and of course an increase in funding levels. This can be best attained by the form of strategic planning system proposed by the government at Jakarta City and then this system can be implemented broadly at the national level.

To reach a sustainable transport system, drivers may have to drive less and enhance accessibility. However, from an individual point of view it may be more attractive to continue driving because of many advantages of individual car use. The car is especially attractive because of its convenience, independence, flexibility, comfort, speed, perceived safety, and privacy. The car also provides more status and pleasure than other modes of transportation.

Conclusion and Future Works

In this study, the various types of smart highway system have been presented. From the various examples of the implementation of such systems being presented, we can say that it is efficient in alleviating the traffic problems that arise especially in jammed cities like Jakarta. There may be some disadvantages in the implementation of such systems, but the advantages far outweigh its disadvantages. Without new technologies, such traffic congestion and emission reduction may be considered impossible to meet if not adopted. Unfortunately, although technologies could theoretically provide the traffic congestion solution, ~~but in~~ CO_2 reduction would be difficult, expensive and long term solutions. There are other combined measures which would provide a quicker and easier solution over a shorter time span.

- *Car use and ownership.* On the urban city like Jakarta, transport system has great inertia and take years to change. As a result, without a strict policy, there will be many more cars in Jakarta. Instead of promoting education to peo-

ple, the government should offer substantial tax incentives on smaller cars to limit the buy of new cars per year. Although seen as more long-term solution, land use planning could be the one solution in Jakarta.

- *Road freight.* There is a need to increase the public awareness of using mass transportation. This system has been applied in Jakarta as 3-in-1 road. This can encourage regional production in a timescales and can reduce empty running.

We have performed the analysis and comparison among the recent development of six fundamental components of intelligent transportation system. We also have elaborated some alternatives to those components and analyzed its feasibility to be implemented in Jakarta transportation system. From the discussion above, we found that the most feasible technology that can be applied to the smart highway system is the smart geo, because the A-GPS technology is provided globally via satellites and can be used in various difficult environments such as urban canyons, inside buildings, etc.

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Japanese Advanced Toilets as a Product of the Country's Contact with the West

1980 年代の日本に生まれた高機能トイレは、今や世界を席巻する勢いだ。しかしそれは、19 世紀以来の過剰な「西洋化」の産物かもしれない。

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Abstract

How to deal with human waste is a problem that every country needs to deal with, but it is Japan that is known for its high-tech toilets.

This essay tells the story of Japan becoming the leading country in the toilet industry and names Western influence as a major contributor. Analyzing historical sources, it highlights the transition of human waste from economic good to aesthetical hindrance, finally ending up as pollution.

Night soil was in popular use from the 12th century and soon became an economic good. But foreigners that started to visit the country in the 19th century condemned it and saw Japan as inferior. To become an equal with the Western powers, Japan established a health regime which altered people's sanitary habits. Then, with the end of WW2, Japan was urged to modernize its toilets on the model of the American occupiers. Devalued night soil was dumped into rivers and the sea, which resulted in deterioration of adjacent waters. Then, in 1980 TOTO introduced electric toilet seats called *washlets* which now set the standard in the toilet industry.

I argue that the *washlet* should be analyzed as a product of the country's history and cultural background, and suggest that the ubiquitous Western toilets are not necessarily the best answer to the present sanitary crisis.

Keywords toilets, night soil, sanitation, Japan, Westernization

Introduction

Urbanization gives rise to the question: how to deal with human waste? It is a problem that every country needs to deal with and it proves not to be an easy task. According to the World Health Organization and UNICEF one third of humanity still lacks access to proper sanitation (2015). U.N. study shows that more people in the world have cell phones than toilets. Improper sanitation is a serious threat to public health, environment and human rights.

Japan is one of the two thirds that have sanitation and its toilets are often given as an example of hygiene and modernity. Who has not heard of the Japanese advanced toilets with heated seat and water spray feature to clean one's bottom and genitals after defecation, among other futuristic features? They are definitely unique in the world and in recent years have been gaining more and more international attention. On "IS JAPAN COOL?" website run by All Nippon Airways, Japan's leading airline, hi-tech toilets are ranked the second "coolest" thing in Japan by foreign visitors, following Japanese hospitality (*omotenashi*). Even the Japanese government realized this commercial potential and has engaged itself in the promotion

of Japanese toilets abroad under the "Japan Toilet Challenge" (*Japan toire charenji*) project, which, among other goals, aims to improve toilets in tourist areas before the upcoming 2020 Tokyo Olympics.

Toilets have indeed become the Japanese flagship product and some even talk about "Japan's toilet obsession".[1] But the history of these modern toilets is surprisingly new—they came into widespread use in the 1960s, and at that time only 6% of population was connected to sewer lines,[2] while electric toilet seat called *washlet* was introduced in 1980. How did Japan manage to surpass Western powers that initiated transition of the country's toiletry practices and become the toilet superpower in such a short time? Continuing to refine things even when others would stop can be said to be a characteristic of Japan's craftsmanship approach, as even Hatoyama Ichirō, prewar Minister for Education and Culture, admitted in 1934 at the inauguration of the Association for the Propagation of Japanese Confucianism.

"Considering the achievements of our long national history, the fate of the world some centuries from now may well be to see our nation assimilate and refine even Western culture. I firmly believe this is our nation's great aspiration and indeed its manifest destiny."[3]

In this paper I will briefly tell the story of toilets and sanitation in Japan to portray the country's rocky road to the toilet superpower. I pay special attention to the contact with the West, which initiated the transition from night soil to *washlets*, making them the symbols of the country's postwar modernity. Moreover, I suggest to reevaluate the idea that the Western style toilets are markers of modernity and are necessary in every country, as sanitary improvement should first consider each country's history and cultural background.

First toilets

Japan's first toilets are thought to appear as early as in Yayoi period (300BC-250AD). Palaeoparasitological analysis found dung beetles in moats encircling large settlements, so we can surmise that people used to defecate into them.[4] In settlements with running streams available toilets were built over rivers so the excrement would be taken away with the water flow. These toilets were called *kawaya*, which literally means a river (*kawa*) house (*ya*)—we might say they were a kind of primitive flush toilet. The name *kawaya* was an equivalent for toilet and it was first mentioned in Kojiki (712), the oldest extant chronicle of Japan. In places without any convenient access to flowing water, cesspit toilets were used. They were very simple holes with two wooden boards put across. When they became full, they were simply buried and a new hole was dug.

During excavation works many holes are discovered and sometimes it is hard to decide what exactly the hole was in the past. An indicator of whether a hole was used as latrine or not is the presence of *chūgi,* sometimes called *kusobera*, inside. *Chūgi*, which literally means "shit stick", are wooden sticks used to scrap away the feces after defecation. They became an important factor in estimating the beginning of the Kamakura period (1185-1333) as the start of popular use of night soil.

In the Heian period (794-1185) agriculture developed significantly and with that the number of fields increased. Thus, in the following Kamakura period manure was inadequate to fertilize crops. From that period on *chūgi* cannot be found in the cesspit toilets anymore. It is assumed that they made collecting night soil difficult so people stopped throwing them into the holes and started to put them into baskets near

1 See *The Washington Post's* „How Japan's toilet obsession produced some of the world's best bathrooms" for an example.

2 Data from 1961, Japan Sewage Works Association 2002: 7.

3 Paramore 2015: 269.

4 Matsui et al. 2003:133.

toilets. Moreover, from the 12th century big cesspit toilets appear – until then they were relatively small.[5] It seems plausible to think of this change in size as the result of developing night soil collecting habits.

By the Edo period (1603-1868) agriculture progressed so much that farmers started visiting towns in order to collect night soil for their crops. At the beginning they would give people vegetables in return, but soon it was not enough to pay for the fertilizer. In the middle of the Edo period professionals started to collect night soil from townspeople and sell it to farmers and it was bought with silver.[6]

Night soil as an economic good

Soon night soil became a profitable business. In Osaka, by the end of the 17th century the price of fertilizer rose so much that farmers from neighboring areas were forming associations to obtain monopsony rights to purchase night soil from various areas. Eventually even fights broke out over collection rights and prices. By the mid-eighteenth century night soil was so expensive that the poorer farmers had difficulty in obtaining sufficient fertilizer and incidents of theft began to appear in the records. In Edo, present day Tokyo, night soil collection was not as popular. Edo administrators seemed more concerned with appearance of the capital city than the ones in Osaka and even ordered to remove small toilets near rivers. Still, by the first half of the 18th century, demand for night soil rose even in Edo. Farmers wrote petitions to allow them to put out buckets at least for urine collection on the streets, but government did not give its permission.[7]

We can see that night soil was a highly valued economic good. Edo landlords who sold excrement from shared toilets in tenement houses could earn an extra 30-40 ryō of annual income – almost twice as much as a normal carpenter earned a year![8] In Osaka, money for night soil from shared toilets became a standard part of the landlord's income and rent was based on the number of tenants – if someone moved out from the tenement house, the rent would rise, as the landlord would get less product to sell. Feces belonged to the house owner, while urine was the property of tenants.[9] Urine was much more difficult to transport and so less valued as a product. It is also interesting to note that night soil collected from wealthy households such as those of feudal lords (*daimyō*) had higher price. The reason was that diet in such households was more nutritious, thus night soil collected from them served as a better fertilizer.[10]

First contact with the West

Valuing human waste as fertilizer kept Japanese cities relatively clean, which surprised the first Europeans who started visiting the country from the middle of the 16th century. Many of them praised Japanese sanitary standards and their practical attitude toward human waste.

We pay someone to carry our excrement away; in Japan they buy it and give rice and money in exchange for it.[11]

Luis Frois, 1585

The interior of the privies is kept extremely clean and a perfume-pan and new paper cut for use are placed there. The privy is always clean without any bad smell.[12]

Joao Rodrigues, lived in
Japan from the late sixteenth
into the early seventeenth century

5 Ota kuritsu kyōdo hakubutsukan 1997: 192-3; 215.

6 Hanley 1987: 9.

7 Ibid.: 9-12.

8 Ota kuritsu kyōdo hakubutsukan 1997: 4.

9 Rotberg 2000: 149.

10 Mansfield 2009: 117.

11 Frois et al. 2014: 205.

12 Hanley 1987: 19.

In the entrance one finds a new pair of reed or straw slippers for those who have an aversion against stepping with their bare feet on the floor, which, however, is clean and covered with mats. People relieve themselves by crouching in Asian fashion over a narrow opening in the floor. The pot below is placed there from the outside and filled with light chaff, wherein the dirt disappears immediately.[13]

Engelbert Kaempfer, 1690-1692

In Europe at the time, night soil was not in popular use as fertilizer and human feces were nothing more than waste. Lack of a sewage system resulted in cities literally drowning in excrement. Stories of Londoners emptying their chamber pots out the windows or of the famous Palace of Versailles being a huge latrine have become well-known myths, and even though we should take them with a pinch of salt there is definitely some amount of truth in them.

It is a common misconception that the invention of water closet improved this dire condition of European cities. In reality it made them even more unsanitary. For example in London, every day tons of feces were dropped untreated into the Thames, the main source of the city's water supply. It means that Londoners were literally consuming their own waste, which certainly was not without consequence. There were several outbreaks of cholera in the 19th century, but it was only after the Great Stink of London in 1858, that works on a sewer network for London finally started. It was opened in 1865 (though the project was not completed until 10 years later). No matter how dreadful in reality was the sanitary condition soon after the invention of water closet, it succeeded in removing human excreta from people's private spaces and leaving them clean. The idea of all the dirt moving to the rivers did not bother them as much.[14]

In Japan on the other hand, a similar transition of human waste did not take place. Night soil was too valuable to simply dispose of it and as the cities remained clean and in a decent sanitary condition, there was not really any need to change the way things were. Even with the development of medical knowledge, when it became obvious that many diseases like cholera are transmitted mostly via fecal-oral route of contaminated food and water, usage of night soil was not questioned. In 1889 Nagayo Sensai, the first head of the Sanitary Department of the Japan Home Ministry, and W. K. Burton, consultant engineer for the Sanitary Department, proposed the construction of a sewer network in Tokyo.

Night soil is a necessary fertilizer for farmers and as such night soil from the city of Tokyo can be sent to nearby prefectures for a potentially high price. Therefore we see no need to follow the example of Western cities and discharge it into the sewer pipes.[15]

The proposal was postponed because of insufficient funding and work focused on the water supply system instead, but we can see that sanitation and improvement of hygienic standards was an important issue for the Meiji government, especially in the context of cholera epidemic. Nevertheless, the use of night soil was not in contradiction with the government scheme. Moreover, in 1900 the first Filth Cleaning Law (*Obutsu sōjihō*) was established, but it excluded human excrement from the list of waste that was to be cleaned. The handling of human waste remained landlords' responsibility, so they could continue to sell it as night soil.[16]

Opening of Japan

In the second part of the 19th century the difference of toiletry habits between Westerners and Japanese

13 Kaempfer et al. 1999: 266.

14 For detailed information on roots of condemn for toilets and feces in the Western culture see Martha Bayless' „Sin and Filth in Medieval Culture: The Devil in the Latrine".

15 Tokyo Metropolitan Government Bureau of Sewerage 1978: 82.

16 Hoshino 2008: 192.

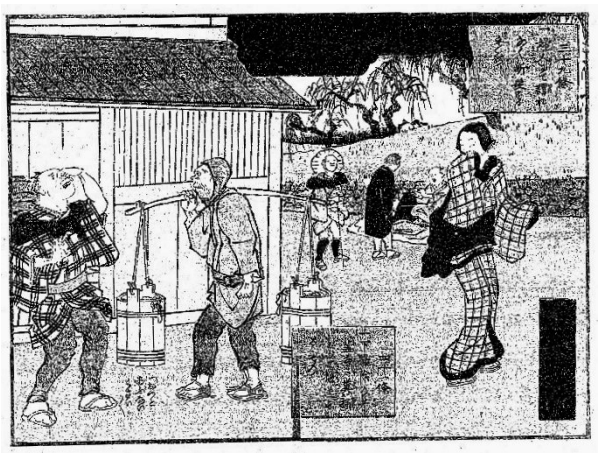

Fig. 1 ***Etoki gojō yomaki,*** **Digital Library from the Meiji Era: People holding their noses as a man walks by with "honey baskets" on a pole.**

resulted in negative comments from the foreign visitors. In 1853, with the arrival of the Black Ships of Commodore Matthew Perry, Japan was forced to open after more than 200 years of limited contact with the outside world. Foreigners started to visit Japan again, but most of them were not as enthusiastic about what they saw as their predecessors from the middle of the 16th century.

Isabella Bird, in a travel diary from her trip to Japan in 1878 complained that "*bad smells, and the torments of fleas and mosquitoes are, I fear, irremediable evils*". She mentions "*miasmata produced by defective domestic arrangements*" but does not give any more detail but admits that "*[m]any unpleasant details have necessarily been omitted.*"[17]

In *Terry's Guide to the Japanese Empire,* Terry Philip describes the "*evil odors from the sanitary arrangements*" which are "*abominable and suggestive of typhoid.*"[18]

Finally, Henry Adams who visited Japan in hot Summer of 1886 noted: "*Tokyo is beastly… nothing but a huge collection of villages, scattered over miles after miles of flat country; without a building fit to live in, or a sewer to relieve the stench of several hundred thousand open privies.*"[19]

As shown before, the use of night soil was not questioned in Meiji Japan. That does not mean though that the government did not care about the foreigners' opinions. One of the Japanese customs that shocked foreigners was public urination. In the Kansai region, pots collecting urine were set up beside roads so people could use them whenever they needed to. In Edo though, urine was not valued as fertilizer so it was not collected – once one felt the need to urinate they would simply do it. There was little if any embarrassment associated with relieving oneself in public, but such behavior seemed barbaric in the foreign eyes. Soon many claims from foreign visitors stating that such customs are unbecoming for a civilized nation appeared and urged Japanese government to do something about it. Such comments hit a raw nerve, as becoming a civilized nation in Western eyes was exactly what the Japanese government was occupied with at the time. Long isolation left the country relatively unaware of the latest technology in the age of industrial revolution and resulted in Japan being seen as inferior to the Western powers. In order to stand equal with the West, Japan rushed toward modernization and by the end of the 19th century it became Japan's priority. That is why foreign claims were taken seriously and in 1871 an ordinance that forbade public urination was passed. The fine was 100 mon. Next year, in 1872, public urination and collection of night soil in buckets without covers were banned by law which was the Meiji equivalent of the present Minor Offense Law.[20] To make it easier for commoners to under-

17 Bird 2013: 95.

18 Terry 1933: xlvii, xxxiv.

19 Mansfield 2009: 117.

20 Ota kuritsu kyōdo hakubutsukan 1997: 5.

stand the new law, the government published *ukiyo-e* paintings portraying how bothering those habits are.

Government's efforts did not really pay off, as public urination proved to be fairly deep-rooted – nearly a decade after the first restriction was passed, Tokyo police recorded more than 4000 violations in a single year.[21] This became a really serious issue as incidents of people urinating in public were even described in newspapers![22]

Health regime

In the Meiji period the idea of hygiene (*eisei*) came to Japan. The government believed that hygiene is the key to becoming equal with the West and promoted staying healthy as the citizen's responsibility. The transition of one's health from private to national issue left many Japanese wary of the government's scheme. To stop the cholera outbreak, infected people were isolated and as there was no treatment at the time, not many of them came back alive. The rumors that people are being killed spread and created an uproar among the people.[23] Strong national engagement in people's everyday life was even criticized by some intellectuals such as Natsume Sōseki, one of the greatest writers in modern Japanese history. In one of his essays he writes: "*But what a horror if we had to… eat for the nation, wash our faces for the nation, go to the toilet for the nation!*"[24]

Soon hygiene became crucial for the Japanese militarism. One report on sanitary conditions in the Japanese navy during the Russo-Japanese war (1904-1905) notes that "*a discipline exists that has no parallel*"[25] and suggests that this was one of the main reasons that Japan defeated the more numerous Russian fleet. Although health and hygiene were

Fig. 2 Poster from 1930 saying: "Health is for the body, for the country" in Kawabata 2003: 45.

extremely important in Japanese nation-building from the second part of the 19th century, just before the Second World War they were taken to a whole new level. When it became clear that the Second Sino-Japanese War (1937-1945) would involve the main islands of Japan and the country would engage in a total war, the government strove to prepare the nation for war. The National Spiritual Mobilization Movement (1937-1940), an organization under the supervision of the government, was established to rally popular consciousness of and support for the war. It strongly relied on the *kokutai* ideology, literally "national body", which viewed the Japanese nation as one superior entity organized around the emperor. Staying healthy was equal with the whole country being healthy. "Train both body and soul"

21 Campbell 2014: 107.

22 Rinoie 1988: 70.

23 Rogaski 2004: 152.

24 Bellah 2003: 43.

25 Braisted 1906: 7.

(Mi mo kokoro mo kitaeru) was one of the slogans urging people to lead a healthy life and getting up early, walking to work and regular exercises were some of the recommendations for people.[26] The answer as to why the health regime has become so important in the wartime propaganda is simple – Japan needed a healthy nation to fight the enemy.

The health regime could not possibly leave out toiletry habits. In 1928 hemorrhoids were classified as a "national disease" by the *Asahi* newspaper and around the same time reports of politicians, including Prime Minister Katō Tomosaburō, suffering from them hit the news.[27] Hemorrhoids were such a big problem that the army had regulations for rectal inspection, which were not easy to pass. Alexander R. Bay estimates that "in 1925… over 55,000 army workdays were lost to hemorrhoid treatment."[28] Some saw the reason for the disease in Japanese-style toilets – Dr. Hirano Kōdō declared that "squatting over the latrine and exerting all one's strength blocked circulation and caused blood congestion around the anus",[29] thus toilets needed improvement. To meet the need many latrines with creative names were developed: the Taishō-toilet and Shōwa-toilet, the Home Ministry-style improved toilet, the Ministry of Health and Welfare-style improved toilet, but none of them got into popular use.

American occupation

On August 15th, 1945 Japan surrendered to the Allies and the American occupation started. As the victor, Allied Powers began to change Japan under slogans of liberalization and democratization, but they also set new standards of everyday life. Americans saw Japanese toiletry habits as unsanitary and looked down on them – Japan was urged to modernize its toilets on the model of the American occupiers. We can imagine that for Japan, which believed in its higher sanitary standards and aspired to lead and set standards for other Asian countries in the Greater East Asia Co-Prosperity Sphere, such contempt was difficult to accept.

Night soil proved to be a problem. Japanese used to cook vegetables before eating them, but Americans were eating raw vegetables in salads and because of that there were many cases of soldiers infested with intestinal parasites. Foreigners saw night soil as filthy and were hesitant to eat Japanese food. When they saw night soil baskets on the street, which they called "honey baskets", they ran away, but we can suppose the smell was more of a reason than some kind of a trauma. At the end of 1946, the American army set hydroponic farms, meaning farms that do not use soil in agriculture, for their exclusive use. Government eschewed usage of night soil and called for total replacement by chemical fertilizers, and they soon became the standard fertilizers in agriculture.

Japan was faced with the problem of what to do with the excess of human waste. As night soil was traditionally used as fertilizer, there was no public sewer system in Japan. In the 1930s, handling of human waste came under municipal management because there was not enough demand for it in big cities and especially Tokyo had problems with night soil removal.[30] Still, night soil was needed in rural areas, so a railway transport of night soil from cities to remote villages started. It is true that even before the postwar period some human waste had been disposed of by dropping it into adjacent waters, but most of it was used as fertilizer.[31] But the American aversion made night soil nothing more than a shameful aesthetic hindrance and Japanese started to massively dump untreated human waste into rivers and the sea.

26 Inoue 2013: 15-52.

27 Bay 2012: 143, 147.

28 Ibid.: 155.

29 Ibid.: 148.

30 Hoshino 2008: 192.

31 Nakamura 2010, 2015.

Environmental crisis

In 1956 the Cabinet Office released its annual economic white paper (*Keizai Hakusho*) which announced that "the postwar period is over" and the TV, refrigerator and washing machine became the symbols of economic revival. But when it came to the toilets, only 6% of the population was connected to sewer lines at the time,[32] while most of Japanese had to rely on "vacuum cars" for human waste disposal. It is estimated that in 1961 as much as 44% of untreated waste water from Tokyo was dumped into the sea.[33] The major source of water pollution is industrial wastewater, but domestic sewage comes close in terms of degradation of the water environment. Finally in the 1960s environmental damage became a problem that could no longer be ignored: tankers were used to dump the waste as far as possible from the shores, but because of the reverse flow much of it came back to the bays. Some of the contractors did not actually stick to the rules to save some fuel. Dropping of untreated human waste into adjacent waters resulted in "yellow waves" in Tokyo Bay, yellowish fish in Osaka Bay and stinking shrimps in Hiroshima. Dokai Bay in Kita-Kyushu was so polluted that it was known as the "Dead Sea" and even *e.coli* bacteria could not survive in it! Western enforcement of their own sanitary standards and abrupt "modernization" of the Japanese toiletry habits resulted in serious deterioration of the environment.

As a key measure to prevent water pollution, the Japanese government revised the Sewerage Law in 1970. It brought new nationwide standards for water quality and a series of subsidized programs supported the construction of night soil facilities. From that time, the public sewerage system quickly spread in densely populated urban areas to become the main sanitation system from the late 1980s. Today it covers 77.6% of population.[34] In rural areas of Japan the onsite sanitation system (septic tanks) functions and access to improved sanitation are universal.

Fig. 3 Ship disposing human waste in the sea, 1968 (Takashima n.d.)

Washlets set the new standard

As the sewer system spread, so did the western-style toilets. They first appeared in Japan in harbors open to foreigners after the arrival of Black Ships of Commodore Perry in 1853, but did not gain popularity then. After WW2 western toilets started being installed in urban areas, but they came into popular use only after 1959, when they became the standard ones in newly built apartment houses. In 1977 the number of Western-style toilets sold in Japan surpassed that of Japanese-style toilets for the first time.[35]

In 1980 TOTO introduced *washlets*—electric toilet seats with various other features, water spray cleaning after defecation being probably the most

32 *Japan Sewage Works* Association 2002: 7.

33 Shibata 1961: 12.

34 Japan Sewage Works Association 2015.
According to the Japan Sewage Works Association, after the 2011 Tōhoku earthquake and tsunami there are some places in Fukushima prefecture where it is impossible to estimate the coverage of sewer system, thus the prefecture was excluded from the statistics – this definitely had a great impact on the final rate.

35 Ueda 2015.

well-known. Interestingly enough, the original came from… America. It was invented in 1964 by American Bidet Company for medical use by patients with hemorrhoids. Sells were not going too well, but TOTO saw the potential, improved the concept and introduced it as *washlet* in 1980. As of 2015 77.5% of homes in Japan have high-tech bidet toilets.[36] The *washlet* has become an international phenomena: it is appreciated not only in Japan, but maybe even more abroad! TOTO in a series of commercials aimed at foreigners coming to Japan introduce the country as "the *Washlet* country" and, well, they might not be wrong!

Conclusion

In this paper I analyzed how Japanese high-tech privies came to set the sanitary standards in the toilet industry. Analyzing the history of toiletry habits in Japan, I focused on the contact with the West and the Western pressure to alter toiletry habits in the country. As a result, human waste transformed from economic good through aesthetic hindrance to dangerous pollution.

Although Japan faced a serious environmental crisis, creative adaptation of Western standards led to the development of probably the best toilets in the world. Therefore one might think that all's well that ends well, but is it really so? Japan managed to deal with the environmental crisis, but let's remember that when it happened, the country was the second strongest economy in the world. As stated in the beginning of this paper, in many developing countries open defecation poses a serious public health, environmental and humanitarian issue. In India about 70% of Indians in rural and 13% in urban areas defecate in the open. But what is really surprising is that even people living in houses with access to a working toilet continue to relieve themselves in the open, suggesting that simply providing people with a toilet does not solve everything.[37] Some even state bluntly: "*Locking us inside these booths with our own filth? I will never see how that is clean.*"[38] I do not mean to suggest that sanitation is not necessary, as it is a prerequisite for a healthy life. But I suggest that it is about time to understand that Western standards with their Western toilets do not necessarily fit in every context, thus they are not the best solution to everything. In order to truly improve sanitation, end open defecation and simply enable people to lead a healthy and safe life, it is absolutely essential to first consider each country's history and cultural background, and then adjust sanitation, as well as any other, facilities to the country's needs. Only when one understands what factors have shaped a country's toiletry habits can they try to improve them, from the bottom up.

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Discover the Priorities of Renewable Sources Potential for Energy Sustainability in Indonesia

電力需要の増加が続くインドネシアで再生可能エネルギー（地熱、太陽光、風力）による発電に適した場所を、各種データの解析から突き止める。

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Abstract Currently, the study of renewable energy potential for energy sustainability becomes an important issue to be discussed. When deciding the site locations for developing renewable energy in Indonesia, it requires the renewable energy resource maps for future introduction of renewable energy. The objectives of this paper are to identify and to rank the priorities of renewable energy sources using Analytical Hierarchy Process (AHP) and Geographical Information System (GIS) for 30 provinces in Indonesia. This study identifies the energy alternative that focuses on solar, wind and geothermal, based on a previous work by the author. The results show that geothermal is the best criterion, followed by solar and wind with weight value of 0.72, 0.22, 0.06 respectively. Resource maps generated identify the high, moderate and low suitability sites to rank the priority decision of renewable energy development for Indonesia. The proposed methodology is useful to discover Indonesia's site priority of renewable energy resources for energy sustainability. The output of this study can be used for decision making to prioritize areas of development in renewable energy for the cases of other countries.

Keywords renewable, energy, Indonesia

Introduction

Indonesia is the world's largest archipelagic state. It is located between 95º to 141º of longitude and between 6º North to 11º South of latitude. It consists of many islands: There are 5 big islands (Sumatera, Kalimantan, Java, Sulawesi and Papua), other smaller islands such as Bali, Ambon, Lombok, Nusa Tenggara, as well as thousands of tiny islands that surround the mainland. It has population over 238 million people.

The energy demand due to population growth is increasing by year, and Indonesia is experiencing energy power shortage. However, Indonesia has many energy resources which are abundant and can increase the energy sustainability. On the purpose to make decision for energy development among the site selection, it is essential to generate resource maps of suitable site locations to make priority decision for renewable energy development in this wide country.

Due to the availability of data, this study is focusing on theoretical potential as a criteria based on a previous study by the author in solar irradiation, wind speed and geothermal resources (Nagasaka and Rumbayan, 2013).

This study presents the spatial multi criteria decision making by combining AHP and GIS to prioritize the site for renewable energy development in

the wide country such as Indonesia that has many alternatives of renewable energy resources available.

There are many different methods of multi criteria decision making and the most known is AHP. The AHP is developed by Saaty. The principles utilized in AHP to solve problem are to construct hierarchies. The hierarchy allows to assess the contribution of individual criterion at lower levels to criterion at higher levels of the hierarchy. The strength of the AHP approach is based on breaking the complex decision problem in a logical manner into small but related sub-problems in the form of levels of a hierarchy. The hierarchical structure of the AHP model permits decision maker (DM) to compare the different prioritization criteria and alternatives more effectively (Saaty, 1990).

Geographical information system (GIS) is a system that captures, stores, analyzes, manages and presents data that are linked to locations. GIS takes the number from databases and puts the information in the map as features. The ability to separate information in layers, and then combine it with other layers of information is the reason why GIS holds such a great potential as research and decision making tools (Foote and Lynch, 2000).

The combination of GIS and AHP techniques for analyzing land use suitability in Vietnam (Nguyen et al, 2001), site suitability evaluation for ecotourism in Thailand (Bunruamkaew and Murayama, 2011), evaluation of eco-environment quality in China (Ying, et al, 2007) have been reported. It was proved that the integration of AHP and GIS can be a powerful tool in order to develop spatial decision making.

Methodology

Using the data collected and the resulting maps for each resources (solar, wind and geothermal), this study is conducted to generate the site priority for renewable energy development in Indonesia and generate resource maps by combining AHP and GIS method. The method used is shown in the Fig. 1.

The following processes are described in detail as:

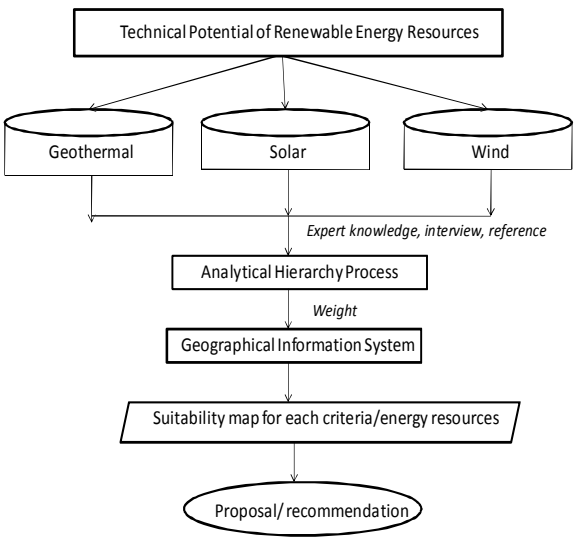

Fig. 1. Schematic of the methodology used

1. Collect the data
2. Develop database for each resources (solar, wind, geothermal)
3. Generate thematic resource in GIS environment.
4. Determine criteria score (x_i) for each resources mapping unit.
5. Recommendation for prioritizing the site of renewable energy development (based on theoretical potential)

The process can be divided in two phases, firstly using AHP method, then secondly apply the result of AHP into GIS environment.

The detail of procedures by using AHP method is described as follows:

1. Define the objective of decision making (in this study, the recommendation for the priority of renewable sources potential in Indonesia).
2. Develop the model of AHP based on decision model. The AHP model consists of goal, criteria, and sub criteria in different levels. Applying this step to rank or prioritize the decision making for

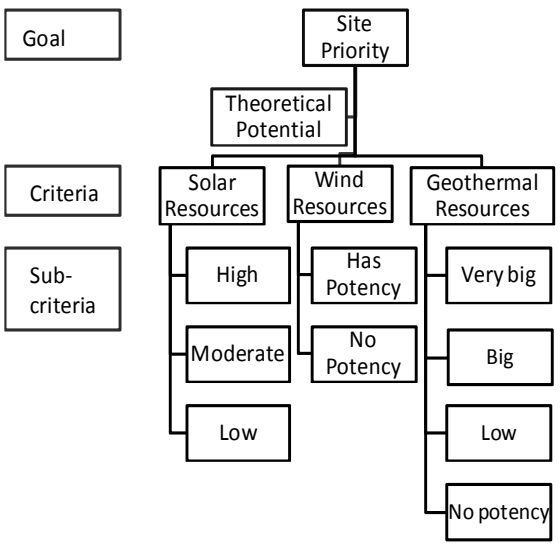

Fig. 2. Development of the AHP model

site suitability for renewable sources potential. The AHP model in this study was developed as shown in Fig. 2.

3. Define the pair of criteria (matrix). Within each level of the hierarchy, the relative importance between each pair of criteria (or among pairs of sub-criteria relating to an upper single criterion) to overall goal is evaluated. A nine-point scale proposed by Satty is used for these evaluation based on expert opinions.

A brainstorming session was conducted among a expert group to assign the values in the matrix as per Saaty's scale that is presented in Table 1.

Table 1. Saaty's scale of preferences in the pair-wise comparison process (Saaty, 1980)

Numerical Rating	Verbal judgments of preferences between alternatives i and alternatives j
1	i is equally important to j
3	i is slightly more important than j
5	i is strongly more important than j
7	i is very strongly more important than j
9	i is extremely more important than j
2, 4, 6, 8	Intermediate values

Pair-wise comparison matrix of criteria is shown in Table 2. The matrices of judgments corresponding to the pair-wise comparison of elements at each level of the hierarchy are presented. Pair-wise comparison of sub-criteria and local weight for solar, geothermal and wind are presented in Table 3, 4 and 5 respectively.

In this study, all scores can be assembled in a pair wise comparison matrix with 1s on the diagonal (e.g., geothermal to geothermal is 1) and reciprocal scores in the lower left triangle (e.g., if geothermal to solar is 5, and then solar to geothermal is 1/5). Pair-wise comparisons generated for the levels of the hierarchy contain expert opinions regarding the relative importance of criterion. The next step in the AHP requires an evaluation of the pair-wise comparison matrices using measurement theory. A standardized eigenvector is extracted from each comparison matrix, allowing us to assign weight to criteria, sub-criteria. These weights allow us to assemble a suitable value for each resources mapping unit.

The weight can be obtained by normalizing the vector in each column of the matrix (dividing each entry of the column by the column total) and averaging over the rows of the resulting matrix as shown at last column for criteria (Table 2) and for sub-criteria (Table 3, 4 and 5).

The score (x_i) and weight (w_i) for criteria (hierarchy 1) and sub criteria (hierarchy 2) are presented in Table 6.

4. Consistency check. It is necessary to know whether the pair-wise comparison has been consistent in order to accept the results of the weighting. The parameter that is used to check this is called the Consistency Ratio. A consistency check is performed by adopting the following procedure using Equations 1, 2 and 3:

The dominant or principal eigenvector of a matrix is an eigenvector corresponding to the eigen value of largest magnitude (for real numbers, largest absolute value) of that matrix. Calculate the eigen value of λ_{max} as:

$$\lambda max = \frac{1}{n}\sum_{i=1}^{n}\frac{(AW)i}{w_i} \quad (1)$$

where A is the matrix, W is the corresponding eigenvector of λ_{max} and w_i (i= 1, 2, …, n) is the weight value for ranking.

$$CI = \frac{\lambda max - n}{n-1} \quad (2)$$

Where CI is the consistency index; while λ_{max} is the eigen value and n is the order of the matrix. According to Xu (2002), the bigger CI occurred, the worse consistency the matrix has. It is found the value of CI in this research was pretty good in 0.06. Then, the consistency ratio (CR) was calculated by using Eq.3:

$$CR = \frac{CI}{RI} \quad (3)$$

Where RI (Random Index) is the average of the resulting consistency index depending on the order of the matrix. It is found that consistency ratio is equal to 0.04. The result below 0.1 shows the consistency of pair wise matrix.

In this study, the consistency check for hierarchy 1 (criteria) is performed as above procedure and presented as follows:

$$\begin{bmatrix} 1 & 5 & 9 \\ 1/5 & 1 & 5 \\ 1/9 & 1/5 & 1 \end{bmatrix} \begin{bmatrix} 0.72 \\ 0.22 \\ 0.06 \end{bmatrix} = \lambda_{max} \begin{bmatrix} 0.72 \\ 0.22 \\ 0.06 \end{bmatrix}$$

From calculation using Eq.1, it is found that eigenvector of AHP model in this research, λ_{max} = 3.12. In order to keep the consistency of the judgment matrix, its consistency should be tested by using Eq. 2 and Eq. 3.

The similar ways to prove the consistency index of judgment are applied for the pair wise of sub criteria matrix (in Table 3, 4 and 5). The result indicates that the pair wise matrix for sub criteria of solar, wind and geothermal are below 0.1. Then the local weight for criteria at level 1 are multiplied the local weight for criteria at level 2. Then the total weight is calculated by using Eq. 4.

$$S = \sum_{i}^{n} w_i x_i \quad (4)$$

where, S: Suitability index, w_i: weight of criterion *i*, and x_i: score of criterion *i*.

In the second phase, the result of weight or priority of criteria where used as input in GIS in the spatial analysis at GIS environment to overlay the map, as shown in Fig.3.

The entire resource databases which consist of solar, wind, geothermal data are formed in polygon format for 30 provinces as boundary in digital map available. The solar irradiation data for 33 provinces are taken from NASA database as monthly average (http://eosweb.larc.nasa.gov); wind speed data also taken from NASA database; the geothermal resources potential data are taken from Pertamina, an energy company of Indonesia.

The previous study about solar irradiation potential, wind energy analysis and geothermal potential analysis were conducted by authors and presented as

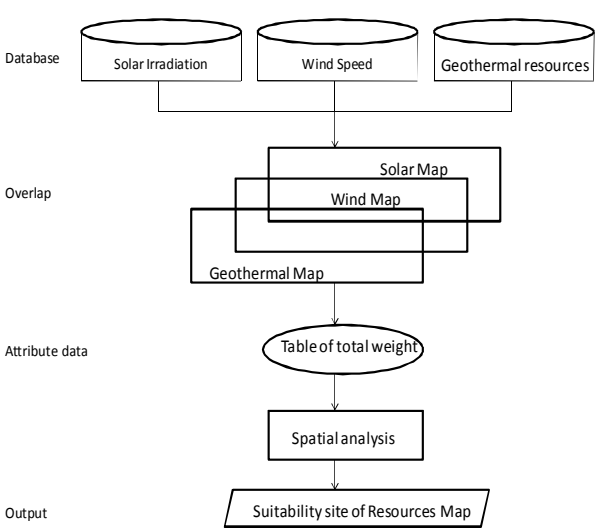

Fig. 3. Develop GIS method used in this study

solar mapping, wind mapping and geothermal mapping for 33 provinces in Indonesia based on data available.

In this study, we overlay all the solar irradiation data, wind velocity data, and geothermal resources potential data which are based on geographical data and AHP model, by using GIS.

Results and Discussions

The result of calculation local weight for hierarchy 1 and the total weight for hierarchy 2 (sub-criteria) are presented in Table 6. All the pair wise matrix indicates at below 10%, therefore there is no review for pair wise that is built based on expert opinions and decision maker references.

In this study the AHP model was built to identify the weight of criteria for two hierarchies. Then the overall weights were obtained based on AHP method. AHP as a well-known criteria decision making was used to define the weight of potential of resources. The scores and weight of solar, wind, geothermal potential for 30 provinces in Indonesia are presented in Table 7.

GIS enables to generate a theoretical potential resources map based on overlapping solar energy map (Fig. 4), wind map (Fig. 5) and geothermal potential map (Fig. 6).

The resource map by combining the AHP and GIS to show the suitability site of renewable energy resources for the entire Indonesia is shown in Fig. 7.

The GIS technology is used to assist the determination of finding the potential for entire Indonesia (33 provinces). Based on the weight calculation from multi criteria decision making using AHP method, the attribute of rank prioritization of resources map is classified in 3 classes, i. e highly suitable (>0.2), suitable (0.1-0.2) and low suitable (<0.1) and the map is generated in GIS environment.

Basically, the high suitability sites of renewable energy potential are found in provinces of Aceh, Medan, Jambi, Semarang, Surabaya, Bali, Lombok, Kupang, Manado and Ambon as shown in Table 7.

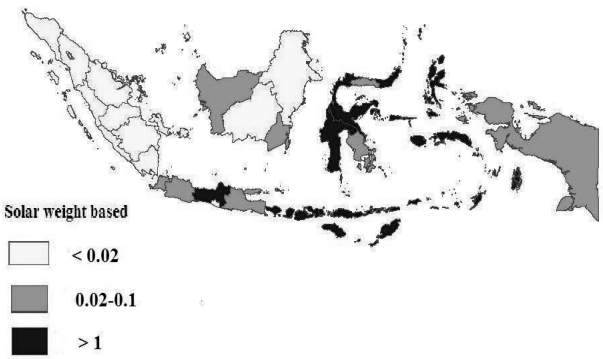

Fig. 4 Indonesia's Solar Irradiation Map

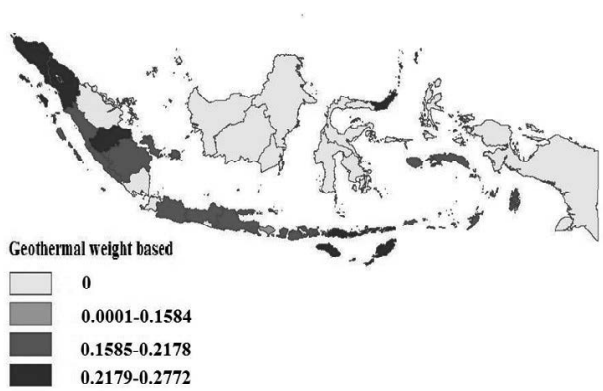

Fig. 5 Indonesia's Geothermal Resources Map

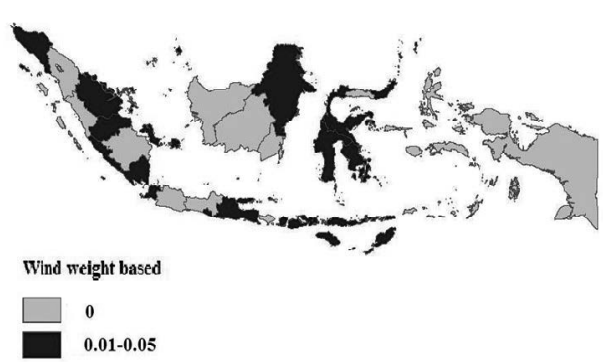

Fig. 6 Indonesia's Wind Resources Map

In Fig. 7, the color indicates that the darkest shows the high suitability for priority of renewable energy development based on theoretical potential criteria.

Conclusions

The result of this current study found that geothermal is the best choice, followed by solar and wind alternatives with weight value of 0.72, 0.22, 0.06 respectively. Resources maps generated identify the high and moderate suitability sites to prioritize decision of renewable energy development for Indonesia. The proposed methodology was useful to discover and identify the renewable energy resources site for energy sustainability in Indonesia.

The output of this study can be used for decision making to define the priority of renewable energy sources potential for the cases of other countries. The method in this study is also relevant to site selections to find priority of renewable energy development as the objective for other countries.

For further study, it is planned to add other criteria for renewable energy options, such as hydro and biomass energy to be analyzed by using AHP and GIS for discovering the priority of renewable sources potential for energy sustainability in Indonesia.

Table 2. Weight of Criteria

Criteria	High	Moderate	Low	Weight
Geothermal	1	5	9	0.72
Solar	1/5	1	5	0.22
Wind	1/9	1/5	1	0.06

Table 3. Pair-Wise Comparison of Sub-Criteria and Local Weight for Solar

Sub Criteria For Solar	High	Moderate	Low	Local weight (w_i)
High	1	5	9	0.72
Moderate	1/5	1	5	0.22
Low	1/9	1/5	1	0.06

Table 4. Pair-Wise Comparison of Sub-Criteria and Local Weight for Geothermal

Sub Criteria For Geothermal	Very big	Big	Low	No	Local Weight (w_i)
Very big	1	5	7	9	0.68
Big	1/5	1	1/7	7	0.22
Low	1/7	1/5	1	5	0.12
No	1/9	1/7	1/5	1	0.04

Table 5. Pair-Wise Comparison of Sub-Criteria and Local Weight for Wind

Sub Criteria For Wind	Has Potency	No Potency	Local Weight (w_i)
Has Potency	1	9	1
No Potency	1/9	1	0

Table 6. Score and Weight of Criteria in Priority Site of Renewable Sources Potential Analysis

Criteria-Hierarchy 1	x_i	Criteria Hierarchy 2	w_i	Local weight (w_i)
Solar Resources	0.22	High	0.72	0.15
		Moderate	0.22	0.05
		Low	0.06	0.01
Wind Resources	0.06	Has Potency	1	0.06
		No Potency	0	0
Geothermal	0.72	Very big	0.68	0.49
		Big	0.16	0.16
		Low	0.12	0.09
		No potency	0.04	0

Table 7. Score and Weight of Solar, Wind, Geothermal Resources Potential for 33 Provinces in Indonesia

Provinces	Solar Weight ($w_1.x_i$)	Wind weight ($w_2.x_2$)	Geothermal weight ($w_3.x_{3)}$	Total weight
Aceh	0.01	0.05	0.45	0.51
Medan	0.01	0	0.45	0.46
Padang	0.01	0	0.11	0.12
Riau Kepulauan Riau	0.01 0.01	0.05 0.05	0 0	0.06 0.06
Jambi	0.01	0.05	0.45	0.51
Palembang	0.01	0	0.11	0.12
Bengkulu	0.01	0.05	0.11	0.17
Lampung	0.01	0.05	0	0.06
Belitung	0.01	0.05	0.11	0.17

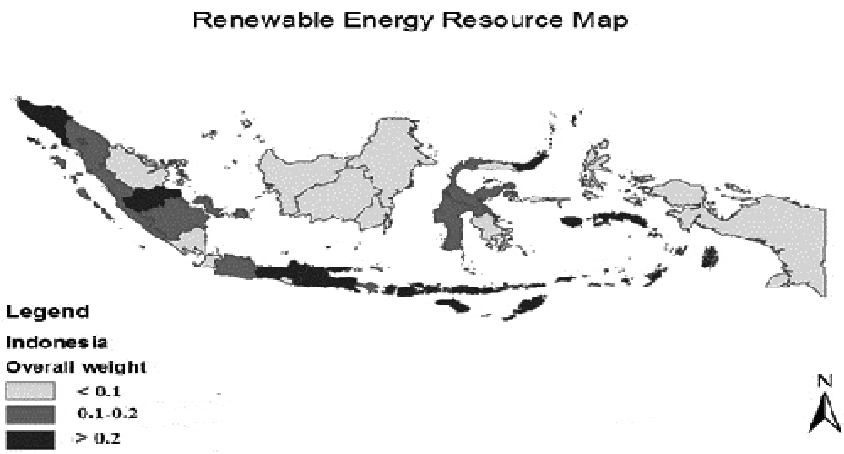

Fig. 7 Indonesia's Priority Site Map of Renewable Resources Potential

Table 7. (continued)

Provinces	Solar Weight ($w_1 x_1$)	Wind weight ($w_2.x_2$)	Geothermal weight ($w_3.x_3$)	Total weight
Jakarta	0.07	0	0	0.07
Bandung	0.07	0	0.11	0.18
Semarang	0.13	0	0.11	0.24
Yogyakarta	0.01	0.05	0	0.06
Surabaya	0.07	0.05	0.11	0.23
Banten	0.07	0.05	0	0.12
Bali	0.13	0	0.08	0.21
Lombok	0.13	0.05	0.45	0.29
Kupang	0.13	0.05	0.11	0.63
Pontianak	0.07	0	0	0.07
Palangkaraya	0.01	0	0	0.01
Banjarmasin	0.07	0	0	0.07
Samarinda	0.01	0.05	0	0.06
Manado	0.13	0.05	0.45	0.63
Palu	0.13	0.05	0	0.18
Makasar Mamuju	0.13 0.13	0.05 0.05	0 0	0.18 0.18
Kendari	0.07	0.05	0	0.12
Gorontalo	0.07	0	0	0.07
Ambon	0.13	0	0.11	0.24
Ternate	0.13	0	0	0.13
Jayapura Papua Barat	0.07 0.07	0 0	0 0	0.07 0.07

Acknowledgments

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1879年コレラの拡散と朝日両国の対応

Spread of Cholera and the responses of Joseon and Japan in 1879

1879年の夏、日本と朝鮮でコレラが大流行した。春先に日本で発生したコレラは津島から開港場の釜山に、さらに朝鮮各地に広まった。この過程での両国政府の防疫対策と互いの認識の差異を検証する。

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Park, Hanmin (Korea University)

Abstract

Cholera broke out both in Joseon and Japan in the summer of 1879. In the area of Tsushima, there were more than 100 patients in June. It also spread out to Busan, with the number of patients reaching up to 150 by mid-August. After the breakout and spread of cholera, many people living in all around Joseon died. Because of increasing patients, the Japanese established a quarantine station and an isolation hospital for Japanese people living in their settlement. Yoshimoto Hanabusa, a charge d'affaires, met high-ranking official of Joseon frequently, and delivered a prevention rule of cholera to prevent the further spread of the disease. Since opening ports, governments of Joseon and Japan took sensitive actions against the breakout of such an epidemic, and tried to make coordination schemes to protect people from the disease. In this paper, I will analyze the case of 1879, focusing on the response of Joseon and Japan from two perspectives: ways to prevent the spread of cholera jointly, and differences in recognition of 'sanitation' between the two nations.

Keywords cholera, quarantine, epidemic, sanitation

1. はじめに

コレラ（Cholera）は本来「過度な下痢」の症状を意味し、ラテン語に由来する用語である。1817年以前まではインド地域の中で限定的に流行した疾病であったが、コレラはイギリスが用いた様々な船舶の交易路と軍隊の移動経路に沿って、ロシア、東南アジア、中国、日本、朝鮮、そしてメキシコなどに拡がっていった。特に、19世紀の半ばから汽船と鉄道の発達によって、人々の移動範囲が広くなり、運搬速度も速くなるにつれ、世界全域の流行も加速化した[1]。日本では1822年の流行以後、コレラは酷熱辣、虎狼痢、虎列剌などの音訳された漢字表記が使用されたが、明治維新後、「虎列剌」が公式用語として定着した。朝鮮で、この名称を病名として初めて用いたのは1879年である[2]。朝鮮では日本式の漢字表現を持ち込んで使いながら、朝鮮式の表記として少し変形された。即ち、虎列剌の「剌」が「刺」に変わって、虎列刺になった。「虎列刺」という名称の定着は1890年代後半から発刊された『獨

1　윌리엄 맥닐著・김우영訳『전염병의 세계사』（이산，2005年），281～283頁。

2　황상익『근대 의료의 풍경』（푸른역사，2013年），506頁。

立新聞』や『帝国新聞』などの純ハングルで書かれた新聞を通じても確認できる。日本式の漢字表記であった「虎列剌（コレラ）」よりも「虎列剌（ホヨルジャ）」が大衆のなかでは広く定着して行くようになった[3]。このコレラは開港（1876年）前では1821年[4]、開港後では1879年と1886年に大流行した。1876年以後ではほぼ5年を周期として流行し、70％に達する高い死亡率を出す恐ろしい伝染病であった[5]。

1879年の夏、朝鮮と日本ではコレラが大規模に流行した。6月頃からは対馬地域にも疾病が蔓延して、百人以上の患者が出た。コレラは開港場であった釜山地域にも発生し、8月中旬には患者が150人余りになるほどであった。その後、コレラは仁川などの朝鮮全域に拡散され、大勢の人々がなくなった。日本国内でも10万人余りが死亡するほど、コレラが猛威を振るった時期であった。

開港期朝鮮におけるコレラの全般的発生と流行については、その間、医学史を専攻する研究者たちが時期別の推移をまとめながら、甲午改革以後のコレラ予防規則のような防疫政策を朝鮮政府が実施するまでの過程を整理している[6]。しかし､資料活用上の制約によってコレラが大流行した各時期の様相、それに対処する朝日両国の対応論理や認識の相違が分析しつくされていない。したがって、本稿ではまず1879年に時期を限定し、朝鮮と日本で大流行したコレラについて一次的には発病初期からその勢いが穏やかになる9月の中旬まで、その進行過程を花房義質代理公使との関わりがある記録及び外交文書や日本で発行された新聞などに基づいて検討する。コレラの流行と拡散が進行するなかで、朝鮮と日本の両国の官吏たちは「条約運営」という大きな課題に各々どのように対処していくのか、その過程で相手に対する認識を如何に表出していたのか、伝染病予防のための「衛生」に関してどのように考えていたかについて検討する。もちろん、この時期の場合、朝鮮はまだ近代的方式に基づいて作成された統計のない時期であるため、朝鮮全域のコレラ発生の様相を正確に確認するには多少の制約がある。そのため挙げられる地域も開港場であった釜山を主にし、他の地域に関する状況は付随的に言及するに留める。

2. 1879年朝鮮でのコレラ発生と展開過程

1879年はコレラが発生して朝鮮と日本の両方で猛威を振るった時期である。日本では3月14日、愛媛県でコレラが突然発生して全国へ拡散し、8月下旬には流行がピークに到った。これが5次コレラ大流行に当たるという[7]。このときのコレラによって、日本では16万2,637人の患者が発生し、そのうち10万5,786人が死亡したという[8]。日本政府は「虎列剌病予防規則」を制定して、石炭酸を使って消毒を実施し、患者を隔離する政策を初めて施行した。この時期に当たって厳しい隔離政策を行なったため、警察官や医師が襲われるなど、各地で騒ぎが起こった[9]。伝染病を管理する官主導の方式に対して

3　申東源『호환　마마　천연두 : 병의　일상　개념사』(돌베개, 2013年)，148～149頁。

4　1821年のコレラ流行と朝鮮の対応様相については、次の研究が詳しいから参考になった。김신회「1821년 콜레라 창궐과 조선 정부 및 민간의 대응 양상」『韓国史論』第60号（ソウル大学校国史学科，2014年)。

5　황상익，前掲書，484頁。

6　三木榮『朝鮮医学史及疾病史』(医歯薬出版株式会社，1972年)。申東源「조선말의 콜레라 유행，1821－1910」『한국과학사학회지』11－1 (韓国科学史学会, 1989年)。申東源『호열자，조선을 습격하다 : 몸과 의학의　한국사』(歴史批評社，2004年)。最近、翻訳を通じて、申東源の本は日本で出版された。申東源著・任正爀訳『コレラ、朝鮮を襲う－身体と医学の朝鮮史』(法政大学出版局，2015年)。

7　三木榮，前掲書，266頁。山本俊一『日本コレラ史』(東京大学出版会，1982年)，416～417頁。

8　笠原英彦・小島和貴『明治期醫療・衛生行政の研究』(ミネルヴァ書房，2011年)，59頁。

9　마키하라 노리오（牧原憲夫）著・박지영訳『민권과　헌법』(語文学社，2012年)，114～115頁。

情緒上の反感を持ったり、或いはそれに適応しなかったことから起こった反発が騒ぎに繋がったのである。

コレラの猖獗は朝鮮でも同じであった。釜山管理庁では、7月初から対馬の厳原港へ問い合わせをしているが、すでにここでもコレラ患者12人のうち8人が亡くなったように病が広がっていた[10]。その情報に基づいて、日本政府はまず7月11日から釜山港に入る船に対して取締規則を施行するよう管理官に通報した。その内容は3項目であるが、それを紹介してみれば次のようになる[11]。

1. 入港ノ船舶有之節ハ国旗ヲ掲タル端舟ニテ見廻リ役医官ト共ニ該船へ乗組一応仕出ノ地名並開帆ノ時日病客ノ有無ヲ取調然シテ医官之ヲ検査シ、コレラ病患者無之ト見認ルトキハ速ニ上陸ヲ許シ、該船ハ船艙内ニ投錨スルヲ得ヘシ。
2. 水夫船客ノ内該患者有之節ハ決シテ上陸ヲ不許、其余無病ニ属スル者ハ必要ノ見廻リ荷物丈ヲ許シ、端舟ヲ以テ南濱ニ廻シ、学校ノ一室ニ仮寓シ、消毒法ヲ施行スヘシ。尤其以前ハタトヘ親族タリトモ其の寓ニ接近スルヲ不許。且該患者ハ避病室ニ移シ、治療ヲ施スヘシ。依テ其船ハ直ニ絶影島へ投錨ヲ為スヘシ。
3. 該船絶影島碇泊中、若シ新患者アルカ或ハ食料並水薪等欠乏ノ節ハ、端舟ヨリ船艙外迄来リ、其段発声通報スヘキ事。

釜山では、7月21日以後日本人居留地内でコレラ患者が出たことが確認される[12]。日本管理庁は疾病予防のための対策を考え始めた。荒川徳滋（金助）を朝鮮の辦察所へ派遣し、絶影島のなかで消毒所を設置する件を議論するようにした後、18日から設置作業に着手した（この問題をめぐる朝日両国認識の相違は後述）。一方、管理官は釜山在留の日本商人たちを対象として7月30日以後しばらくのあいだ韓人らとの通交と取引を禁止し、コレラの流行期限は2ヶ月、つまり8月から9月までだから、その期間中、館内で食べる米穀の量を調べて報告せよと告示をした[13]。

漢城に留まっていた花房代理公使もコレラの流行に関して各地の地方官へ厳に命を下して、速やかに予防措置を取ることを朝鮮政府に要請した[14]。礼曹判書沈舜沢宛に送った公文では、予防規則を早く実施することによって、両国の人民たちがコレラに罹ってすぐに死ぬ事態(横夭の憂)を防止せよとのことが含まれている[15]。これと同時に花房は朝鮮政府の参考のために、コレラ予防規則の一部を漢文に訳したものを併せて送付した。この予防規則は釜山地域で管理官が居留日本人を対象として先に発布して施行したもので、全体が19個の条項に構成されたものである（項目別の詳しい内容は後述）。これに対して沈舜沢は翌日予防規則を見せてくれたことについて感謝すると返答した[16]。これから2ヶ月後、1880年から開港が約定されていた元山地域について下見をして開港場の区域まで設定した上、元山を出発するとき、花房公使は徳源府使金綺秀にもコレラの消毒薬と海軍小軍医である

10 『明治十二年代理公使朝鮮事務始末』（以下『事務始末』と略す）巻8：虎列剌病予防往復，1879年8月8日，代理公使花房義質宛の管理官前田献吉報告。

11 『事務始末』巻13：釜山往復，1879年8月8日，代理公使花房義質宛の管理官前田献吉報告の附属文書，1879年7月21日布達。

12 『郵便報知新聞』1879年8月22日，「朝鮮釜山浦の近況(7月23日附通信)」。『事務始末』巻13：釜山往復，「明治12年7月8月朝鮮国釜山港コレラ患者表」。

13 『郵便報知新聞』1879年8月21日，「朝鮮釜山浦より来信の略（8月2日出)」。『横濱毎日新聞』1879年8月22日，「朝鮮釜山浦より来信の略（8月2日出)」。

14 『事務始末』巻2：日記，8月21日。

15 『事務始末』巻8：虎列剌病予防往復，口號，1879年8月21日，礼曹判書沈舜沢宛の代理公使花房義質公文。『旧韓国外交文書：日案』巻1（高麗大学校亜細亜問題研究所編)，文書番号56，43頁。

16 『事務始末』巻8:虎列剌病予防往復, ハ號, 己卯7月初5日, 代理公使花房義質宛の礼曹判書沈舜沢公文。『旧韓国外交文書：日案』巻1，文書番号57，44頁。

表 1　1878 年～ 1880 年，朝鮮各地域の人口変動統計

	漢城	京畿	黃海	全羅	慶尚	忠清	江原	平安	咸鏡	合計
1878	197,200	692,517	572,696	947,680	1,498,504	839,134	335,328	884,066	657,929	6,633,054
1879	168,427	682,576	581,235	939,583	1,470,082	839,196	335,604	884,478	658,846	6,560,027
1880	188,953	675,435	582,492	937,239	1,475,698	838,675	335,857	885,017	661,861	6,581,227

秩父克然が作成した薬の服用法を併せて送った[17]。コレラの予防及び対応に関して情報の非対称性があるが、朝日のあいだである程度の共助が行われている様子が見られる。

石幡貞は 10 月 13 日元山に着した後、徳源府使と面会したことがある。この時の記録を通じて京畿道及びソウルの地域でコレラが流行し始めた時期と主な官職者の死亡事実を確認することができる。金綺秀によれば、彼が漢城を出発したのは 9 月 6 日のことで、3 日後にコレラが流行したという。そのために趙寅熙（京畿道観察使）、金炳学、金世均（水原留守）などの高官たちが次々に死んだ[18]。趙寅熙は、1876 年 8 月に宮本小一理事官が渡韓した時、朝鮮側の協商代表者として貿易章程の締結と調印を担当した人である。漢城を始め京畿道地域では 8 月下旬まではまだコレラが流行するという風聞がないから良かったと述べた花房の発言まで合わせて考えれば[19]、金綺秀が挙げた流行の時点は 9 月初からだったと判断しても無理はないと思われる。黃玹の見聞によっても、当時ソウルで怪疾、すなわちコレラが大きく発生し、このために死亡した者の数だけを見ても 6 万人に達したという[20]。ちなみに、朝鮮政府から公式に集計された戸口調査報告に基づいて 1878 年から 1880 年までの人口変動を提示すると、次のようになる[21]。

表 1 を通じて漢城と慶尚道の場合、1878 年と比べると、2 万 8 千人余り、京畿は 9 千 9 百人余り、全羅道は 8 千余人が減少した。朝鮮全地域の人口数を通じて見れば、7 万 3 千人余りが 1 年のあいだで急激に減少したことが分かる。もちろん、数値比較において人口の自然増減を考えなければならない問題も確かに存在する。でも、黃玹が見聞した人員数とほぼ同じ、少なくとも朝鮮全体人口の約 1% 以上の人々が、1879 年の夏、コレラに罹って死亡したと考えても差し支えがないと思われる。

3. 釜山地域のコレラ発生現況と「虎列剌予防竝取扱方規則」

1）釜山地域内部のコレラ感染者と死亡者現況

コレラが発生した後、前田管理官は朝鮮の辦察官へコレラに感染した人々の数と死亡者を居留民たちに随時伝えようにすると公文を送って情報の共有と協調を求めた[22]。一方、前田管理官は釜山居留地にある商法会議所の議長及び委員だちを召集し、コレラの拡散を防ぐために一時的に韓人との交流を禁じる方策に協力するよう求めた[23]。彼は商人たちの代表と協議し、12 ヶ月間の貿易をやめることを決め

17 『事務始末』巻 8：虎列剌病予防往復，二號，1879 年 10 月 10 日，徳源府使金綺秀宛の代理公使花房義質公文。

18 『事務始末』巻 2：日記，10 月 9 日。『事務始末』巻 8：虎列剌病予防往復，提要。「京城ノ通信ニ據レバ傳染病益盛ニ大臣金炳學水原留守金世均モ為メニ免去スト云」。

19 『事務始末』巻 13：釜山往復，1879 年 8 月 17 日，花房代理公使宛の前田管理官報告。「此邊ハ未タ伝染病ノ風聞無之先大慶ニ存候」。

20 황현著・임형택外訳『역주 매천야록』上（문학과지성사，2005 年），142 頁。この記録を通じても元領府事金炳学が死亡したことが確認される。

21 『日省録』高宗 15 年 12 月 29 日，高宗 16 年 12 月 29 日，高宗 17 年 12 月 30 日の「京兆献民数」に基づいて作成。

22 『郵便報知新聞』1879 年 8 月 27 日，「朝鮮釜山浦とりの通信」。

23 『郵便報知新聞』1879 年 9 月 8 日，「釜山虎列剌景況通信」。

た上、7 月 29 日の夜 10 時から居留地の出入口をパトロールする人と監視番を組織して現場に投入した[24]。日本人と韓人の接触を一時的に制限する処置を速やかに取ったのである。

では、実際釜山で発生したコレラ患者と死亡者の現況は如何に推移していたのか。釜山管理官が 7 月から 8 月のあいだ、発病して死亡し、あるいは回復した人々の人的事項を簡単に調べて本国に報告した資料が残っている。従って、ここではその資料に基づいて 1879 年当時の釜山におけるコレラの現況と推移を検討してみよう。次の図表は 8 月 8 日午後現在に纏められたコレラ患者の情報である[25]。長崎県と山口県出身の平民がここに進出していることがよく分かるが、発病してから一日ですぐ死亡してしまう場合が少なくなく、致命率が相当高いことを示している。当時、日本で発行されていた新聞にも挙げられるようになったが、最初のコレラ感染患者は尾方久太郎であった。

辦察所が朝鮮人でコレラに感染した患者と死亡者について、日誌の形式で整理して伝えたものが次の表である。日本管理庁で在留日本人を対象として作成した上の表に比べれば、人的事項を詳細に確認することは難しいが、旧倭館地域や草梁や釜山地域の患者発病の状態については変化がよく分かる。8 月 17 日まで地域別に集計された発病者と死亡者の統計は表 3 のようになる[26]。

8 月 8 日、釜山管理官の報告によれば、釜山港の

表 2　コレラ患者の情報と発病状況

名前	出身地 / 身分	職業	発病日	状態
尾方久太郎	長崎県 / 平民	大工職	7 月 21 日	8 月 1 日で快癒
山崎宗兵衛	長崎県 / 平民	仲買商	7 月 22 日	7 月 23 日で死亡
梅太郎	山口県 / 平民	船頭	7 月 26 日	治療中
山本七九郎	長崎県 / 平民	土方人定	7 月 28 日	治療中
杉山源蔵	山口県 / 平民	土方人定	7 月 30 日	7 月 31 日で死亡
野村竹次郎	山口県 / 平民	大工職	8 月 4 日	治療中
藤次郎	山口県 / 平民	水夫	8 月 4 日	8 月 5 日で死亡
上田よね（上田千代吉の妻）	長崎県 / 平民		8 月 5 日	8 月 6 日で死亡
助蔵	山口県 / 平民	水夫	8 月 6 日	治療中
上田千代吉	長崎県 / 平民	大工職	8 月 6 日	治療中

辺りは依然としてコレラが盛んに流行していた。そして避病院を絶影島に設置し、戸塚小軍医を漢城へ遣わすことに決定したため、矢野大軍医がしばらく管理庁に留まっていることを伝えた[27]。同日、矢野も花房と近藤宛の書簡を送ったため、その時の状況を把握する参考になる。その書簡に依れば、居留地のなかでも多数のコレラ患者が発生したが、釜山の古館地域の韓人らの間で特に流行していたので貿易と交際が根絶され、必要な物品は対馬地方から丁卯艦を通じて購求しているとした。このような状況であるのに、戸塚を漢城へ派遣することを決めたのは甚だしいという発言が居留民のなかから頻繁に出ていることも合わせて報告した[28]。

まず、上に提示した表だけでは、居留地の内で日本人のコレラ患者数が外れているため現況が分かりにくい。8 月 17 日、管理官前田の報告に拠れば、150 人の患者がまだいるが、11 日以後には釜山港

24 『事務始末』巻 13：釜山往復，「韓人虎列剌病ニ感染ノ景況上申」，1879 年 8 月，外務卿寺島宗則宛の管理官前田献吉報告。

25 『事務始末』巻 13：釜山往復，8 月 16 日来信附属の「明治 12 年 7 月 8 月朝鮮国釜山港コレラ患者表」。

26 『事務始末』巻 13：釜山往復，8 月 16 日来信附属の「辦察所日報」及び 1879 年 8 月 17 日の代理公使花房義質宛の管理官前田献吉報告の附属書類。『日本外交文書』巻 12，文書番号 128「韓人虎列剌病に感染之景況上申ノ件」附属書，232 ～ 233 頁。『日本外交文書』には、8 月 5 日までの数しか記載されていないが、この情報を伝えたものが朴琪淙という人だったことには興味深いものがある。

27 『事務始末』巻 2：日記，8 月 16 日。

28 『花房義質関係文書』，1879 年 8 月 8 日，花房義質・近藤眞鋤宛の矢野義徹書簡。資料の中では年度が書かれていないが、書簡の内容は 1879 年のコレラ流行当時の状況を挙げている。従って、ここでは作成された時期を 1879 年に推定した。

表３　八月、釜山地域のコレラ患者と死亡者の統計

日附	地域	患者	死亡者	備考
８月１日以前	釜山	數十	89	
	旧館	34		
	草梁	23		
８月１日	釜山	18	4	陰暦６月14日
	旧館	3	2	
	草梁	2		
８月３日	釜山	34	7	陰暦６月16日
	旧館	12	2	
	草梁	5		
８月４日	釜山	42	12	陰暦６月17日
	旧館	17	6	
	草梁	7		
８月５日	釜山	41	6	陰暦６月18日
	旧館	17	3	
	草梁	6		
８月６日	釜山	41	6	
	旧館	17	3	
	草梁	6		
８月７日	釜山	18	3	
	旧館	6	3	
	草梁	5	1	
８月８日	釜山	23	5	
	旧館	19	3	
	草梁	16	4	
８月９日	釜山	23	8	
	旧館	33	2	
	草梁	8	1	
８月10日	釜山	21	3	
	旧館	17	2	
	草梁	31	2	
８月11日	釜山	6	4	
	旧館	11	1	
	草梁	27	3	
８月12日	釜山	11		
	旧館	19	3	
	草梁	23	2	
８月13日	釜山	16		
	旧館	21	2	
	草梁	21	3	
８月14日～８月15日	釜山	8	2	
	旧館	16		
	草梁	27	3	
８月16日	釜山	7	1	毎日、約10人ずつ死亡したという。
	旧館	11	2	
	草梁	26		
８月17日	釜山	7	1	東萊水営と九浦地域でコレラが盛行中。
	旧館	11		
	草梁	26		

のなかで新たに感染した人はなかったという[29]。しかし、８月25日の報告からも分かるように、流行が穏やかになっている推移だったが、相変わらず患者と死亡者が出ていた。17日の報告以後、新しい患者が４人発生したが、そのうち２人は死亡、そのほかは治療中という便りが花房公使に伝えられたことを通じて確認できる。東萊水営と九浦などでは、まだコレラが蔓延していたという便りもこのときに伝達された[30]。その後、最後に追加の報告がなされた８月18日と19日の患者と死亡者数は次のようになるが、20日から24日までは死亡者と新規患者が報告されることがなかった。朝鮮側の小通事に依れば、「釜山旧館草梁邊ハ漸々鎮静ニ趣クトノミ」という[31]。

９月４日以後、もうこれ以上のコレラ患者は出てこなかった。釜山鎭辺りの地域でも病勢が大きく衰退している状態だと前田管理官は花房に報告した。８月末から９月初に至って、釜山地域では幸にコレラが鎮静局面に入ったことがわかる部分である。９月28日、前田管理官はその間のコレラ関連現況について７月21日から９月４日までの統計を集めて外務省へ報告した[32]。その報告によれば、釜山居留の日本人は７月現在840人であったが、患者が24人、そして死亡者が18人だったという。８月１日から18日まで朝鮮側の概略的な地域別の戸口数や患者と死亡者の数は次のようになる。死亡の申し出が正確でなかったため集計上の制約があるものの、日本居留地内の死亡者と比べてみれば、603人だっ

29 『事務始末』巻13：釜山往復，1879年８月17日，代理公使花房義質宛の管理官前田献吉報告。「當地流行病ノ模様去ル十一日付ヲ以テ御報知ニ及ヒ置候後、即今居留地内患者百五拾各位」。

30 『事務始末』巻２：日記，８月26日。『事務始末』巻13：釜山往復，1879年８月25日，代理公使花房義質宛の管理官前田献吉報告。

31 『事務始末』巻13：釜山往復，1879年８月25日，代理公使花房義質宛の管理官前田献吉報告の附属文書。

32 『日本外交文書』巻12，文書番号130「朝鮮國内外人コレラ病感染ノ景況上申ノ件」の附属書１，234頁。

表４　８月下旬、釜山のコレラ患者と死亡者の数

日附	地域	患者	死亡者	備考
8 月 18 日	釜山	7	1	なし。
	旧館	11	1	
	草梁	26	1	
8 月 19 日	釜山	7		8 月 20 日から 24 日まで追加された発病者及び死亡者の報告はなし。
	旧館	11		
	草梁	26		

表５　釜山付近の人口とコレラに関する集計

地域	人口	患者	死亡者
釜山鎮	3,200	293	170
旧館	1,150	248	133
草梁	860	262	120
東萊府	不明	不明	180

たため朝鮮の方が日本よりも数の面で多かった[33]。先に提示した表とも死亡者の累積された数で相違があるが、これらは死後に集計されたものが反映されてコレラによって被害を受けた朝鮮人たちの数が増えるようになったと見る方がよいだろう。これに対して前田は「當居留地近邑に於て韓人の該病に罹りしもの夥多」であったが、「館内に蔓延せさるは寔に之れ予防之效力を奏せし確証にして官民共称賛致し居既に予防法を了解仕候」と報告した[34]。コレラを防ぐための対処をよく取ったか否やによって生死が明らかに分かれていることが確認できる。

コレラ病勢の好転にしたがって、9 月 15 日からは朝鮮人と日本人も従前のように往来がなされているという。ただし発病した患者に対して矢野大軍医一人で外診まで担当しているため、それは中々困る状況なので、代理公使を随行して漢城へ行って留まっていた戸塚小軍医を釜山に呼び戻すよう要請した[35]。ただ大軍医一人で釜山の全域を担当するには、現実的に相当の無理があったのである。

2)「虎列剌予防竝取扱方規則」の条項別規定

釜山管理官が日本人居留民たちを中心にして先に行い、朝鮮政府にも翻訳して伝えた予防規則の正式名称は「虎列剌予防竝取扱方規則」である。全体 19 個の項目になっている[36]。その内容を簡単に纏めながら紹介してみよう。

1 条にはコレラの感染と伝播経路、2 条に病の潜伏其間、3 条に消毒法、4 条に石炭酸水を用いた消毒、5 条にコレラ患者と関わりがある用品の運搬と焼却、6 条に患者衣服の日光消毒、7 条に薫蒸消毒、8 条に死体と棺の処理が挙げられる。次の項目からは絶影島に設けられた避病院の運営に関する内容が書かれているが、検疫委員の管理監督に従うべき内容が大勢を占めている。9 条は患者の家族が見舞いに行く時の対処方法、10 条は完治患者の退院手続き、11 条は一人で居住し、あるいは貧しく看病人を雇えない人や不潔な地域で雑居して予防消毒法を施行できないと認められる者に対する避病院への送致、12 条は他人との接触に関する許可、13 条は患者の家に対する識別標及び出入統制、14 条は患者の排泄した汚染物の処理に関する注意事項、15 条は下水溝などに対する消毒実施について記している。続いて、16 条は患者が使った寝具衣類の焼却処理、17 条は死体を焼却場まで運搬する過程での処理方法（黄色の小さい旗にコレラという文字を書

33　同じ時期、日本の各地で発生したコレラの患者数を簡単に提示してみれば次のようになる（杉山弘「コレラ騒動論：その構図と論理」『自由民権と近代社会』〔新井勝紘編，吉川弘文館，2004 年〕，155 頁を基に表を作成）。

県名	埼玉県	滋賀県	岐阜県	静岡県	山梨県	栃木県	秋田県
患者数	635	551	445	1,268	1,026	784	916

34　『日本外交文書』巻 12，文書番号 130「朝鮮國内外人コレラ病感染ノ景況上申ノ件」，234 頁。

35　『事務始末』巻 13：釜山往復，1879 年 9 月 15 日，代理公使花房義質宛の管理官前田献吉報告。

36　『事務始末』巻 8：虎列剌病予防往復，イ号，1879 年 8 月 8 日，代理公使花房義質宛の管理官前田献吉報告の附属書類。『事務始末』巻 13：釜山往復，1879 年 8 月 8 日，代理公使花房義質宛の管理官前田献吉報告の附属居留地達写。

くこと)、18 条は患者運搬道具の消毒と処理方法を含んでいる。最後に、19 条にはコレラに対して医師の診察をもらった後、それに罹ったことを知ったにも係わらず、此点に関して怠けたり、違反したりするときは厳重に処分すべきことを規定した。

「虎列剌予防竝取扱方規則」の内容は、明治 10 年の内務省達乙第 79 号「虎列剌病予防心得」と明治 12 年の太政官第 23 号「虎列剌病予防仮規則」から選別されて出たものである[37]。第 1 条から第 8 条までは、「虎列剌病予防心得」の予防法附録消毒薬及其方法で確認される。第 9 条から第 19 条までは、「虎列剌病予防仮規則」の第 9 条から第 15 条、第 18 条、第 20 条、第 21 条及び第 24 条の内容とほぼ一致する。但し、第 8 条と第 9 条のなかで、死体の火葬と埋葬、避病院の設置を絶影島で行うという条項は、朝鮮の状況を念頭に置きながら新たに記入された部分に当たる。

4. コレラの対処過程で現れる朝日両国の認識

1）絶影島の避病院と倉庫設置に対する朝鮮の撤去要求

7 月 16 日、荒川徳滋八等属は朝鮮の辦察所へ行って絶影島に消毒所を設ける件について話した。この件については荒川が作成した記録と朝鮮側の公文を比べて見ると、発言の内容で記録上の相違があることが確認される。まず、絶影島は牛と馬を飼う牧畜地であり、ここに日本が求めた消毒所を設置することについては朝廷へ伺うこと（判断権限がないから上部へ報告して命令を受けるはず）に対しては、両方の記録が一致する。だが、両方の考えの差異は、絶影島に建物を設けることにあった。荒川は、「小軒ヲ造立シ船隻ノ来ル毎ニ乗組ノ人数並ニ荷物等ヲ其所ニ揚ヶ消毒法ヲ行ヒ、而シテ人ト荷物等ハ直ニ我港内ニ引キ入ルルトキハ該症伝染ノ憂ヲ免レ候而已ナラス、彼我生霊ノ大幸ト存候」といいながら、「一宇ヲ設クルハ一時コレラ病予防ノ為ニシテ永ク建込候訳ニ無之」とした。東萊府使がこんな要求をすぐに受け入れるはずがないとしてこれを断ったところ、「コレラ病伝染ハ目前燃眉ノ急成ニ因リ如此懇議ヲ尽スト雖モ、絶影島ハ牛馬ノ牧場重地ヲ論シ、或ハ朝家ノ許可ヲ得スンハ一宇ノ建物も難許抔ノ云々實ニ了解不致候」と不満を披瀝した[38]。では、朝鮮側の訳学と東萊府使はこの問題についてどのように発言したのか。朝鮮側の記録に因ると、訳学は既に設館を通じて境界を決めたこともあり、幕を設けることも条約にはないから、朝廷の命令がある前に勝手に許されないと反対の意思をしっかり述べた[39]。東萊府使も、これは前にはなかったことで、政府からの処分を待たずにまず幕を設置しようとすることから、その情況を考えれば、もっと狡猾して悪いものだと判断し、これを厳に禁止することを訳学が伝えよと命じた[40]。この問題について政府のもとでも、これは曾てなかった事だから、禁止する方が宜しいと暁諭することを指示した[41]。ここで注意すべき点は、朝鮮側からは、まだ条約に載せられていない要求事項だと判断して絶影島に臨時的にも消毒所の設置を許可しないという処分を下したが、日本の記録にはこの内容までは載せられていないことである。

この会談から 2 日後の 7 月 18 日、日本は実際に絶影島内に消毒所を設ける作業に着手しはじめ、一週間後に完成した上、消毒法の実施段階に移っ

37　山本俊一 , 前掲書 ,865 ～ 871 頁の附録資料を参考。

38 『事務始末』巻 13：釜山往復，8 月 16 日来信附属番外。

39 『倭使日記』巻 11, 六月初十日到付東萊府使尹致和牒報。「是如故答之，以設館既有定界，結幕又無條約，況此島卽牧地封山也，朝令之前，不可自下擅許云爾」。

40 『倭使日記』巻 11，前掲資料。「今此館倭之謂，以救病欲爲結幕於牧地已，是無前之事，而不待政府處分，先欲結幕者，究其情狀去益狡惡乙，仍于令譯學嚴飭禁斷」。

41 『倭使日記』巻 11，前掲資料。「題辭。此是曾所未有之事，曉諭禁止爲宜向事」。

た[42]。避病院では松前十六等出仕が勤め、港内のコレラ患者に関する治療は戸塚軍医が担当した。此に加えて、避病院まで設置が必要だということを朝鮮側へ通報した。しかし、慶尚監司李根弼はこの事件が発生したころ、その展開過程を中央にすぐ報告しながら、関係者の処罰について伺った。まず、かれは絶影島を管轄していた多大浦僉使韓友燮に対して罷職させた。此れに加えて、東萊府使尹致和に対しては、その地域（絶影島）は封土の重要なところであり、それは条約にもなかったことなので、府使は法律に依り叱って曉諭することも出来ないし、事件が起きる前に制止することもしなかったから、以前には一度もなかったことが発生するようになったといいながら、その責任を問って処分することを要請した[43]。それに対して議政府では次のように国王高宗に処理方向を伺った上[44]、許可を得た。

日本側が伝染病のため仕方なく一時的に消毒所を設置したことについては、朝鮮の朝廷もある程度の情状を参酌しようとした。しかし、これをそのままに捨て置いてはいけないと判断したため、撤去させることを命じた。条約に載せられていない事項であるが、この問題に関連された地方官をすぐ処罰することよりも、一応は懐柔策を用いて問題となった事件を収拾しようとする配慮が窺える。ところが、8月末に日本側が絶影島の内に貨物を保管できる倉庫6間を仮設置して、再び問題になってしまう。前田管理官はコレラの盛行とそれに伴う交易中断を理由として倉庫の設けの合理化を試した。だが、訳学劉光杓は日本側が先般に避病院を設置したものも、もう「規定以外の事」だったのに、これに加えて倉庫を新たに増築することは道理があるまいと言い、速やかに撤去することを求めて来た。この報告に接した慶尚左兵使の李泰鉉も、倉庫設置が言い訳であることを把握し、早く撤去させるように命じた[45]。最初に避病院を設けた時と同じに、状況に対して臨時変通が欲しいといいながらも、正式に朝鮮政府と協議をしなくて絶影島の内に倉庫のような建物を増築した仕業は、確かに条約違反に当たる可能性が高い事項であった。それなればこそ、朝鮮側は即刻撤去するよう要求したのである。絶影島への空間拡張要求はその後も続いて朝日間で懸案になっていくものであるが、1879年の避病院設置においてすでに始まっていたのである。

ともかくも、この時期には朝鮮の地方官吏たちの場合、条約文に根拠になる規定がなく、「辺政」に当たる問題と認識していた。それ故、日本側が撤去するように彼らをよく懐柔せよという伝統的方式で問題解決に臨んでいたことが窺える。同じ時期だが、朝日両国のあいだで無関税の問題をめぐって花房公使と交渉を進めていた朝鮮政府では、関税を自主的に設定するためには新しい対応論理と接近方法が現実的に必要だと切感したこととは少し相違があるかも知れない[46]。新たに条約を結び始めた1879年の時点において、未だ中央政府と地方官庁のあいだでは、日本に対して条約の締結と運営という次元で、論理的に鋭く攻駁して相手を問い詰める方法よりも、善処や曉諭を通じて問題を解決しようとした姿が垣間見える。

2）避病院の設置とコレラの発生経路に対する日本の認識

一方、前田管理官は避病院の設置がいま至急のことを強調した。かれは「速カニ撲滅不致テハ却テ巨多ノ費用ヲ要スルノミナラス、平素不潔ヲ極メタル

42 『事務始末』巻8：虎列剌病豫防往復，1879年8月8日，代理公使花房義質宛の管理官前田献吉報告。

43 『倭使日記』巻12，6月19日啓下。「有亦以其地則封岡所重，以其事則條約所無，該府使不能據法責諭先事阻搪，有此前所未有之事」。

44 『承政院日記』高宗16年6月20日。『高宗純宗實録』高宗16年6月20日。

45 『高宗純宗実録』高宗16年8月4日。

46 朴漢珉「1878년 두모진 수세를 둘러싼 조일 양국의 인식과 대응」『韓日関係史研究』第39号（韓日関係史学会，2011年）。

韓人ニ伝染候テハ容易ナラサル義」と述べた[47]。蔓延しているコレラを防ぐために多くの費用がかかっても、初期で避病院を設けるのが重要な懸案であることを強調した。そう言うながら、一方では韓人らが「不潔」だから伝染病が拡がると恐れた。彼らが平素とても「不潔」だという認識は、後に外務卿宛に発送した公文のなかでも繰り返して言及された表現である。これに加えて、彼はコレラ伝播の原因を朝鮮内部から発生したのではないだろうかと本人の考えを述べた[48]。しかし、そのように彼が推論した根拠は、2年前（1877）に住永九等属が全羅道地域まで出張した頃のことから出たから、直接に発病の因果関係を結び付けることには無理があると思われる。

コレラが朝鮮の全羅道地域から発生したと理解したものは鳳翔艦の艦長であった山崎景則も同じだった。彼は、「日本地長崎神戸大阪ハ少々コレラ病流行」の便りを伝えながら、「釜山浦日本居留地ハ右病気無之候得共、韓人ニコレラ病大流行ノ由之レハ全羅道ヨリ来リ候由ニテ、當時館中韓人ノ往来ヲ絶候由ナリ」という話をした[49]。この船に対しては検疫委員が消毒を行い、医員も出張して治療をするようにした後、回航させた[50]。

厳密にすると、コレラがどこから発生して朝鮮のなかで拡散するようになったかについては資料上に断定することは無理であろう。しかし、釜山内でコレラの初発生より10日ほどの前に、管理官が対馬からのコレラ患者の発生現況に関する情報を確認しつつ、そこから伝播しないようにもっとも警戒していたこと、初めの感染患者が日本居留地内で7月21日に発生して以後、急激に拡散したこと、三木栄などの医学史研究者がすでに日本で大流行していたコレラが朝鮮に伝播して北上したと指摘した研究などを合わせて考える必要があるだろう。いづれにせよ、釜山地域の状況は好転したが、それにも関わらず、京畿の以北地域までコレラが拡散し、少なくとも朝鮮全体人口のほぼ1%の人々がコレラに罹って死亡したことは、当時コレラの恐ろしい威力をよく示している。

5. おわりに

コレラが盛んに流行した1879年は、朝鮮が開港した直後の時点であった。この一年のあいだで朝鮮全地域では、7万3千人ぐらいの人口が急激に減らした。開港場である釜山を中心にしてコレラの予防をするための防疫活動が、まず日本人居留者を対象として行われた。だが、これは地域内で限定的な効果しかなかった。また朝鮮と日本の間で緊密な協調を通じて検疫システムを構築し、コレラが朝鮮全域に拡散されることを防ぐには至らなかった。但し、官吏らの間でコレラの発病患者及び死亡者の数について管理の次元で情報が共有されながら、予防規則の伝達が為されたこと、避病院と検疫所の設置をめぐって条約運営上の騒ぎがあったことは、それから後、開港場を中心にする疾病の輸入と防除をするための検疫規則の制定まで繋がる前に草創期の状況が如何に進められたかを示している。

日本側の場合、居留民の保護とコレラ患者の拡散を防ぐための「緊急性」を理由として絶影島の内で一時的に避病院と検疫所を設置することを一応成功させた。この中には朝鮮人を「不潔」だと見下す認識も含まれていた。しかし、朝鮮からは「朝日修好条規」や「貿易規則」の条約文のなかでこれらの設置に関する根拠条項がなかったから問題になった。事案の緊急性のためにこれを一応許可した地方官たちを善処し、該当施設を絶影島から撤去させるように命じた。この時期では、まだ「辺政」を治めるとい

47 『事務始末』巻13:釜山往復,8月16日来信附属の第4號,1879年7月12日，外務卿寺島宗則宛の管理官前田献吉報告。

48 『事務始末』巻13：釜山往復，韓人虎列剌病ニ感染ノ景況上申，1879年8月，外務卿寺島宗則宛の管理官前田献吉報告。

49 『事務始末』巻14：軍艦往復，1879年8月15日，花房公使・近藤書記官宛の山崎景則公文。

50 『郵便報知新聞』1879年8月22日,「朝鮮釜山浦の近況（7月23日附通信）」。

う伝統的な視角に基づいて事態に接近していたことが分かる。これは条約の締結がすべての対応方式において、即刻的に変化を齎さなかったことを示しているのではないかと思う。ここには海外から輸入される物と人に対して、検疫が可能な機構としての海関と緊密に関わりがある検疫規定が、依然として朝鮮のなかで公式的に定着されていなかったことも大きく影響を及んだ。1880 年に入ると、釜山の他に元山と仁川が新たに開港され、各開港場には海関が設けられた。それに加えて「朝日通商章程」(1883 年）も締結された。しかし開港場の検疫に関して体系的な取締規定が完成される時期に到るまでは、もう少し時間が必要だった。1886 年のコレラは 3 つの開港場でいまだ一貫された検疫規則がない状況で再発し、検疫仮規則及び伝染病予防仮規則の制定と適用をめくってさまざまな問題が朝鮮と各国の間で発生した。この問題については今後の研究を通じて詳しく検討するつもりである。

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The Correlation between Perceived Social Support and Mental Health among Adolescent Street Children

ジャカルタなど３都市で、路上生活の子どもたちの生活実態と精神衛生面の問題を調査し、いかなる公的・私的な支援が必要かを考察する。

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Abstract This study was conducted to investigate the correlation between perceived social support and mental health among adolescent street children. Perceived social support is measured by adapting Multidimensional Scale of Perceived Social Support (MSPSS) developed by Zimet, Dahlem, Zimet, and Farley (1988) and mental health measured by Mental Health Continuum-Short Form (MHC-SF) developed by Keyes (2002). Data was analyzed by using Pearson Correlation. A sample of 60 adolescent street children in Jakarta, Bogor, and Depok, cities in Indonesia participated in this study. The result shows positive and significant correlation between perceived social support and mental health ($r = 0.377$, $n = 60$, $p < 0.01$, two tailed). Most of participants have families and maintain contact with their families by returning home. Most of them assumed their parents as significant others in their lives.

Keywords mental health, perceived social support, street children, adolescent

Introduction

Child is a bud who will grow and become the next generation of a nation. For becoming a good figure a child certainly need to get proper support from their environment, especially from their family. To receive family support and protection is a basic right of every child. But in reality, not all the children get the right which must be gotten. It happens to them who are poor like the abandoned children, street children, children who are traded to another place, children with low economic status, etc. (Mangunsong, 2011).

Poor children phenomenon like the street children is a problem which needs special concern because of the great number of them. Social Ministry Data shows that in 2005 there were 46,800 street children who were spread in 21 provinces in Indonesia (www.ilo.org). Based on National Data from 2010, street children in Indonesia reached 85,013 children who were spread in 33 provinces (Nugraha, 2013). Social Ministry Data shows that street children in Indonesia reached 230,000 (Sutriyanto, 2011; The Jakarta Post, 2012).

Street children have many reasons why they finally choose street as their home or workplace either for temporary or forever. There are many street children who leave from their home because of psychological, physical, or sexual violence (UNICEF, 2005). Lalor (1999) also mentioned that significant factor which causes the children come to street is violence at home. In Indonesia, where the number of street children is rising, almost 70% of them escapes from their home because of poverty and violence in their family (Mulyadi, 2008).

The selection of the street as their home to avoid negative condition which they get at home factually

can cause possibility for them to get any other negative condition. When they are on the street, children are susceptible to any kind of exploitation and act of despising also far away from ideal condition of life like what Children Right Convention is hoped (UNICEF, 2005). They also susceptible to starving, diseases, accident, and any kind of exploitation (Kombarakaran, 2004). UNICEF (2005) explains that street child cannot be a part of conflict to some parties who should protect them, like in some cases when police or competent authorities did act of despising, caning, even arresting and murder that were done by societies because of thinking the street children cause problems even in this case often involve district government or does not respected by their district government. Lalor (1999) also stated the similar thing that street children are very susceptible to violence and become victim either police, other street children or people who go through the street.

The street life is full of challenges. According to Koller and Hutz (2001), street children often face more risk than other normal children. They explain that bigger risk is caused by street children who face not only physical, social, and emotional negative factor at home but also on the street. Some researches show that street children are getting high hopelessness level, susceptible to depression and depressive disease (Woan, Lin, & Auerswald, 2013). Most of street children feel that they have no bright future and are getting difficult life (UNICEF, 2002).

The most interesting one Aptekar (cited in Koller & Hutz, 2001) stated that compared to their siblings who decide to keep stay at home, street children are mentally healthier. Observation which was done by Koller and Hutz (cited in Koller & Hutz, 2001) found that street children can through their life on the street even so full of risk because they can develop a coping strategy and they are resilience in facing condition that is susceptible of risk. Koller and Hutz (2001) mentioned that to develop and survive in difficult environment, street children implement an effective strategy that is to join a group that thrives on street and is called "gang". Street children join a "gang" on purpose to protect themselves (Lalor, 1999). "Gang" as if become replacement family when they spend their time on the street while they are far away from their family. Agnelli (cited in Lalor, 1999) explains that in a "gang," a child gets a status, happiness, admiration, protection, and brotherhood. Also they can find some new identity that will be strengthened by the unique language that can be understood by only members of that "gang" or in other word esoteric slang. Finding family replacement during on the street reflects that street children need to keep emotional relationship with family member, even though they seem to be enjoying the free spirit of having no parental control, but actually they need the warmth and care of a family (Kombarakaran, 2004).

Besides joining in a group or famously called "gang" as effective strategy that was done by street children, according Koller and Hultz (2001) street children also develop some kind of peer relationships that are emotional group and business group. Emotional group is functioned if street children want to spend their night by having fun together. While business group is functioned as protection and need fulfilment placed to survive their life. The other strategy that are done by street children is going to social organization for getting food and make it as a protective place. Kombarakaran (2004) also explained about the usage of facilities that are provided by non-government organization (NGO) s to fulfill the needs of street children. In Indonesia, there are NGOs or social organizations that are not just functioned to fulfill needs of food and home but also education. Demartoto (2012) explained that education has a role as socialization, selection, distribution, and social integration media. Therefore, street children who take that opportunity can get social support through social relationship which was made inside like when they are in a "gang" or peer relationship.

According to Thoits (2010), social support refer to emotional help, informational help, or simply from significant others like family member, friends, or job partner also can be a real support which is received from other people (received social support)

or perception which is available support when it is needed (perceived social support) is more profitable. Dunkel-Schetter and Bennet (1990) also Wethington and Kessler (cited in Thoits, 1995) stated that perceived social support has very strong influence to mental health than received social support. A person with high perceived social support has a belief that their family and friends are certifiable to give appropriate help in difficult condition (Lakey, n.d.). This is fit in with Thoits research (cited in Taylor et al., 2004) stated that real support (received support) given by other people can be different which is needed so, according to Cohen and McKay (1984) also Cohen and Wills (cited in Taylor et al., 2004), can cause failure to fulfill receiver needs.

Besides more profitable, perceived social support has role in well-being which is mental health component. Mental health, according to Keyes (2002), describes how people view or value positively their life. Mental health has three components that consist of emotional well-being, psychological well-being, and social well-being (Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2010). Perceived social support role in well-being can be seen in some research result below. Martinez, Aricak, Graves, Myszak, and Nellis (2011) said that a person whose perceptions about existing of social support from important person in their life is one of basic factor which is related to psychological well-being. From emotional well-being side, Turner and Marino (1994) mentioned that perceived social support is related to emotional well-being.

Perceived social support role can be viewed in adolescent. During adolescence there is fast and unstable emotional change so perceived social support role is very important in this age. (Wenz-Gross et al., cited in Martinez, Aricak, Graves, Myszak & Nellis, 2011). Besides that, many researchers found that perceived social support and depression have negative relation (Keleckler & Waas, 1993; Ostrander Weinfurt, & Nay, 1997; Pattern et al., cited in Demaray & Malecki, 2002). This means when perceived social support of a person increases so the depression level will decreases. Depression problem can be found in adolescence. Depression prevalence increase while adolescence (Papalia & Feldman, 2012). Adolescent street children have higher stressed and depression level than those who live normally or are not on the street (Ayerst, 1999).

Problem which is also faced in adolescence is runaway from their home. Runaway is done because adolescent think their parents do not understand them and too much busy with themselves (Santrock, 2014). He explains that runaway process is step in going on from reducing the time in home to spend the time on the street further with their peer. A peer group is social support source that is important in adolescence when their parents' attitude is dissapointed (Papalia & Feldman, 2012).

The researches above show that street children face risk condition which can be impacted to their life, but on the other side they can survive in the street life because they can develop some effective coping strategy so they will be mentally healthy. Through that coping strategy, they can get social support which also has role to their mental health. Research about role of social support, especially perceived social support, just still see the correlation between perceived social support to mental health component separately or have not being comprehensive. Therefore, this research is aimed to know the correlation between perceived social support and mental health comprehensively, especially adolescent street children because there are many cases about runaway from home to the street also about depression case number is increased in adolescence.

Literature Review

Mental Health

Lamers, Westerhof, Bohlmeijer, ten Klooster, and Keyes (2010) explain that mental health concept in the earlier is more defined as there is no psychopathology, but at the last few years has changed by refer to more positive condition. One of figure who describe that mental health refer to positive condition

is Corey L. M. Keyes.

According to Keyes (2002, 2005) mental health is defined as "s*ymptoms of hedonia and positive functioning, operationalized by measures of subjective well-being—individuals' perceptions and evaluations of their lives and the quality of their functioning in life* (p. 540)". Based on that definition can be known that mental health is individual positive feelings to their own life (hedonia) (Keyes, 2005) and individual positive function that was operationalized in subjective well-being column that is individual appraisal to their life quality (Keyes & Simoes, 2012). This is fit in with what Keyes ever mentioned (Keyes, 2002) that in last 40 years, mental health was operationalized and measured for subjective well-being research. Subjective well-being measurement can be done by measuring emotional symptoms that is emotional well-being and functional well-being that consists of psychological well-being and social well-being (Keyes, 2002). In other words, mental health can be detect by measuring emotional well-being, psychological well-being, and social well-being.

To describe mental health, Keyes (2002) introduced the terms of "flourishing" and "languishing". Flourishing is used to describe mentally healthy individual or presence of mental health (Keyes, 2002). Flourishing individual has well-being that can be got if he or she has positive emotion and well functioned psychologically or socially (Keyes, 2002) or in other words he or she has high emotional well-being, psychological well-being, and social well-being (Keyes, 2005). On the other hand, languishing individual shows no mental health (absence of mental health) (Keyes, 2002). The languishing individual has low well-being level because he or she feel emptiness and stagnation like feel hopeless (Keyes, 2002). Keyes (2002) also explained that individual who is in between flourishing and languishing in their life is belong to moderately mentally healthy. In 2002, Keyes developed mental health measurement that is called Mental Health Continuum to know how far an individual getting flourishing, languishing, or moderately mentally healthy.

Mental Health Component

Lamers, Westerhof, Bohlmeijer, ten Klooster and Keyes (2010) stated that there are three components that form mental health that are emotional well-being, psychological well-being, and social well-being. Emotional well-being is a group of symptoms that describes there is or no positive feeling about life (Keyes, 2002), consist of three dimension that are positive affect, happiness, and life satisfaction (Keyes, 2003). Psychological well-being is how far someone is functioned in their own life (Robitschek & Keyes, 2009), consist of six dimension that are self-acceptance, positive relations with others, personal growth, purpose in life, environmental mastery, and autonomy (Keyes, 2002). Social well-being is someone's valuation of her or his function in the society (Keyes, 1998), there are five dimensions that are social coherence, social actualization, social integration, social acceptance, and social contribution (Keyes, 2002).

Factors that Influence Mental Health

Horwitz (2010) explained that social factor influences mental health level. That factor consists of social integration, social stratification, social inequality, and cultural values. First, social integration is active involvement in social relationship, activities, and the role like parents, friend, neighbor, and others (Papalia & Feldman, 2012). Social integration has correlation with positive mental health (Horwitz, 2010). This can be seen from Thoits and Hewitt's explanation (cited in Horwitz, 2010) that people who more often keep contact with other people like family, friend and neighbor, and are also often involved in an organization has better mental health than those who are socially isolated. Beside mentally healthy, people who are socially integrated is more able in stressed coping that is faced because of through the social link that they have, they get more social support, helping hand and sympathy than isolated people (Horwitz, 2010). Second, social stratification is different from

a person to another including authority, status, and resources. Social stratification also has influence to mental health. Third, Link, and Phelan (cited in Horwitz, 2010) mention that gap of social class status like wealth, knowledge, authority, influence and prestige has strong influence to the mental health. McLeod and Nonnmaker (cited in Horwitz, 2010) explain that bad mental health of someone is caused by poverty. Fourth, mental health can be reached on culture that implant the solidarity value in a group (group cohesion), meaningfulness, and life purpose.

Besides that, McCulloch and Goldie (cited in Goldie, Dowds, & O'Sullivan, n.d.) stated that there are something that determine mental health, such as sameness and discrimination in society, unemployment number, social coherence, education, medical infrastructure, neighborliness, family structure, family dynamic, parenting, lifestyle (such as smoking and alcohol consumption habits), financial, physical health. The other important thing in determining mental health is age, gender, and ethnic (Barry cited in Goldie, Dowds, & O'Sullivan, n.d.).

Social Support

Goebert and Loue (cited in Tonsing, Zimet, & Tse, 2012) explain that social support consist of two components that are structural support and functional support. Canty-Mitchell and Zimet (cited in Tonsing, Zimet, & Tse, 2012) said that structural support include social network, how often an individual get in touch with member of that network, reciprocal support, and the quality of support. Functional support is individual perception related with received support level like emotional support, affirmative support and tangible support (House & Kahn, 1985; Kahn & Antonucci cited in Tonsing, Zimet, & Tse, 2012)

Concept of structural and functional support in general is well known with received and perceived social support terminology (Tonsing, Zimet, & Tse, 2012) Therefore, it can be understood that structural support is received social support while functional support is perceived social support. While perceived social support concerns mainly on cognitive aspect, received social support concerns more on attitude aspect. Received social support is behavior component of social support because of needing interpersonal relation role (Dunkel-Schetter & Benner cited in Coventry, Gillespie, Health, & Martin, 2004). Someone can get social support from any parties. According Zimet, Dahlem, and Farley (1988) social support source can be from family, friends, and significant others.

Family. Family is an environment where a child get nurturance, love, and any chances that can be got (Berns, 2013). Family role is not only in giving economic support but also emotional support (Berns, 2013). He explains that economic support is like providing safe and healthy home, clothes, and food for children while emotional support can be done by making interaction each other. Emotional support also can be awareness and involving each other. This is very important to emotional well-being of family member (Berns, 2013).

Friend. According to Santrock (2014), friend is a smaller part of peer group, a place where they can feel friendship, support, and intimacy that are profitable to each other. In adolescence, hours spent with friends are much more than in other age group of life (Papalia & Feldman, 2012). Role of friendship in adolescence can be seen from a longitudinal research done by Wentzel, Barry, and Caldwell (cited in Santrock, 2014). They found that a student who has no friend is more possibly getting emotionally distressed like depression and low well-being, less involved in pro-social activities, and having low value. Positive impact that can be get from making friends certainly must be supported with the good quality of friendship. This is fit in with the explanation that adolescent who has supportive, stable, and close friendship will be easier to be socialized, showing good performance in school, less hostile to others, worried, and getting depression (Berndt & Perry, 1990; Buhrmester, 1990; Hartup & Stevens cited in Papalia & Feldman, 2012).

Significant Others. In this research, significant others is anyone who is important to someone in their life. Canty-Mitchell and Zimet (2000) explains

that significant others or special person is relevant thing that is used on adolescence which is the time to start relationships with girlfriend or boyfriend and the increasing influence of adult people besides parents. The adult besides parents (non-parental adults) that can be relied on adolescent for getting support and have significant influence for them can be from different people like extended family, teacher, employer, trainer, or older friends (Chen, Greenberger, & Farruggia, 2003).

Street Child

The most general definition of street child, based on Inter-NGO at Switzerland in 1985 (UNICEF, 2002), is "any girl or boy who has not reached adulthood, for whom the street (in the broadest sense of the word, including unoccupied dwellings, wasteland, etc.) has become her or his habitual abode and/or sources of livelihood, and who is inadequately protected, supervised or directed by responsible adults" (p. 89).

Refer to that definition, street child is the child who has not reached adult age either boy or girl who make the street as their daily home and/or the place to earn a living, also less of getting protection, controlling, or instruction from adults that should be have responsibility of them.

UNICEF (2002) categorizes street children in two categories, that are "children of the street" and "children on the street". That category based on the relation between street children with adult who are responsible of them and their home (Harju, 2013). "Children of the street" are those who stay and sleep at town street because of homelessness so that it may be they do not get nurturance that should be get because of less emotional and psychological support (UNICEF, 2002). Lalor (1999) mentioned that street is main home for children of the street but they are possible occasionally contact interfacing with their family and visit their home rarely. In the street, they stay with other street children or homeless adult street (UNICEF, 2002). "Children on the street" are those who earn a living or begging for money on the street but at night they back to their home (UNICEF, 2002). In other words, they just work but not stay and sleep on the street. Therefore, they still have contact with their family (UNICEF, 2002).

Street children categorization in two groups is useful, but in other side there are something which is overlapping and in grey area (UNICEF, 2002). Muchini (cited in UNICEF, 2002) explains that there are "children of the street" that totally lost contact with their family but there are also some who still keep contact. Muchini added that some "children of the street" visit their mother or siblings before finally back to their "home" in the street. Besides, street children who in grey area sometimes sleep at home and sometimes sleep on the street are classified to the "children on the street".

Research Methodology

Participants

Participants of this research are 60 adolescent street children consist of boys (n = 55) and girls (n = 5) who come from Jakarta (n = 16), Depok (n = 30), and Bogor (n = 14). Age range of participant is based on definition of adolescent according to Peterson (cited in Schmied & Tully, 2009). That participant were gotten with non probability sampling method, exactly convenience sampling or accidental sampling. Data was taken once in each participant (one shot study design). Then, data were processed using Pearson Correlation statistic method for knowing how significant the correlation between perceived social support and mental health.

Instruments

Perceived Social Support. Perceived social support was measured by using Multidimensional Scale of Perceived Social Support (MSPSS) which was developed by Zimet, Dahlem, Zimet, and Farley in 1988 on purpose to assess the perception of the social support availability which come from family, friend, and significant others. This instrument has been validated on any kind of samples including adolescent (Cheng & Chan, 2004). MSPSS which was used in

this research is the adaptation result which has been done by Trifilia (2013) from English to Bahasa and changed seven scales to four scales. The result of MSPSS four scales test showed that this instrument reliable with 0.817 in reliability coefficient and valid with item-validity coefficient on range 0.295-0.625.

Mental Health. Mental health measurement was done by using Mental Health Continuum-Short Form (MHC-SF), an instrument with 14 items which was developed by Keyes (2002) and has been translated in Bahasa. MHC-SF is functioned to measure mental health which involved emotional, psychological, and social well-being in one questionnaire (Lamers, 2012). Through this instrument, individual position can be known, is he or she getting flourishing (complete mental health), languishing (incomplete mental health) or moderately mentally healthy. MHC-SF has very good internal consistency value which is more than 0.8 and also very good discriminant validity, one of it when it was tested on adolescent in 12-18 years old (C.L.M. Keyes, personal communication, April 7th, 2015). Like the statistic calculation result before which showed MHC-SF is good in measuring the mental health, the probation test result on this research also showed that MHC-SF reliable with 0.841 in reliability coefficient and valid with 0.335-0.578 in validity item.

Variables

This research is consist of two variables which are perceived social support and mental health. Perceived social support is subjective valuation of someone that other people will give support if it is needed, also feel that she or he is loved and valued (Lakey & Lutz, 1996). According to Keyes (2002, 2005) mental health is "symptoms of hedonia and positive functioning, operationalized by measures of subjective well-being—individuals' perceptions and evaluations of their lives and the quality of their functioning in life" (p. 540).

Results

Statistically, result shows that there is significant correlation between perceived social support and mental health, $r = +0.377$, $n = 60$, $p < 0.01$, *two tails*. Research analysis result shows that perceived social support has significant positive relation with mental health. It means the increase of individual perceived social support will make the increase of mental health (flourishing) and conversely. Thereby can be said that more trust an individual to other person will give support when it is needed and she or he will feel that is loved and worth or more positive to view their life, and conversely.

Table 1 General Outlook of Participants based on Gender and Getting School or Not

Aspect	Frequency	%
Gender		
Boy	55	91.7
Girl	5	8.3
Getting School or Not		
Getting School	27	45
Not (but ever)	25	41.7
Not (no information)	8	13.3

Based on table 1, can be known that boy participant (91.7%) is more than girl participant (8.3%). This is fit in with Lalor (1999) who state that in around the world boy street children are more than girl street children. Based on getting school or not aspect nowadays, roughly half of participants are not getting school (55%). But most of them were, in the past, at school (41.7 %). The rest (45%) are still getting school. This result is fit in with researches before which was done in Indonesia by www.ilo.org that more that 50% of street children or on other words most of them still in school age.

Table 2 General Outlook based on Having Family or Not and What was Done During on the Street

Aspect	Frequency	%
Having family or Not		
Still having family and return home/meet up with them after from the street	48	80
Still having family but does not return home/meet up with them after from the street	9	15

Aspect	Frequency	%
Have no family	2	3.3
Unfilled	1	1.7
What Was Done on The Street		
Just Work	53	88.3
Work and live/sleep	3	5
Work and sometimes live/sleep	3	5
Others	1	1.7

Most of participants still have family and return home/meet up with family after from the street (80%). This result is fit in with UNICEF (2005) that there are many street children who still keep contact with their family. On the street, most of participants who still have family and return home/meet up with their family after from the street also during on the street just work, so can be concluded that most of them are in "children on the street" category while the others is "of the street" and "grey" category. Grey category means they who their role is overlap, for example they sometimes live or sleep on the street but sometimes this category is classified in "children on the street" category (Muchini cited in UNICEF, 2002).

Table 3 General Outlook based on Reason Why on The Street and Involved in Group/"Gang" or Not.

Aspect	Frequency	%
Reason on the Street		
Helping parents financially	34	56.7
Runaway from home	3	5
Looking for pocket money	16	26.7
Friends allurement	3	5
Others	4	6.7
Group/Gang		
Yes	26	43.3
No	34	56.7
Involvement of The Activity		
Involved	48	80
Uninvolved	12	20
Having Problems (Ever/Never)		
Ever	49	81.7
Never	10	16.7

Main reason which delivers them to street life is for helping parents financially (56.7%). During on the street number of participants who have group/gang on the street is less than who does not have group/gang (56.7%). Majority of participants are involved in activity which was done in their surrounding environment (80%). During work or live and sleep on the street, majority of them have experienced problems (81.7%). Problems cited by participants are driven from street, chased after or caught by government apparatus and security like police, Social Department, even TNI. Other problems which were faced by participants are forced to give money, driven from surrounding society, suspected as thieve also fight with other street musician (*pengamen*), surrounding society, and public transportation driver, etc. Problems which were faced by participants show suitability with what UNICEF stated in 2005, that the street children do not get rid of conflict with other parties and they should have been given protection to them also what stated by Lalor (1999) that street children is very susceptible with violence and become victim of police, other street children and other people who passed the street.

Table 4 Mental Health Category

Category	Frequency	%
Flourishing	33	55
Moderate	18	30
Languishing	9	15

From the categorization above mental health can be known that majority of participants are mentally healthy (flourishing) (55%). This result does not fit in with some research who shows that street children getting high hopelessness level, susceptible of depression and depressive symptoms (Woan, Lin, & Auerswald, 2013) also most of street children feel no bright future and are having difficult life (UNICEF, 2002).

The fact that there are more adolescent street children who are mentally healthy can be caused by some reasons below:

1. Most of research participants still have family and return back home or keep contact with their family (80%). According to family functions that were stated by Berns (2013), one of its emotional support that can be done by making interaction, caring, and involved each other. This is impor-

tant to emotional well-being of family member (Berns, 2013) include child, not except for adolescent street children. This also can be related with probing result that was done, most of participant mentioned parents as significant others or special person for them.

2. Most of them are involved in surrounding society activities (80%), it means they try to keep contact with other people. Horwitz (2010) stated that social integration has relation with positive mental health (Horwitz, 2010). This is later was explained by Thoits and Hewitt (cited in Horwitz, 2010) that people who more often keep contact with other people like family, friend, and neighbor also often involved in an organization has better mental health than they who is socially isolated. Beside mentally healthy, people who is socially integrated is more able in stressed coping that is faced because of through the social network that they have, they get more social support, helping hand, and sympathy than isolated people (Horwitz, 2010). Adolescent street children who most of them involved in social activity can be seen as a characteristic that appear in adolescence. This is fit in with relation concept according Cameron and Karabanow (cited in Schmied & Tully, 2009) that adolescent making relation with wider social network.

Although this research shows mentally healthy participants but there are something which need to be considered in understanding that result.

1. Researchers do not differentiate chilfren who were found on the street from those in foundation or community. Those who were found on the street are 31 children, while those who were either in foundation or community are 29 children.
2. Instrument that was used in this research used positive items which abstract and more describe about feeling at the moment (here and now) like instrument of mental health not about truly feeling so this can be influence the result.
3. The participants may have emotional problems at home and decided to come to the street. When on the street they can get happiness because they feel free from unsupported family condition, and also get many friends. This can cause they think their life is more positive so mentally healthy.
4. There are more participants who dropped out of school, this means they do not have rules righteously that is implemented at school. There is no rule that must be obeyed or in other words is freedom which is felt by participants can be one of causal factor they think positively their life.
5. Refer to most of participants' reason that they decide come to the street is help parents financial, participants can be understand what they do as a right thing (to help and the ability of them to earn money) so they view positively their life whereas indirectly they do the role that have been not proper for them or it should be done by their parent even less until cause they out of school.
6. Freedom from parental control and disciplines on the street also need to be calculated as a factor that may cause the view of their life as a positive thing.

Conclusion

Based on the result and analysis that has been done can be concluded that there is significant positive correlation between perceived social support and mental health of adolescent street children. This result can be understood that as perceived social support of adolescent street children increases, mental health of them increases. Conversely, the decrease of perceived social support of adolescent street children will decrease their mental health. Besides, can be concluded that most of adolescent street children mentally healthy.

Discussion

Result of research analysis shows that perceived social support has significant positive correlation with mental health, it means the increase of perceived social support of an individual so their mental

health (flourishing) will increase, so does conversely. Thereby, can be said that more trust an individual that of there will be other people who will provide support when needed also feel that they are loved and valued so they will be mentally healthier or think that their life is more positive, and conversely.

Majority of participants (55%) are mentally healthy (flourishing). This means that adolescent street children think and value positively their life. Research result that shows more adolescent street children who mentally healthy (flourishing) is not fit in with some research that shows street children is getting high hopeless level, susceptible of depression and depressive symptoms (Woan, Lin, & Auerswald, 2013) also most of them feel they have no bright future and difficult on their life (UNICEF, 2002).

The more number of adolescent street children who view positively their life maybe happen because most of them return back to home and meet up with their family (80%). According to family functions that were stated by Berns (2013), one of its emotional support that can be done by making interaction, caring, and involved each other. This is important to emotional well-being of family member (Berns, 2013) include child not except for adolescent street children. The other of this research result can explain the role of family to mental health of adolescent street children where there are correlation between family and significant others dimension (which most of according the participant is parents) from perceived social support and mental health which means that adolescent street children believe that family especially their parents will give helping hand when they need and cause they feel be loved and worth.

The more of adolescent street children who mentally healthy (flourishing) can be caused most of them involved in surrounding environment activities (80%) which means they still keep contact with other people. Horwitz (2010) stated that social integration has correlation with positive mental health (Horwitz, 2010). This is explained later by Thoits and Hewitt (cited in Horwitz, 2010) that people who more often keep contact with other people like family, friend, and neighbor also often involved in an organization has better mental health than they who is socially isolated. Beside mentally healthy, people who is socially integrated is more able in stressed coping that is faced because of through the social link that they have, they get more social support, helping hand, and sympathy than isolated people (Horwitz, 2010). Adolescent street children who most of them involved in social activity can be seen as a characteristic that appear in adolescence. This is fit in with correlation concept according Cameron and Karabanow (cited in Schmied & Tully, 2009) that adolescent making relation with wider social network.

Suggestions

Methodological Suggestions

1. Street children in this research can be categorized to special population because the uniqueness of them than population in general. Therefore, it is needed to be considered something such as building rapport and explain what is the purpose of involving them as participant so will be created trust, seriously in answering the questionnaire, and the most important is they are not just an object but also have role on this success of research. Besides, it is needed maintaining in instrument filling (if using instrumentation like questionnaire) and probing for getting deeper information of the answer that they give like how the problem they faced look alike during on the street so it was suggested to do individually administration.
2. On the next research is hoped more sample number from any district or area so it will be more representative of street children in Indonesia, especially in adolescence.
3. Research related with street children also can be done on street children in age of range around less of 12 years old or adult because on the field researcher found the big number of street children who fit in with that criteria.
4. It will be better if conduct longitudinal research related with adolescent street children mental

health to know how far consistency of result which shows that there are more adolescent street children include in mentally healthy category (flourishing).

5. The result shows that there is no fit in between participant number who have mentally healthy with they who joined in a gang (group on the street) can be made for next research for knowing influence of gang (group on the street) existing to mental health of street children or what does the factor that cause street children mentally healthy.
6. Instrument that is used on this research especially mental health has positive items and tend to abstract that can cause participant (even less with uniqueness that is had by street children) differently mean it form the truth purpose. Besides, the items more describe the feel at that moment (here and now) because asking feel during last one month so still uncertain describe the truth feeling of participant. This is need to be considered to use instrumentation that can measure negative feeling from participant so can be known negative or positive feeling that they have.

Practical Suggestions

1. Research result shows that there is positive correlation between perceived social support and mental health especially social support source from family and significant others. Therefore, it is needed role of that parties to give support for adolescent street children even less in fact most of them still have family and stay at home. From this result can be a reference to do intervention by doing activities that involve adolescent street children and their family or significant others.
2. The number of adolescent street children who do not go to school need to have skill training as one of preparation step to face the future because they cannot just depend to street life.
3. Based on research result which describes the majority of adolescent street children involve in surrounding activities, the surrounding parties should invite them in various activities so they can be socially integrated, and clear the negative opinion to street children. This also can increase their mental health.

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Spatial-Temporal Distribution of Carbon Capture Technology Drawing on Patent Data

火力発電所等から出る二酸化炭素の回収・貯蔵（CCS）技術の研究開発と導入がどこまで進んでいるかを、各国の特許取得状況から解析した。

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Abstract Carbon capture & storage (CCS) is a currently available technology that can allow industrial sectors to meet deep emissions reduction goals. The development of carbon capture technology is vital to make CCS viable. As a significant output indicator of innovation, patent can provide a comprehensive view on innovation activities. This study aims to present an overview on carbon capture technology, in the attempt to characterize spatial and temporal distribution based on patent bibliometrics. We make a retrieval strategy and built a database set of 9847 patents in span of forty years from Derwent Innovations Index database. About temporal trend, this study reveals slow increasing phase and sharp increasing phase by annual patent count. Then we presents emerging stage and growth stage by cumulative patent count, drawing on theoretical model of technology life cycle. Year of 2006 is the turning point apparently, but it's not an accident due to shifts emerged in governments, innovators and firms in years before. About spatial distribution, this study highlights eight countries (Japan, USA, France, China, Germany, Netherlands, UK and Korea) who have most of patents in the world in terms of top 50 patent assignee codes. We also introduce another means of CCS project for comparing study between innovation and operation, finding an obvious spatial overlap between patent layer and project layer. Then four categories of countries are found by distinguishing innovational features and (or) commercial statuses. The study tries to show the relative technical development trends across major countries. French occupies top mostly, China ranks up quickly, Japan, USA and Germany rank down relatively. Based on analysis above, we speculate that "Good Time" of carbon capture technology is coming, but operation of CCS project is still in slow growth due to some limitations.

Keywords Carbon Capture Technology, Spatial-Temporal Distribution, Patent Bibliometrics, CCS

1 Introduction

1.1. Climate change and CCS

2015 was the warmest year on record by far [1]. Most of the observed increase in global average temperatures since the mid-20th century is very likely (>90% probability) due to observed increase in anthropogenic greenhouse gases (GHGs) concentrations [2]. The climate will continue to change over the coming decades as more and more heat-trapping GHGs emitted by human activities accumulate in the atmosphere. On the other hand, if not focusing on costs, humanity can solve the GHGs concentrations problem by fifteen available and implemented technologies, including carbon dioxide (CO_2) capture and storage (CCS) [3]. CCS is a currently available

technology that can allow industrial sectors (e.g., fossil-fuel power generation, iron and steel, cement, natural gas processing, oil refining, etc.) to meet deep emissions reduction goals. CCS can contribute one-sixth of CO_2 emission reductions required in 2050, and can contribute 14% of the cumulative emissions reductions between 2015 and 2050 compared to a business-as-usual approach, which would correspond to a 6°C rise in average global temperature [4].

CCS is not a single technology but involves the implementation of the following processes in an integrated manner: separation of CO_2 from mixtures of gases (e.g., the flue gases from a power station or a stream of CO_2-rich natural gas) and compression of this CO_2 to a liquid-like state; transport of the CO_2 to a suitable storage site; injection of the CO_2 into a geologic formation where it is retained by a natural (or engineered) trapping mechanism and monitored as necessary [5]. For enhancing CO_2 usage, utilization of CO_2 is integrated into CCS as CCUS in some countries, such as China [6]. Due to the fact that CO_2 is used maturely in fields such as enhanced oil recovery (EOR), enhanced coal-bed methane (ECBM), CO_2 chemical utilization and CO_2 biotransformation. Nonetheless, these is no essential difference between CCS and CCUS.

Many CCS technologies are commercially available today and can be applied across different sectors. CO_2 capture technologies include types of capture systems (see Fig. 1) such as post-combustion, pre-combustion and oxyfuel combustion, which have been available in natural gas processing, fertilizer manufacturing and hydrogen production. CO_2 transport technologies are the most technically mature in CCS, including pipeline and shipping. CO_2 storage technologies include many of same in oil and gas industry and have been proven to be economically feasible under specific conditions.

1.2. Carbon capture innovation activity

In most CCS systems, the cost of capture (including compression) is the largest cost component due to an additional high energy penalty, which could be reduced by technical development and economies of scale [8,9]. Furthermore, in the view of technology, the development of CO_2 capture technologies is vital to make CCS viable [10]. Meanwhile, in the view of patent bibliometrics, we find that most of CCS patents refer to CO_2 capture technologies in testing extractions which were done at the beginning of this study. Some former studies also revealed that carbon capture patents account for a large part in CCS patents (e.g., [11,12]). Hence, suitability of CCS in industrial applications mostly depends on the costs and readiness of carbon capture [4]. For focusing on the most key point, we study on carbon capture technology in this paper.

There are a number of possibilities for the measurement of innovation [13], which can be divided into two categories: input-based indicators and output-based indicators. Patent is considered as a significant output indicator of innovation or a tangible sign of knowledge, which can give a valuable insight into innovative activity of an object technology [14]. The main advantage of patent is that they are publicly available for rather long time periods and provide detailed technological information [15]. Patent is used in providing a comprehensive view

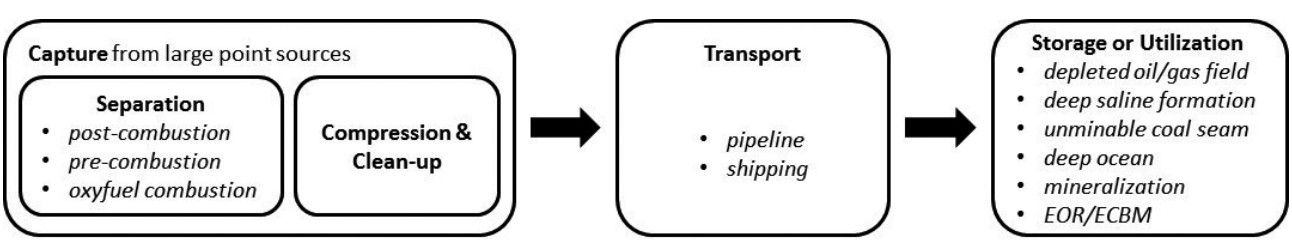

Fig. 1. Carbon capture and storage (CCS) chain. (Note: Modified based on Rubin et al., 2012 [7] and IEA, 2013 [5].)

on innovation activities in many domains, including low-carbon without a doubt. In former refers on low-carbon innovation activities, patent count provides a wealth of information on innovations and inventors as a kind of indication, e.g., [16–23].

Several studies investigated CCS technology or carbon capture technology by using patent bibliometrics. Dechezlepretre [24], WIPO [25] and OECD [18] analyzed a cluster of CCMTs (climate change mitigation technologies) which included CCS as a part, gave brief overviews on CCS technology. Cristina [10], Li [26] and Zhang [27] focused on specific technical routes and reagents in carbon capture drawing on patent bibliometrics or drawing on patent bibliometrics and article bibliometrics together. Wang [11] drew patent map of CCS and discussed technological features in nine countries. Miao [12] drew development paths by a different method from others which was patent citation analysis. We review these studies and make a general comparison (see Table 1).

First, we can divide these articles into two categories by distinguishing the purpose of study. One category is a general report which take CCS as a supplemental field rather than an essential part. Another category is full of specialized words which focus on technical routes mainly. But few studies pay attention on an overall spatial-temporal analysis in scale of all carbon capture technologies, for a deeper understand on developmental trend and technological distribution.

Second, patent count differs widely across studies from 945 to 9840, probably due to various databases, diverse retrieval strategies and distinguishing time span. In general but not absolutely, searching in sev-

Table 1 Former studies related to carbon capture technology by patent bibliometrics.

Refer	Description	Database set	Source
Dechezlepretre 2009 [24]	Took CCS as one of thirteen climate change mitigation technologies, provided an analysis of geographic distribution and international diffusion in an overall view. CCS is negligible, 0.35% of all fields' patents.	954 CCS patents	PATSTAT
WIPO 2009 [25]	Took CCS as one of nine alternative energy technologies, described CCS trends very briefly in terms of technology, although CCS is not, strictly speaking, an alternative energy	6858 CCS patents	EPO, WIPO, USPTO, JPO, KIPO, SIPO
OECD 2010 [18]	Took carbon capture as one of ten CCMTs, presented growth rate, inventive activity, major applicants and average patent family size with other technologies together.	8069 carbon capture patents	PATSTAT
Wang 2010 [11]	Presented CCS patent key word map by Thomson Data Analyzer and Aureka, described growth and IPC distribution briefly, discussed nine countries' technological features.	1171 CCS patents	DII
Cristina 2011 [10]	Gave an overview through patents applications and scientific articles together, presented five technical routes: absorption, adsorption, membranes, enzymatic and thermodynamics.	1123 carbon capture patents	EPO
Miao 2013 [12]	Put forward research ideas based on patent citation analysis approach, different from other refers in this table. Drew the CCS development map and identified the main paths by algorithm of path recognition which based on patent citation.	1498 CCS patents	USPTO
Li 2013 [26]	Gave details on seventy-nine representative patents, presented three technical routes: solvent, sorbent and membrane, made perspectives on potential technical routes.	9840 carbon capture patents	Espacenet
Zhang 2014 [27]	Gave a briefly overview of four technical routes (absorption, adsorption, cryogenic and membrane) and three reagents (absorption reagent, adsorption reagent and membrane reagent) by patent and article analysis, discussed CCS policies in China.	1344 carbon capture patents	USPTO

Note: PATSTAT for European Patent Office Worldwide Patent Statistical Database, EPO for European Patent Office, WIPO for World Intellectual Property Office, USPTO for United States Patent and Trademark Office, JPO for Japan Patent Office, KIPO for Korean Intellectual Property Office, SIPO for State Intellectual Property Office of the People's Republic of China, DII for Derwent Innovations Index database.

eral databases (e.g., WIPO [25] used six databases) or search in an integrated database (e.g., OECD [18] used PATSTAT and Li [26] used Espacenet), could provide a more suitable result. However, Dechezlepretre [24] and Wang [11] got fewer patents from integrated database PATSTAT and Derwent Innovations Index database. The reason we examine is the incomplete search expression in their studies.

Finally, patent family was used popularly. A patent family is a set of similar patents taken in various countries to protect a single invention. Therefore analysis by patent family reflects the number of inventions present more accurately.

Thereby, our study aims at extending these previous studies through the creation of a more complete database set from Derwent Innovations Index database, by using a more suitable search expressions. Then, highlights development stages in forty years and analyzes geographical feature in terms of countries. In addition, employs database of CCS projects at first in similar studies, thus making us able to reveal overlap of patent layer and project layer.

The remainder of this article is structured as follows: Section 2 outlines the data source and retrieval strategy. Database in Section 2 is used in Section 3 to analyze temporal distribution of carbon capture in terms of yearly and cumulative. Section 4 shows spatial distribution, and adopts another means of CCS project count for comparative study between patent and project. Section 5 contains a concluding discussion.

2 Patent database set and retrieval strategy

In this study, Derwent Innovations Index (DII) database of Web of Science (from the I.S.I. Web of Knowledge) is used to search and analyze patent data set. DII database is a widely accepted patent data source that covers over 14.3 million basic inventions from 40 worldwide patent-issuing authorities. For patent bibliometrics study, the most fundamental task is to set the range of retrieval and choose appropriate index words. Based on former studies (see Table 1), search indicators in this study include two dimensions: search topics and search IPC codes.

About search topics, we collected key words of types of carbon capture processes, combined them as one topic search expression by logic operators. Whilst, for a more rigorous search result, we identified thesaurus details of IPC codes related to those key words, combined them as one IPC codes search expression by logic operators too. IPC system is the most popular hierarchical classification system of patents among countries or organizations with official patent offices, launched by the World Intellectual Property Organization (WIPO). We tested dozens of combined search topics and search IPC codes, compared results of inputting different expressions, adopted the most suitable expressions after trial and error. In testing, we found a dozen of world famous vehicle companies, which are not professional in domain of carbon capture at all. Most of patents applied by those vehicle companies related to automobile exhaust gases pollution control. Therefore, we excluded this interference technology expressions by using logic operator “not”. Comparing with foregoing studies, as far as we know, it is the first time to exclude exhaust control technologies in patent data searching by logic operator, for accessing a more concentrative database set of carbon capture patents.

Expressions of search topics and search IPC codes used in this study are as below:

Search topics (description see Table 2a): (CO2 or (carbon dioxide)) and (captur* or recover* or separat* or remov* or absor* or adsor* or membran* or cryogen* or enzm* or combust* or puri* or concentrat* or extract* or compress* or thermo*) not (car or auto* or vehicl* or engin* or exhaust*).

Search IPC codes (thesaurus description see Table 2b): (B01D-000/00 or B01D-053/00 or B01D-053/02 or B01D-053/04 or B01D-053/14 or B01D-053/18 or B01D-053/22 or B01D-053/78 or B01D-053/86 or B01D-053/94 or C01B-003/38 or C01B-031/20 or F23J-015/00 or F25J-001/00 or F25J-003/00 or F25J-003/02 or F25J-003/04 or

F25J-003/08) not (H01M-008/04 or H01M-008/06).

The final patent data searching was conducted on April 2016. A total of 9847 patent files were found in time span of forty years from 1976 to 2015. For each patent in our database, several data fields were extracted such as authorization year, assignee name, assignee code and IPC code etc.

Table 2a Descriptions of search topics

	Search topics	Descriptions
1	CO2	CO2, CO_2.
2	carbon dioxide	carbon dioxide.
3	captur*	capture, captured, capturing, etc.
4	recover*	recover, recovery, recovered, recovering, etc.
5	separat*	separate, separated, separating, separation, etc.
6	remov*	remove, removed, removing, remover, etc.
7	absor*	absorb, absorbed, absorbing, absorbent, absorpt, absorptive, absorption, etc.
8	adsor*	adsorb, adsorbed, adsorbing, adsorbable, adsorp, adsorption, adsorptive, etc.
9	membran*	membrane, membranous, etc.
10	cryogen*	cryogen, cryogenic, etc.
11	enzym*	enzyme, enzymes, enzymic, enzymolysis, etc.
12	combust*	combust, combusted, combusting, combustion, combustible, etc.
13	puri*	purify, purified, purifying, purification, etc.
14	concentrat*	concentrate, concentrated, concentrating, concentration, etc.
15	extract*	extract, extracted, extracting, extractive, extraction, extractable, extractant, etc.
16	compress*	compress, compressed, compressing, compressive, compressible, compression, etc.
17	thermo*	thermo, thermodynamics, etc.
18	car	car.
19	auto*	auto, automobile, automotive, etc.
20	vehicl*	vehicle, etc.
21	engin*	engine, etc.
22	exhaust*	exhaust, exhausted, exhausting, etc.

Table 2b Thesaurus descriptions of search IPC codes

	IPC codes	Thesaurus descriptions
1	B01D-000/00	Separation
2	B01D-053/00	Separation of gases or vapours; Recovering vapours of volatile solvents from gases
3	B01D-053/02	by adsorption
4	B01D-053/04	with stationary adsorbents
5	B01D-053/14	by absorption
6	B01D-053/18	Absorbing units; Liquid distributors therefor
7	B01D-053/22	by diffusion
8	B01D-053/78	with gas-liquid contact
9	B01D-053/86	Catalytic processes
10	B01D-053/94	by catalytic processes
11	C01B-003/38	using catalysts
12	C01B-031/20	Carbon dioxide
13	F23J-015/00	Arrangements of devices for treating smoke or fumes
14	F25J-001/00	Processes or apparatus for liquefying or solidifying gases or gaseous mixtures
15	F25J-003/00	Processes or apparatus for separating the constituents of gaseous mixtures involving the use of liquefaction or solidification
16	F25J-003/02	by rectification, i.e. by continuous interchange of heat and material between a vapour stream and a liquid stream
17	F25J-003/04	for air
18	F25J-003/08	Separating gaseous impurities from gases or gaseous mixtures
19	H01M-008/04	Auxiliary arrangements or processes, e.g., for control of pressure, for circulation of fluids
20	H01M-008/06	Combination of fuel cell with means for production of reactants or for treatment of residues

3 Temporal distribution of carbon capture technology

Practitioners and researchers are often interested in, regarding to a certain technology field, what the tendency is and where it will drive to. For evaluating progress in carbon capture innovation approach, we extract data of authorization year from database set, identify shifts by yearly growth and cumulative development, and then draw some similar conclusions from diverse views.

3.1. Yearly development of patent count

Fig. 2 presents authorized carbon capture patents yearly since 1976, as measured by patent count. The trend shows two phases clearly: 1) fluctuant and slow increasing phase; 2) sharp increasing phase. Apparently, year of 2006 is the turning point of technology development. In fluctuant and slow increasing phase before 2006, annual patent count increased slowly, even negative growth in some years. The AAGR (average annual growth rate) was only 2.6%. The annual average is about 133 patents. In sharp increasing phase since 2006, annual patent count increases quickly, the AAGR was 23.8% from 2006 to 2013. This phase presents a linear increasing with high curve similarity: $R^2 = 0.9908$ (see Fig. 2). The annual average count from 2006 to 2015 is about 636, nearly 5 times of former phase.

The shape increasing since 2006 is not an accident of course, implies many shifts.

First, there is a wide agreement among 100 experts surveyed in Alphen's study [9] that capture facilities are not substantially different from conventional industrial facilities. Thus in most years, carbon capture technology was applied in general sector and grew slowly. As carbon capture being a crucial technology in CCS chain, innovation activities have been booming.

Second, considering it usually needs years to deploy and implement innovation activities by governments and innovators, the increasing trend in carbon capture technology from new century seems to reflect a significant influence of climate change policies since the signing of the Kyoto Protocol in 1997. Dechezlepretre [24] also pointed out that Kyoto Protocol affected innovations in a cluster of climate change mitigation technologies including CCS technology, probably due to innovators reacted swiftly to policy changes, private sector received a strong signal and many countries took early action before ratification.

Third, the increasing trend is also related to environmental concerns and commercial drives [26]. Sleipner project in Norwegian continental shelf is a milestone effort of carbon mitigation, which is called "the mother of all CCS projects", separates and injects 1 Mt CO_2 into saline formation each year since 1996 [28]. On the other hand, several CCS projects are driven by commercial utilization of CO_2 like CO_2 injection for enhanced oil recovery (EOR).

In addition, patent counts in 2014 and 2015 do not correspond with the reality, due to the time lag between application and authorization. Thereby, the last two years are used for comparing rather than analyzing exactly.

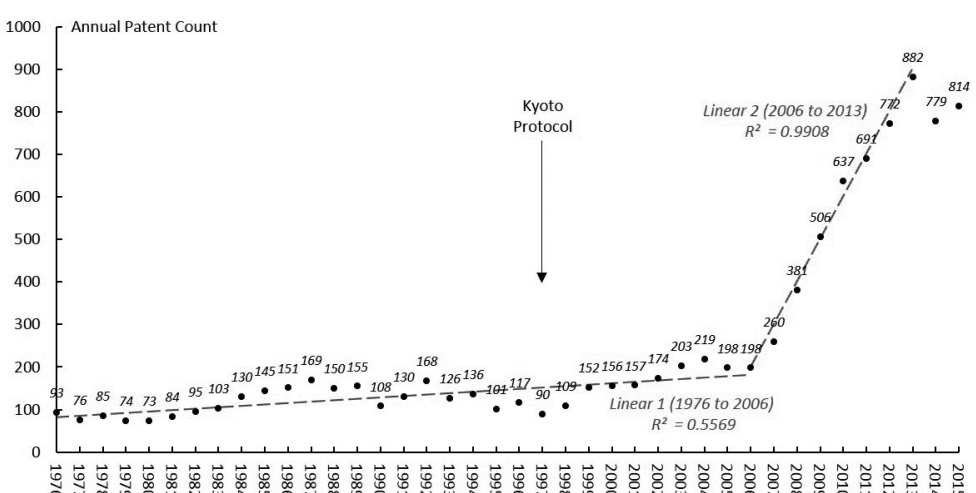

Fig. 2. Annual patent count of carbon capture by authorized year, linear 1 presents trend from 1976 to 2006, linear 2 presents trend from 2006 to 2013. (Data Source: Derwent Innovations Index Database, 2016.)

3.2. Technology life cycle of carbon capture

The concept of technology life cycle is always presented to measure technological changes, beginning from Arthur [29], and it includes two dimensions and four stages. Two dimensions are competitive impact and integration in products or process ---- patent can be regarded as a product of innovation activities. Four stages are emerging, growth, maturity and saturation stages. According to Arthur's definition, the emerging stage is a new technology with low competitive impact and low integration in products or processes. In the growth stage, there are pacing technologies with high competitive impact that have not yet been integrated in new products or processes. In the maturity stage, some pacing technologies are integrated into products or processes. In the saturation stage, a technology becomes a base technology and might be replaced by a new technology. Fig. 3a illustrates the S-curve definition of four stages.

Fig. 3b presents cumulative patent count of carbon capture from 1976 to 2015. Comparing to theoretical model of technological life cycle showed in Fig. 3a, turning period of emerging stage to growth stage is highlighted in Fig. 3b, from 2010 to 2020 around. As a consequence, two stages of technological life cycle can be found: 1) the emerging stage and 2) the growth stage. We believe that the growth stage is coming, a sharp increasing of patent count will be available in future years. Need to point out that, two stages of technological life cycle are in

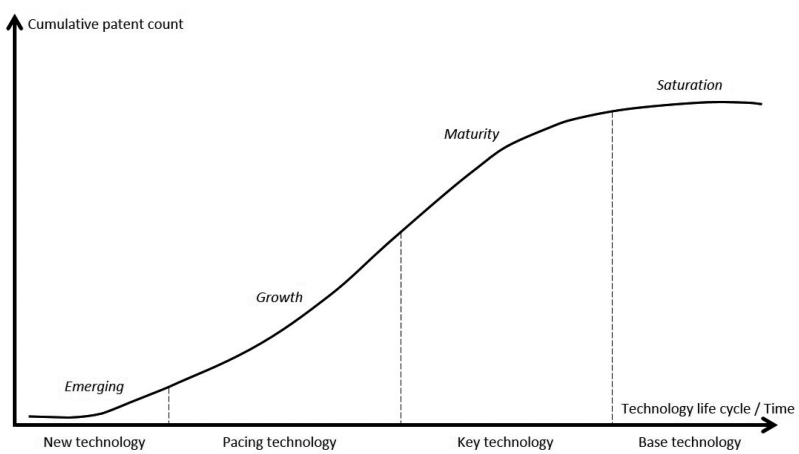

Fig. 3a. The S-curve concept of a technological life cycle by cumulative patent count. (Note: Modified based on Ernst, 1997 [30].)

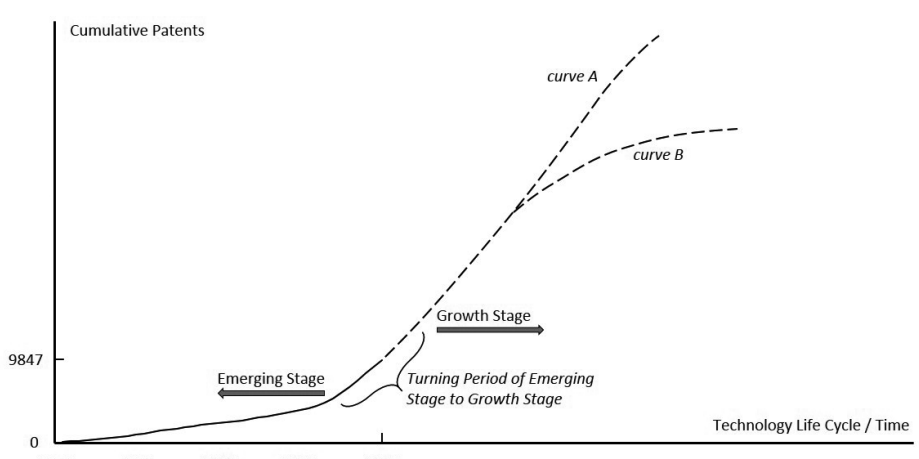

Fig. 3b. Technological life cycle of carbon capture by cumulative patent count. (Data Source: Derwent Innovations Index Database, 2016.)

terms of cumulative patent count, different from two phases by annual patent count mentioned in Fig. 2.

4 Spatial distribution of carbon capture technology

In the previous section, we give a discussion on temporal trend in overall countries. For assessing which countries are leading the innovation and which countries are more active in project operation, we focus on spatial distribution of technology and project together. At first, distribution of patent is presented in terms of top 50 assignee codes. Then, spatial comparison between patent and project is presented. Lastly, we try to discuss relative development trends among high-tech countries.

We identify spatial distribution of patent across countries in terms of assignee code, and try to highlight the relative development trends among high-tech countries by using data of assignee code too. Thus, assignee code should be discussed in front. The wide range of company name variations that can exist in any patent database is a documented problem. Between misspellings, transliterations from other languages, and abbreviations for common words (such as "Co." for "Company" or "Ltd" for "Limited"), many different versions of a company name can be recorded in a patent database, and this can hamper accurate keyword retrieval [31]. Luckily, Derwent indexers address this problem by assignee code. Every patentee in DII has one assignee code, however one assignee code usually contains many patentee names. Patentee names that are contained in one assignee code always have relationships to each other in many cases, such as belonging to a same company, company merger and restructuring, even misspelling of name. Consequently, when we try to survey the innovational level of a company in DII, we extract patents by assignee code, then we won't exclude valid data or include invalid data. Need not to point out that DII is the only patent database that include assignee code. It is also an important reason for us to choose DII as patent data source.

4.1. Spatial distribution of technology

We extract data of assignee codes in carbon capture patent database set. For a more clear and valid result, we choose top 50 assignee codes from total 4613 codes (see Table 3). Top 50 assignee codes own 4232 patent files, account for 42.97% of all

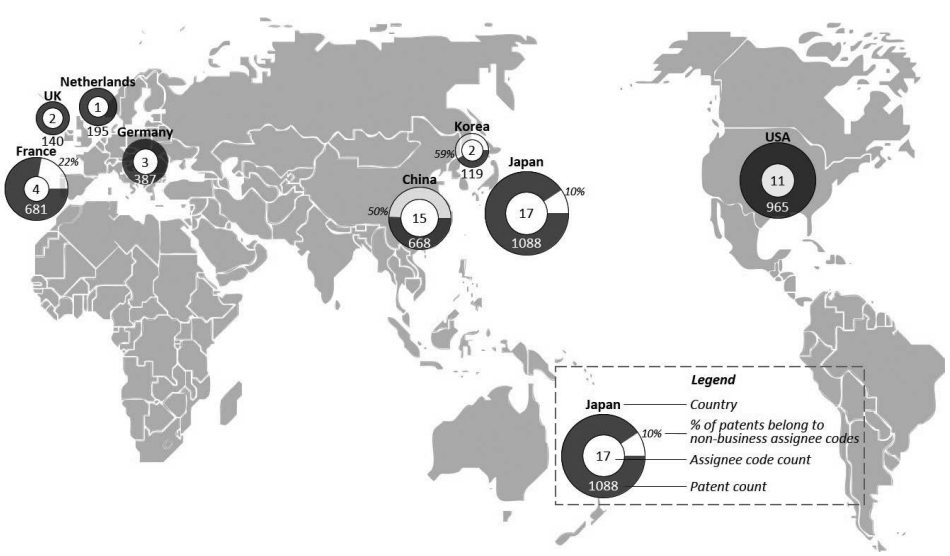

Fig. 4a. Spatial distribution of top 50 assignee codes, of patents belong to top 50, of patent belong to non-business assignee codes in top 50. (Data Source: Derwent Innovations Index Database, 2016.)

Table 3 Basic Information of Top 50 Assignee Codes. (Note: Totally 55 assignee codes because of 6 tying in 50th. Data Source: Derwent Innovations Index Database, 2016.)

Assignee code		Main assignee name	Patent count	Country	Classification
1	AIRL-C	AIR LIQUIDE SA	349	France	Company
2	LINM-C	LINDE AG	229	Germany	Company
3	AIRP-C	AIR PROD & CHEM INC	216	USA	Company
4	MITO-C	MITSUBISHI HEAVY IND CO LTD	211	Japan	Company
5	SHEL-C	SHELL INT RES MIJ BV	195	Netherlands	Company
6	INSF-C	INST FRANCAIS DU PETROLE	152	France	Institute
7	ALSM-C	ALSTOM TECHNOLOGY LTD	148	France	Company
8	ESSO-C	EXXONMOBIL RES & ENG CO	144	USA	Company
9	UNVO-C	UOP LLC	130	USA	Company
10	PRAX-C	PRAXAIR TECHNOLOGY INC	114	USA	Company
11	BRTO-C	BOC GROUP	108	UK	Company
12	HITA-C	HITACHI LTD	108	Japan	Company
13	SHAN-N	SHANDONG SERI PETROTECH DEV CO LTD	100	China	Company
14	TOKE-C	TOSHIBA KK	90	Japan	Company
15	NIIO-C	NIPPON SANSO	88	Japan	Company
16	BADI-C	BASF AG	87	Germany	Company
17	SNPC-C	CHINA PETROLEUM & CHEM CORP	85	China	Company
18	GENE-C	GENERAL ELECTRIC CO	81	USA	Company
19	YAWA-C	NIPPON STEEL CORP	79	Japan	Company
20	UNIC-C	UNION CARBIDE CORP	72	USA	Company
21	SIEI-C	SIEMENS AG	71	Germany	Company
22	KOER-C	KOREA INST ENERGY RES	70	Korea	Institute
23	KANT-C	KANSAI ELECTRIC POWER	55	Japan	Company
24	DOWC-C	DOW CHEM CO	52	USA	Company
25	FUJF-C	FUJI FILM CORP	51	Japan	Company
26	CALI-C	CHEVRON USA INC	50	USA	Company
27	HITG-C	BABCOCK-HITACHI	49	Japan	Company
28	ISHI-C	ISHIKAWAJIMA HARIMA HEAVY IND	49	Japan	Company
29	KEPC-C	KOREA ELECTRIC POWER CORP	49	Korea	Company
30	KOBM-C	KOBE STEEL LTD	48	Japan	Company
31	UBEI-C	UBE IND	44	Japan	Company
32	UYZH-C	UNIV ZHEJIANG	44	China	University
33	BEIJ-N	BEIJING YEJING TECHNOLOGY CO LTD	42	China	Company
34	UTIJ-C	UNIV TIANJIN	42	China	University
35	SEIT-C	SUMITOMO SEIKA CHEM CO LTD	41	Japan	Company
36	CHIK-N	CHIKYU KANKYO SANGYO GIJITSU KENKYU	40	Japan	Institute
37	CHHU-N	CHINA HUANENG GROUP CLEAN ENERGY TECHNOL	39	China	Company
38	RENA-N	RES INST NANJING CHEM IND GROUP	39	China	Company
39	CHSC-N	CHINESE ACAD SCI PROCESS ENG INST	38	China	Institute
40	DUPO-C	DU PONT DE NEMOURS & CO E I	38	USA	Company
41	UYQI-C	UNIV QINGHUA	38	China	University
42	MATU-C	MATSUSHITA ELEC IND CO LTD	37	Japan	Company
43	WANG-I	WANG Y	36	China	Individual
44	FLUO-C	FLUOR TECHNOLOGIES CORP	35	USA	Company
45	ZHAN-I	ZHAN-I	35	China	Individual
46	KAWI-C	KAWASAKI STEEL CORP	34	Japan	Company
47	MEMB-N	MEMBRANE TECHNOLOGY & RES INC	33	USA	Company
48	UYCH-N	UNIV CHINA PETROLEUM	33	China	University
49	UYDA-C	UNIV DALIAN TECHNOLOGY	33	China	University
50	AGEN-C	AGENCY OF IND SCI & TECHNOLOGY	32	Japan	Institute
51	BRPE-C	BP ALTERNATIVE ENERGY INT LTD	32	UK	Company
52	GEOR-N	GEORGE LORD METHOD RES & DEV AIR LIQUIDE	32	France	Company
53	JIAN-N	JIANGSU RUIFENG TECHNOLOGY IND CO LTD	32	China	Company
54	NIIT-C	DOKURITSU GYOSEI HOJIN SANGYO GIJUTSU SO	32	Japan	Institute
55	UYSE-C	UNIV SOUTHEAST	32	China	University

9847 patent files. Top 50 assignees include most of influential companies, institutes and universities in carbon capture technology in the world. In addition, because of 6 assignee codes tying in 50th, there are fifty-five assignee codes in top 50.

Fig. 4a shows that top 50 assignee codes, 4232 patents, are concentrated in eight countries—Japan, USA, France, China, Germany, Netherlands, UK and Korea in order from most to fewer. First, East Asia, EU and North America have most of patents in the world, comparing the economic vitalities in these areas. The only developing country is China, whose patent count is increasing quickly in last 5 years. Second, the performance of Japan is particularly impressive as it ranks first both in patent count and assignee code count. Nevertheless, inventors from EU have more patents in average. Each inventor in Netherlands has 195 patents, in France has 170 and in Germany has 129. On the other hand, each inventor from USA, UK, Japan, Korea and China has 88, 70, 64, 60 and 45 patents. Third, countries in East Asia and France have more non-business assignees such as universities, institutes and individuals. 59% of patent files in Korea, 50% in China, 22% in France and 10% in Japan are contributed by non-business inventors. This status highlights the fundamental role of research-based organizations who get the financial assistances from governments in some countries.

4.2. Comparison between technology and project

All of our discussions above are trying to characterize features of spatial-temporal distribution by patent. However, patent is not the only innovation indicator. Another widely used indirect approach is the effect of technology. We consider large-scale integrated CCS project as an approximate effect of carbon capture technology, also a final-output production of innovation. Thus this study employs count of projects for understanding the spatial relationship between patents and projects. In addition, a large-scale integrated CCS project is a full-chain project (see Fig. 1), which is defined as a project involving the capture, transport and storage of CO_2 at a scale of 1) at least 800,000 tons of CO_2 annually for a coal–based power plant; 2) at least 400,000 tons of CO_2 annually for other emissions–intensive industrial facilities [32].

Fig. 4b presents spatial distribution of forty large-scale integrated CCS projects, which are distinguished in five stages [33]: identify, evaluate, define, execute and operate. Namely some of projects are in operation and some of them will begin in the coming years, although a few of them will be cancelled.

First, as more and more countries drawing a plan for CCS development, CCS demonstration projects are operated world widely. Canada, Norway, UK, Netherlands, USA and Australia are early birds, who planned full-scale CCS demonstrations in a variety of applications before 2009 [34], then China, Korea, Algeria, Brazil, Saudi Arabia and United Arab Emirates are involved in the list.

Second, an obvious spatial overlap is found between patent layer (Fig. 4a) and project layer (Fig. 4b). There are 31 large-scale integrated CCS projects in USA, China, EU and Canada, accounts for 77.5% of 40 projects in the world. On the other hand, as we have discussed above, East Asia, EU and North America own the most patents in the world. The overlaps between patents and projects imply a crucial role of innovation to development of CCS.

Finally, CO_2-EOR (enhanced oil recovery) is the most primary storage type in CCS chain, drives twenty-three large-scale integrated CCS projects. As a practiced commercially technology since the early 1970s in USA, injection of CO_2 to improve recovery of oil was operated in nearly 140 projects globally since 2010 [5]. Significantly, CO_2-EOR improves large-scale integrated CCS projects not only in so-called high-tech countries, also in so-called low-tech but oil-rich countries, such as Saudi Arabia, United Arab Emirates and Brazil. CCS projects are much meaningful for technical diffusion, by channels of international trade and foreign direct investment [35].

Fig. 5 presents fifteen countries in terms of patent and project, reveals four categories. The four categories point out three main aspects. First, a cor-

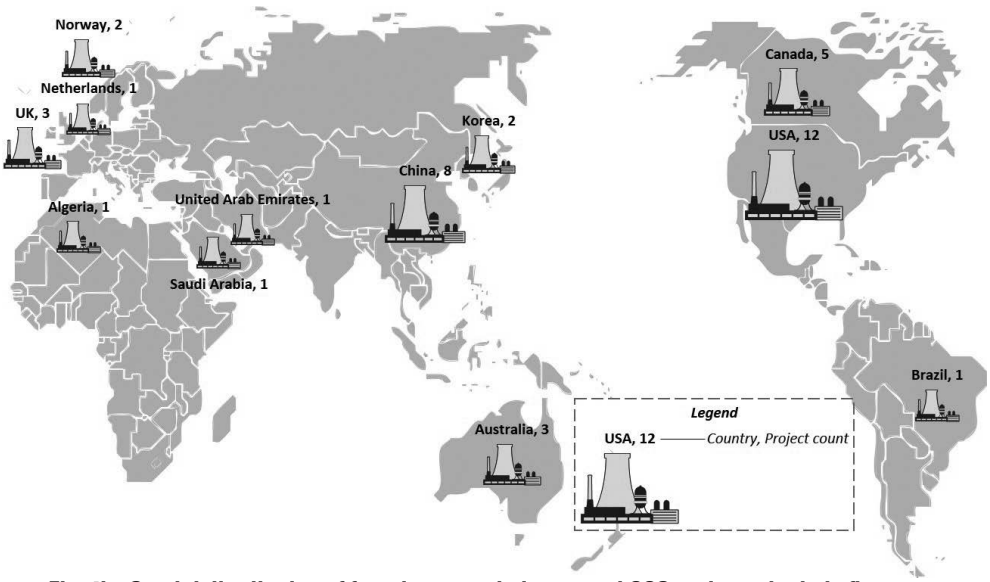

Fig. 4b. Spatial distribution of forty large-scale integrated CCS projects, include five stages of identify, evaluate, define, execute and operate. (Note: More details can be found in data source: Global CCS Institute, 2016 [33].)

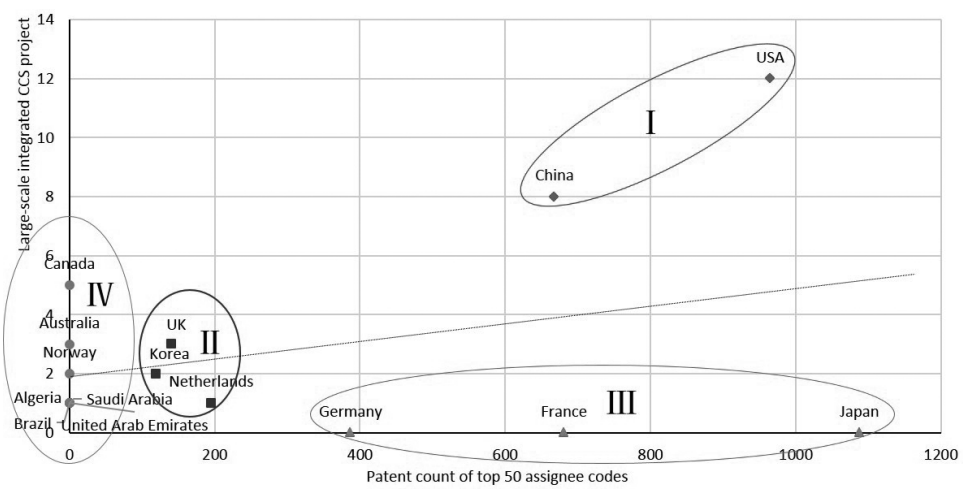

Fig. 5. Four categories of fifteen countries in terms of patent count of top 50 assignee codes and large-scale integrated CCS project. (Data Source: Derwent Innovations Index Database, 2016 and Global CCS Institute, 2016.)

relation is found between projects and technologies, although is weak. Second, lack of technology cannot block project operated, on contrary, high-tech is not the sufficient condition of CCS project. Third, as a complex system project, CCS project is limited by many factors, but CO_2 sources and sinks lie at the core of feasibility [36].

Category Ⅰ includes USA and China, the biggest developed and developing country, each of them has more patents and more projects at the same time. USA and China both are oil (gas) producing countries and depend heavily on coal as a fuel [4]. Fur-

thermore, as they all have vast territories and waters, it's possible to find more appropriate geologic formations. By IEA, almost 80% of CCS projects is expected to be deployed in China and USA, in where CCS could grow to become a major industry in itself [37].

Category Ⅱ includes Netherlands, UK and Korea, each of them has fewer patents and fewer projects than Category Ⅰ. Most of projects in Category Ⅱ are in stage of evaluate, standing for needing around five years to be in stage of operate.

Category Ⅲ includes Japan, France and Germany, which are all developed and high-tech countries in carbon capture. Category Ⅲ and Ⅰ stand out as world leaders in innovation of carbon capture together. However category Ⅲ countries do not implement any large-scale project, partly due to restriction of suitable geological storage options (e.g., Japan) and lack of CO_2 sources (e.g., France and Germany).

Category Ⅳ includes Canada, Australia, Norway, Algeria, Brazil, Saudi Arabia and United Arab Emirates, each of them is implementing or plan to implement CCS large-scale projects, although they are not high-tech countries in carbon capture field. Norway is the first country that operated a pilot-scale CCS project in 2008, capturing CO_2 from nature gas processing and injecting in geologic formation offshore without EOR. Canada and Australia are easy to explore feasible geologic formations due to vast territories and waters like USA and China. Projects in Canada, Algeria, Brazil, Saudi Arabia and United Arab Emirates are all about oil and gas industries, some of projects capture CO_2 from nature gas processing, some of storage CO_2 for EOR.

4.3. Rank changing in top 10 assignee codes

For trying to highlight the relative trends across major high-tech countries, we examine the top 10 assignee codes in last 10 years in terms of country. As noted in the previous section, countries such as Japan, USA, France, China, Germany, UK and Korea have more patents than other countries. Thus, companies or institutes from these countries are consequently involved in top 10 assignee codes.

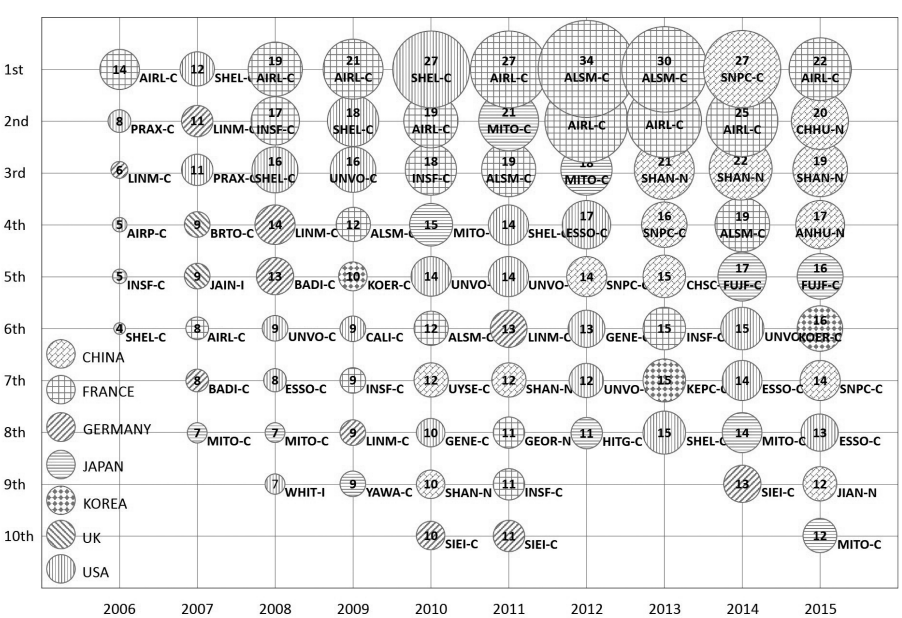

Fig. 6a. Top 10 assignee codes in 10 years, five-letter code presents assignee code, number in bubble presents patent count, bubble dimension represents the patent count belong to assignee code.

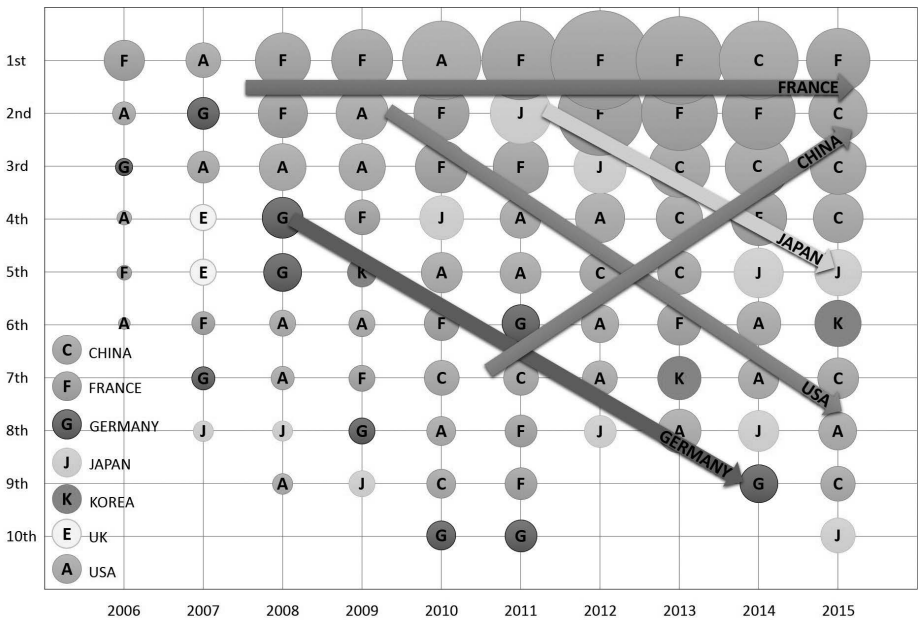

Fig. 6b. Top 10 assignee codes in 10 years and trends of countries, a bubble with capital letter represents an assignee code, capital letter in bubble represent country that own this assignee code, bubble dimension represents the patent count belong to assignee code, an arrow presents the relative development trend of country whose name is signed in arrow. (Note: Because of tied codes, assignee codes in last ranks were omitted in some years. Data Source: Derwent Innovations Index Database, 2016.)

About Fig. 6a and 6b, the y-axis reports ranking of top 10 assignee codes by year. Fig. 6b is based on Fig. 6a, presenting the trends more visually by some arrows that represent countries. First, it is very impressive that French companies occupied in 1st and 2nd mostly, such as Alstom (ALSM-C) and Air Liquide (AIRL-C) topped the list for seven times in ten years together. Second, Chinese companies emerged frequently since 2013, notably topped in 2014 (China Sinopec) and arranged from 2nd to 4th in 2015 (China Huaneng, Shanghai Longking and Anhui Huaertai). It seems that inventors from China will apply more patent files in years. Third, ranks of companies from Japan, USA and Germany are lower than before, mainly due to initiatives of Chinese companies.

5 Conclusion

This study adopts at least 6 patent indicators for quantifying spatial-temporal distribution of carbon capture technology by patent bibliometrics. Meanwhile, the study adopts data set of large-scale integrated CCS project for comparing with patent. First, we speculate that "Good Time" of carbon capture technology is coming, although later and weaker than some other low-carbon technologies. As count of authorized patents keeps increasing rapidly since 2006, the technology life cycle of carbon capture is or will be soon in growth stage. Second, carbon capture patents distribute mainly in East Asia, EU and North America. However CCS projects locate more widely. Third, in the view of innovation, carbon capture technologies is vital to make CCS viable. However, in the view of commercialization, CCS project operation is impeded by limitations, including CO_2 sources and geological conditions. From former studies [5,8,10,38], limitations also include lack of policy and economic drivers, restrictions from local laws and international conventions, environmental concerns on carbon escape from storage, etc.

This study has some limitations that should be acknowledged. First, we give a review by means of patent count, but some biases exist due to the fact that patent count does not represent the whole portfolio of patent analysis. Second, there can be some biases in cross-country comparisons by top 50 or top 10 assignee codes rather than all assignees. Third, we can't give deep discussions on e.g., international technology diffusion and project development trend, due to insufficiency of research methods. In addition to address these limitations, further study will place more emphasis on the method of patent bibliometrics (e.g., citation analysis) by using visualizing and analyzing software, for providing a wider scale discussion and a precise analysis, characterizing technology spillover and diffusion across countries, and presenting suggestions of CCS development for organizations, governments, innovators and firms.

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Zakat as a Solution Toward Poverty: Based on The Practice of Lazismu Ums

イスラム法（シャリーア）により義務づけられている寄付行為（zakat）を組織化し、貧困解消に役立てているインドネシアの事例を検証する。

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Abstract

Indonesia is currently facing a major problem of the nation's welfare. Of the 240 million people, 60 million are poor. 100 million people are prone to be poor, their income is slightly higher than the poor.10% of the almost poor have a chance of falling into poorer in the next year. This shows the failure of the economic system adopted by the State in realizing distributive justice. Today's economic system causes excessive concentration of wealth and social problems of disparity. The gap may reduce the benefits of high economic growth, where economic growth is basically to reduce poverty. If poverty is not dealt with in the next 10 to 15 years, poverty will increase three-fold.

Indonesia is trying to be a provider of welfare services by providing a social safety net for the poor. Unfortunately, 85% of social safety net is not targeted well and not enjoyed by the poor. It needs "the third way" as an alternative since capitalism and socialism are not able to overcome poverty. Islamic economy puts emphasis on the economic distribution, and zakat (almsgiving) is the most important method in the realization of economic distribution and as a solution to reduce poverty. Muhammadiyah is a pioneer in social welfare reform, particularly it is theological and it is activities related to zakat. This study will deal with (1) the Islamic doctrine of Islamic Philanthropy (2) the mechanism of zakat on poverty reduction (3) How Muhammadiyah manage philanthropy activities in a modern organization.

Keywords Poverty, Zakat, Islamic Philanthropy.

Introduction

Indonesia is currently facing a major problem of the nation's welfare. Of the 240 million people, 60 million are poor. NGO activists argue that the number of Indonesian people in poverty reaches 70 million people, but BPS (Bureau of Public Statistics) quibbles if poverty in Indonesia is only 28 million people. Apart from differences of data shown by BPS and activists, a problem of poverty is still a crucial issue in Indonesia.

If poverty is not handled properly in the next 10-15 years, it will increase three-fold or more. This is caused by:

1. The increasing number of elderly
2. The poor people have more children
3. The tendency of low education

Every month the poor families receive around IDR 1,080,000 (US$ 78)[1] as cost of living divided into 67% for food, 28% for homes, 5% for health and education. This small proportion in health and

1 1US$= IDR 13.850, January 26 2016

education resulted in their children educated and health will remain low, so that poverty will be inherited to their children.[2]

In addition, there are 100 million people who are almost poor, 10% of them have a chance of falling into poverty in the next year. Economic shocks such as illness, natural disasters, loss of employment or inflation can easily make them impoverished. According to Enny Sri Hartati, Director of the Institute for Development of Economics and Finance (INDEF), the large population of almost poor today reflects the failure of the previous government in designing and implementing the quality of economic development programs.

Economic growth is expected to reduce poverty and the government draws up a number of development policies to boost economic growth. However, development policies to promote economic growth in developing countries make economic inequality in each region gets wider since factors of production (capital and labor resources) concentrate in the developed regions. The increasing gap makes difficult for poor people to escape from poverty. Eastern Indonesia is disadvantaged area compared to the rest of Indonesia, especially Java. Indonesia is a country with the highest inequality among Southeast Asia.

"The main strategy of effort against poverty and reduce inequality is by helping the poor help themselves, through the provision of more jobs to earn more income. We also need to ensure children across Indonesia have equal access to quality services, so that they can start life with justice," according to the Chief Economist of the World Bank in Indonesia, Vivi Alatas. One of the efforts of the State to help the poor is by giving social safety nets. The budget for social security increases every year, until today Indonesia spend 0.7% of GDP (Gross Domestic Product) for programs of social assistance compared to Brazil using 1.5% of its GDP and so do other middle low-income countries.[3] Unfortunately, 85% of the budget for poverty alleviation in Indonesia is not on target, the majority of the budget is not enjoyed by the poor.[4]

According to the World Bank Country Director for Indonesia, Rodrigo A. Chaves, "Eradicating poverty and inequality will be the most important challenge for the next government of Indonesia. By implementing effective public policies as equal as partnering the private sector and civil society organizations, the World Bank believes, Indonesia will make substantial progress. Alleviating poverty and shared prosperity is a World Bank mission, and we will support the new government in achieving these goals."[5]

One of the civil society organizations that have played an active role in alleviating poverty in Indonesia is Muhammadiyah. Muhammadiyah is one of Islamic voluntary organizations in Indonesia. Compared to many other Islamic voluntary organisations, Muhammadiyah's work in the area of philanthropy was (and is) exceptional, since it initiated philanthropic practices for social welfare and educational projects, such as establishing and maintaining schools, hospitals, and orphanages. The puritan spirit of Muhammadiyah brings a high-spirited and action-oriented attitude to its implementation of the Islamic teachings of philanthropy. Islamic philanthropic practices named zakat (almsgiving), alms (donations, giving), and waqf (religious endowment).

In this paper, there are three main parts. The first part describes the Islamic doctrine of Islamic Philanthropy. The second section will discuss zakat mechanism to fight poverty. The last section surveys how Muhammadiyah manage philanthropic activities in a modern organization.

2 Average of Expending poor family, Indonesia Poverty, Infografis World Bank.

3 Penurunan Kemisinan di Indonesia Melambat, Ketimpangan Meningkat: World Bank. September 23, 2014

4 Pengentasan Kemiskinan: Pemerintah Tak Efektif Tekan Angka Kemiskinan. Agus Supriadi & Elisa Valentia Sari, CNN Indonesia. November 03, 2014.

5 Penurunan Kemisinan di Indonesia Melambat, Ketimpangan Meningkat: World Bank. September 23, 2014

I. Zakat and Islamic Teaching of Islamic Philanthropy

Zakat is a religious levy aimed at purifying the individual, and the payment of Zakat brings a Muslim nearer to Allah. Zakat is the third of the five fundamental pillars of Islam. It is a continuous obligation on the rich for the welfare of the poor in an Islamic community. The Qur'an has repeatedly exhorted Muslims to pay zakat. The following are some verses enjoining Zakat:

"and they have been ordered... to establish regular prayers and to pay Zakat..."[6]

"... and in their wealth and possessions is assigned a right for the needy and those who suffer deprivation"[7].

"... and render to the kindred his due right as well as to the needy and the wayfarer, and do not squander (your wealth) senselessly".

Zakat is the right of God on every wealth in the hands of Muslims. If the owner of the wealth is minor or insane, his guardian must pay the Zakat once it is due. This obligation is expressly stipulated in the Quran:

"(O Mohammad) Take out of their possessions Sadaqat so that you may cleanse and purify them thereby, and pray for them..."

Who should pay zakat and subjected to Zakat payments

Every Muslim person must pay Zakat if he/she possesses wealth that exceeds *nisab*[8].

"For it is He who has brought into being gardens- (both) the cultivated ones and those growing wild - and the date-palm, and fields bearing multiform produce, and the olive tree and the pomegranate: (all) resembling one another and yet so different. Eat of their fruit when it comes to fruition, and give their due on harvest day". [9]

Bukhari related that the Prophet (P) said, "There is Sadaqat imposed on every Muslim". Some asked, "What if the Muslim has nothing to give?" He said, "Let him work with his hands so that he benefits himself and pays Sadaqat".

Subjected to Zakat payments:

1. animal wealth;
2. commercial assets;
3. gold and silver;
4. agricultural production;
5. honey and animal products;
6. mineral wealth and treasures extracted from the earth or sea;
7. estates, factories and all other earning assets;
8. income from employment;
9. labor and professional income,
10. Shares and stocks (bonds).

Avenues (Mustahiq) of Zakat

In verse 9:60, God has designated where to spend Zakat.

"The alms are only for the poor and the needy, and those collect them, and those whose hearts are to be reconciled, and to free the captives and the debtor, and the cause of Allah and for the wayfarer; a duty imposed by Allah, Allah is knower, wise."

Based on the verse has as eight classes entitled to accept zakat as follow:

1. the poor (*fuqara*),
2. the needy (*masakin*),
3. zakah collectors (*amilin*),
4. those newly converted to Islam (*muallaf*),
5. ransoming of slaves (*riqab*),
6. the debtors (*algharimin*),
7. in the cause of Allah (*fi sabilillah*),
8. and the wayfarers (*ibnu sabil*)

(Aziz on Firdaus et al. 1993).

6 Qur'an 95: 5

7 Qur'an 51:19

8 Nisab is limit of exemption

9 Qur'an 6:14

II. Zakat in Taking out of Poverty

Zakat is an Islamic fiscal instrument that has extraordinary potential for investment. If the potential of zakat is done properly, it will be a very large source of funding, so it can become the driving force of economic empowerment and equal distribution of income. So that it can improve the national economy.

Islam and income distribution

Zakat is important in Islam since it aims at achieving an equitable distribution of resources among present individuals and future generations. Also Islam stresses the need to give the poor the chance to review their rights in such a way so that their pride and dignity can be preserved and upheld. Here are the purposes of zakat in Islamic economy:

1. The purpose of da'wah

What is meant here is the da'wah for Islam and to straighten of love to Allah. The most obvious example is existence of category for the newly converts in zakat.

2. The purpose of education

Distribution of zakat in the perspective of Islamic economy can realize some of the goals of education, where the most important are as follows:

a. Education to cast morality character, such as easy to give alm, charity, and share with others.
b. Purify the despicable characters, such as stingy, greedy, and selfish.

3. The social objective

The most important social objectives in the distribution are:

a. Meet the needs of the needy, and to build the solidarity character in the Muslim society.
b. Strengthen the bond of love and affection between individuals and groups in society.
c. Scrape the causes of hatred in society, which will have an impact on the realization of public security and tranquility.
d. Fairness in distribution, includes:
   - Distribution of resources;
   - The distribution of income from the factors of production.
   - Distribution among people, and distributive justice between today generations and future generations.

4. Economic Interest

Distribution in Islamic economy has important economical goals which include the following:

a. Asset development.
b. Empowering human resources who are unemployed.
c. Contribute to the realization of economic welfare, since the level of economic welfare associated with the level of consumption.
d. The best use of the economic resources.

Zakat as an alternative instrument for poverty alleviation

Zakat becomes an effective alternative instrument in alleviating poverty and has many advantages compared with conventional fiscal instrument. Zakat is a form of social security with an objective to ensure the minimization of income inequality and social justice. The nature of zakat is, should be able to give benefit to consumption and production to improve the well-being and eradicate poverty. Zakat should be distributed equitably to the mustahiq in accordance with the Shari'a. Here are the characteristics that make zakat as an effective alternative instrument for poverty alleviation:

1. The use of zakat has been clearly specified in Shari'a (QS. At-Tawbah: 60) where the charity is only for eight groups (ashnaf) only[10]. Other than eight groups it is unlawful to receive zakat. These eight groups characteristics make zakat inherently pro-poor.
2. Zakat has low tariffs and fixed and never changes because it is regulated by the Shari'a. For example, zakat applied to trade, the tariff of only 2.5%. Because of this low tariff, the application of zakat will not interfere investment incentives and will create the transparency of public policies and provide business certainty.

10 See Avenues of Zakat.

3. Zakat have different rates for each type of different treasures, and provide relief for businesses that have a higher degree of difficulty in production. For example, the tariff Zakat for agricultural products resulted from irrigated land is 5%, and the charge become 10% if it's produced from rain field land. Therefore zakat is market-friendly because it will not interfere with the business climate.
4. Contemporary *ulama* in the opinion zakat is imposed on a broad basis and covers a wide range of economic activities. Zakat was also taken from the revenues generated from the asset or skill workers. Thus, it has potential for very large charity. This becomes an important base for financing poverty programs.
5. Zakat is a spiritual tax that must be paid by Muslim under any circumstances, therefore the acceptance of zakat tends to be stable. This will ensure the continuity of poverty alleviation programs in the long term.

The multiplier effect of Zakat

If the implementation of worship zakat is done systematically and organized, it will give many multiplier effects that does little to increase revenue, as described in the Quran surah Al Baqarah verse 261:

"The example of those who spend their wealth in the way of Allah is like a seed (of grain) which grows seven spikes; in each spike is a hundred grains. And Allah multiplies (his reward) from whom He wills. And Allah is all-Encompassing and Knowing."

Economically zakat multiplier effect can be explained as follows: it is assumed zakat is given in the form of consumptive. It will increase the purchasing power to mustahik to buy item he needs. Consequently it will have impact in increasing the production of companies; this increases the production capacity, which means the company will absorb more labor. The increased production would increase the taxes paid by the company to the state. When revenues increase, the state will have the ability to build infrastructure for development and to provide

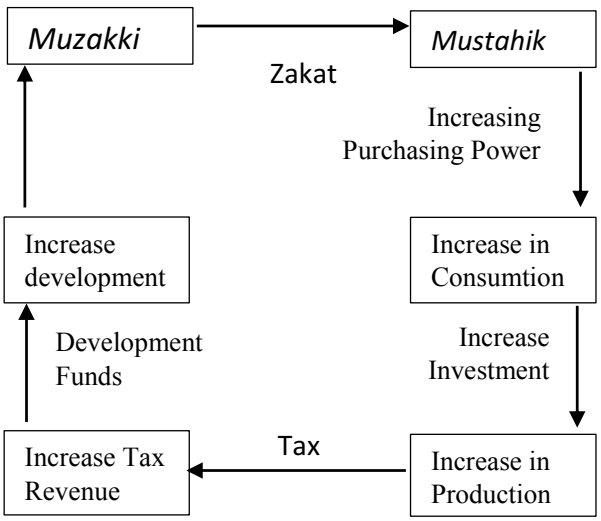

Figure 1. The Multiplier Effect of Zakat in Economy

public facilities for the community. If zakat is given in the productive form such as working capital or revolving funds, then of course the multiplier effect obtained will be greater in the economy.

Based on this mechanism, it can be seen that the proper management of zakat, professionalism and accountability will be able to empower the charity and will give significant multiplier effect in the economy, especially in helping the government to reduce poverty through community empowerment programs. This mechanism shows that alms in the consumptive form has a significant influence, more over if zakat distributed in the productive form then the multiplier effect will have greater impact in the economy. And it will be able to bring a significant effect in poverty alleviation in a country.

Potential Zakat in Indonesia

Indonesia has huge potency of zakat. Rough calculation results made by Eri Sudewo in 2006, as mentioned by Miftah (2009), showed that the potential of zakat in Indonesia could reach 10.8 trillion rupiah per year. According to the calculations mae by Public Interest Research and Advocacy Center (PIRAC) in 2007, based on a survey of 2500 respondents in

11 major cities zakat potential in Indonesia was Rp 9.09 trillion.[11] Meanwhile, Muhammad Syafii Antonio, a Sharia economic expert mentions that the potential zakat Indonesia can reach Rp 17 trillion. Then according research made by Ivan Syaftian, a researcher from the University of Indonesia in 2008, the potency zakat in profession amount to Rp. 4.825 trillion per year.[12]

But it is unfortunate that the great potential of zakat have not tapped maximally yet. Until now, the amount of zakat collected by BAZNAS and LAZ throughout Indonesia is about Rp 3 trillion. This is because the way of paying zakat by people in society still traditional. Where, people (*Muzakki*) gives zakat directly to recipients (*Mustahik*). Zakat can be explored maximally by channeling the zakat when there is renewal in the truly organized body as was done by Muhammadiyah. Muhammadiyah was the pioneer in transforming traditional practices of giving zakat into a different practice which is truly organized philanthropy body. In 2002 Muhammadiyah found LAZISMU (Lembaga Amil Zakat, Infaq and Shodaqoh Muhammadiyah) to collect Zakat from the public, manage and distribute zakat to mustahik.

III. Muhammadiyah and Modern Islamic Philanthropy

Modern philanthropy is an activity of giving and volunteering for public needs that are managed by an organized institution. Islamic philanthropic practices, namely *zakat*, *alms*, and *waqf*, were initially practiced in Indonesia as individual direct giving and unmanaged, but then gradually became organized. The first attempt to organize Islamic charitable alms was initiated in the early twentieth century by Muhammadiyah. Muhammadiyah was the pioneer in transforming traditional practices of giving alms into organized philanthropy body, by mobilizing community resources for religious social change in the name of religion. Muhammadiyah was established on November 12, 1912.

Three Bases for Muhammadiyah's Philanthropy

Amelia Fauzia discussed three aspects playing behind Muhammadiyah's philanthropic reforms: Al-Ma'un theology, modernism, and puritanism. Al-Ma'un theology refers to chapter 107 of the Qur'an, entitled Al-Ma'un (small kindness, almsgiving). It reads:

"Have you seen the one who denies the Recompense? For that is the one who drives away the orphan. And does not encourage the feeding of the poor. So woe to those who pray. [But] who are heedless of their prayer1869. Those who make show [of their deeds]. And withhold [simple] assistance."

The verses generally encourage generosity, particularly for orphans and poor. They demonstrate an understanding of religious Existentialism, making it clear that religious rituals, such as prayers, should have social effects. They carefully label those who are unkind to orphans and the poor as hypocrites. The idea of religious morality, especially from this Al-Ma'un chapter, was given serious attention by the founder of Muhammadiyah, Kyai Haji Ahmad Dahlan (1868-1923). It provided the Muhammadiyah's pursuit to become the best group or community (*Khairul ummah*) that ordains the good and forbids the evil (*ya'muruna bil ma'ruf wa yanhauna wa anil munkar*).

In addition to the Al-Ma'un theology, modernism and puritanism contributed important elements to the creation of a strong movement to organize charity and to change the culture of direct giving. Modernism contributed to Muhammadiyah certain mechanism term and legal effects, while modernists brought the culture of rational thought. Among the products of modernism were the establishment of (modern) schools, hospitals and orphanages, the registration

11 Press Release "Meningkatkan, Kesadaran dan Kapasitas Masyarakat dalam Berzakat". PIRAC. 2007.

12 Al Arif, M. Nur Rianto. Efek Pengganda Zakat Serta Implikasinya Terhadap Program Penentasan Kemiskinan. Jurnal Ekbisi Fakultas Syariah UIN Sunan Kalijaga. Yogyakarta. Vol.5, No. 1. December 2010, page 42-29.

of donors and *waqf* properties, and the culture of transparency and accountability. The puritan spirit contributed a rational approach to religious teachings on philanthropy. In other words, Muhammadiyah's struggle against superstition, non-authentic religious inventions and religious delusions (*takhayul*, *bid'ah* and *churafat*, abbreviated as TBC) and also initiated in charitable matters. The products were ijtihad on organized payment and distribution of zakat and use of zakat for orphan, the poor and the needy.

Muhammadiyah develops local initiatives to establish the institutions that are responsible for collecting, managing and channeling philanthropy. In some areas they have established philanthropy management institutions with different names, such as: Assembly Endowments, Lazmupul, treasury, Lazisfa. Muhammadiyah also established a philanthropy management agency named Bapelurzam. Bapelurzam is run by central leader of Muhammadiyah and operations supported by the structural shape. However, in operational Bapelurzam considered to be failed, from 300 Bapelurzam in every district/ cities throughout Indonesia there are only 2 Bapelurzam running well. In 2002 Muhammadiyah establish Lazismu as philanthropic management institutions that are more transparent and accountable.

Lazismu and Islamic Philanthropy Fund

In the middle of the modernization of the institutional managers of philanthropic organizations in Indonesia which has lasted more than a decade, Muhammadiyah has taken the initiative to establish an institution named Lembaga Amil Zakat Muhammadiyah, shortened Lazismu. This institution has important role in building collective awareness among Muhammadiyah members to project funds coming from *zakat* and *sedekah*. Lazismu was established in Jakarta in 2002, it was confirmed by the Minister of Religious Affairs of the Republic of Indonesia as a Lembaga Amil Zakat National under Decision 457/21 November 2002. Lazismu is actively campaigning, offering new ideas of philanthropic fund management model in Muhammadiyah and has built networks in various areas. Some new networks have been formed with government agencies, corporations, and other civil society organizations.

In operating the programs, Lazismu is supported by Multi-Line Network, a consolidated network of charity organizations that are spread across the provinces (in district /city). It makes Lazismu's empowerment programs are able to reach all areas of Indonesia in a rapid, focused and on targeted.

As a national amil zakat institution, Lazismu receives donations from various parties. Because of its civil society base, the support from members and sympathizers of Muhammadiyah to Lazismu is very large up to 94% and 6% of contributions are from citizens of non Muhammadiyah. Thus, it is a job for the boards of Lazismu to optimize the sources of funds outside Muhammadiyah members.

Figure2. Muhammadiyah University of Malang.

Figure 3. PKU Muhammadiyah Hospital in Surakarta.

Muhammadiyah has the potential of large amount of philanthropy funds derived from two sources, namely Muhammadiyah and Amal Usaha Muhammadiyah. Amal Usaha Muhammadiyah is a term for enterprises owned by Muhammadiyah. It has an important role in mobilizing the philanthropic tradition of Muhammadiyah. There are a number of substancial social funds (donation and alms) managed by Amal Usaha Muhammadiyah which can be synergized together with Lazismu and partners in the field of social Lazismu humanity. At least there is a potential philanthropic fund about more than IDR 365,581,600,000 which can be extracted and utilized annually. As well as the IDR 159,223,410,000 philanthropic funds derived from Muhammadiyah members. Thus, the overall picture of the potential is IDR 524,805,010,000. This figure will increase if the assumption of the number of citizens change according to sampling and calculation method. Moreover, number of Amal Usaha Muhammadiyah listed are only from Muhammadiyah Universities, Hospitals and schools, not including Bank and other types of businesses.

Lazismu Muhammadiyah University of Surakarta

Lazismu Muhammadiyah University of Surakarta is Lazismu which manages philanthropic funds from Muhammadiyah University of Surakarta (UMS). UMS is a kind of Amal Usaha Muhammadiyah colleges in the city of Surakarta, Central Java. The establishment of Lembaga Amil Zakat, Infaq, and Shadaqah UMS started from the formation of Zakat Center UMS in October 2001. It transformed into LAZIS UMS after the merger process between the management of zakat with Infaq management employees on May 4, 2003. LAZIS UMS entered in networking Lazismu Centre after joining Rakornas Lazismu in 2012, and changed its name to Lazismu UMS. Lazismu UMS has a legal entity which is a foundation based on SK Menag No. 457 of 2002, dated 21 November 2002.

The vision of Lazismu UMS is becoming Zakat management organization, Infaq, Sadaqah (Islamic philanthropic) a trustworthy and professional. Mission Lazismu UMS:

1. Collecting and managing the Islamic philanthropic.
2. Develop a transparent system for the management of Islamic philanthropic.
3. Building partnerships with in-line institutions

Lazismu UMS manages Zakat funds, Infak, and Sadaqah of lecturers and employees of the University of Muhammadiyah Surakarta. Other sources of funding are from individuals or institutions as well as income from revolving funds and profit sharing. The amount of zakat are quoted from lecturers and staff. For faculty and staff, the zakat is quoted at 2.5% and at 1.5% for honorary employees. In managing Islamic philanthropic, Lazismu UMS is in collaboration with the Islamic Bank of Central Java and

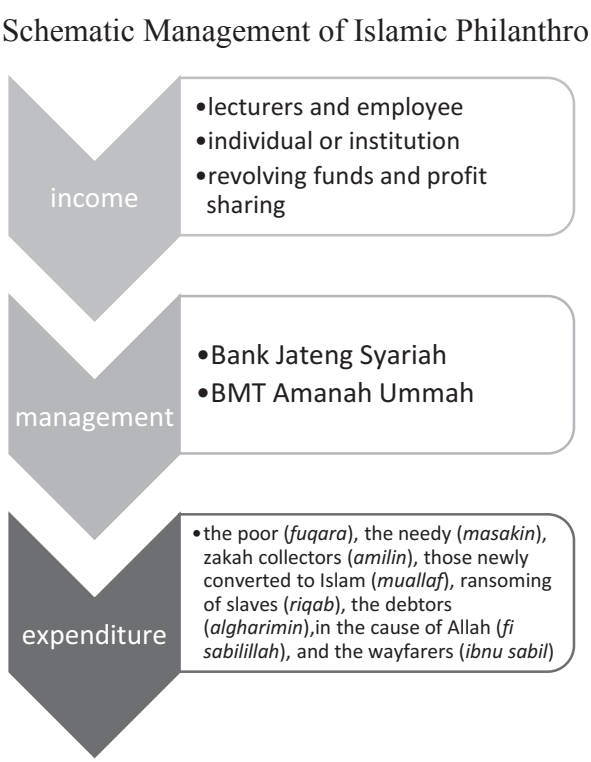

Figure 4. Schematic management of Islamic philanthropic fund by Lazismu UMS

BMT Amanah Ummah. The following is a scheme of Islamic philanthropic management.

Lazismu UMS distributes the zakat to 8 asnaf (groups) in accordance with the command of God contained in the Al qur'an 9:60. The distribution of zakat conducted by UMS Lazismu divided into two kinds of zakat distribution namely for consumptive and productive. Consumptive zakat distribution by Lazismu UMS is in the form of scholarships to families of UMS orphan students, groceries for kindergarten teacher of Aisyiah, groceries for PDA Surakarta, donations to orphanages, health care assistance, the emergency response in collaboration with Muhammadiyah Disaster Management Center (MDMC), Ramadan program, recitals for poor employees, the construction of the mosque, the construction/ operation of the school, musholla renovating, building bathroom program.

Productive zakat distribution is given by Lazismu UMS in the form of capital to mustahiq and is often called the revolving fund. Other productive zakat distribution program are HP technician and the assisted village. The purpose of the revolving fund is to motivate mustahiq to work harder. UMS Lazismu revolving fund program has been able to train the independence of mustahiq to fulfil their daily needs, this is proved by the number of mustahiq which has managed to expand their business by 20%. Mustahiq who received a revolving fund declared successful in developing a business if the business has been eligible to become a Small and Medium Enterprises (SMEs). In the implementation of the revolving fund program Lazismu UMS has limitations on the monitoring of the mustahiq in the management of their businesses so mustahiq stop their efforts. This is due to the limited number of amil Lazismu UMS which are only two.

The limited number of amil also affects the distribution of zakat, as seen in the amount of zakat distributed amount which is smaller than the amount of zakat collected from lecturers and employees of UMS. The zakat is collected from muzakki and entirely distributed to mustahiq. In 2011 the number of zakat funds from muzaki that is not distributed to mustahiq was 7:47% and in 2015 this number increased to 41.93%. To overcome this distribution problem Lazismu UMS in cooperation with UMS students and social organization provide counseling, job skills training and monitoring to mustahiq. This collaboration is expected to improve the distribution of zakat and increase mustahiq motivation in working harder.

In addition to zakat distribution problems, the absence of standard operating procedures makes Lazismu UMS face difficulties in daily operations. According to Choirul Muttaqien, managing director

Table 1. Islamic Philantropic Fund colected and distribution by Lazismu. (In IDR)

		2011	2012	2013	2014	2015
	Income	401,825,372	543,012,134	773,822,357	1,068,891,100	1,121,958,671
	Distribution					
1	the poor	54,503,350	61,391,350	82,079,500	128,725,800	75,740,000
2	the needy	100,536,000	116,379,300	135,105,700	168,891,100	285,893,300
3	zakah collectors	39,405,246	53,613,871	53,176,277	68,906,346	79,755,857
4	those newly converted to Islam	9,789,900	28,475,000	118,255,000	12,892,500	13,622,000
5	ransoming of slaves					
6	the debtors		4,500,000	21,923,000	3,770,000	4,150,000
7	in the cause of Allah	164,684,300	154,136,000	185,850,050	241,348,450	192,100,500
8	the wayfarers	2,893,000	1,609,000	865,000	905,000	285,000
	Total	371,811,796	420,104,521	597,254,527	625,439,196	651,546,657

Lazismu, "learning from the failure of the establishment of previous Lembaga Amil Zakat Muhammadiyah, namely the Bapelurzam which was formed structurally and driven by Muhammadiyah, encouraging the formation of Lembaga Amil Zakat with a new and better form by using the network multiline system. The network multiline system in every Lazismu in city / district has the same level, as well as having the opportunity to develop organizational culture in accordance with the values of the local culture. This is what makes the absence of lazismu SOP from the center. "The absence of Lazismu SOP makes amil Lazismu in the district / city have high creativity in running Lazismu.

Conclusion

According to calculations by the Public Interest Research and Advocacy Center (PIRAC) 2007 zakat potential in Indonesia is IDR 9.09 trillion. Until now, the amount of zakat collected by BAZNAS throughout Indonesia and LAZ about is about IDR 3 trillion. One cause of the low zakat collected by BAZNAS and LAZ is the increased in direct giving zakat distribution. As a result of the distribution patterns in a direct and individualized, zakat only serves as a charitable donation, short-term oriented, and unable to address the problems faced by the society. This direct distribution of zakat on the one hand can help the society, on the other hand it leads to dependence.

If zakat is distributed through certain institutions of zakat, it can be managed with properly, professionally and accountable so it can utilize the zakat and provide a significant multiplier effect in the economy, especially in helping the government to reduce poverty through community empowerment programs. If zakat is distributed in the form of productive assistance, the multiplier effect will be greater in the economy. This will be able to provide a significant effect in reducing poverty in a country.

Social problems can be tackled from the source of zakat, which not only can reduce the poor, but also have a wider coverage. It became one of the reason in establishing Lazismu. Lazismu establishment was intended as zakat management institutions with modern management that can deliver Zakat to be part of the solution to the social community problems that continues to grow. In Lazismu UMS, revolving fund program mustahiq increased the motivation for doing the best. The increase of mustahiq motivation is proven from the number of mustahiq who are able to develop their businesses to meet the standards for admission in the category of Small and Medium Enterprises (SMEs) by 20%. The amount of motivated mustahiq through revolving fund is expected to be able to motivate others to manage their business well so that in a subsequent period the amount mustahiq out of poverty has increased and the purpose of zakat distribution to reduce poverty can be achieved.

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共生の社会交渉を可能にする資源の所有と分配

―バヌアツ共和国メリック島の事例から

太平洋の島嶼国バヌアツのメリック島には食料や資源を個々に所有しつつ無償で分配する社会システムがある。そこでは限りある資源を有効に活用しつつ、私的所有を前提とした「共生」が成り立っている。

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Abstract

How to share the limited resources with other members of the community? How to maintain the livable environment? As a possible model of solution, I want to introduce the way of a society that is still thriving on small islands in the Pacific Ocean, for several hundreds, even over a thousand, years.

In small communities in the Pacific Ocean, people are routinely giving and distributing foods among them, as a way to build connections and cooperative relations in their communities. Particularly, in the outlying areas where there is no operating ferry service even today, they have to rely on self-sufficient ways to acquire foods in their given environment. So they frequently exchange a variety of gifts over foods. In effect, these activities guarantee the fair distribution of resources on their islands. This paper focuses on the fact that the people in these communities are regularly giving and distributing things, while maintaining the ownership of those things.

Mering island in the Republic of Vanuatu is a very small community of only 15 people. Main subsistence is farming and fishing. Although they often cooperate in farming, there exists no common land. Each person produces “my yam” and gives them away to other people. They are enjoying this act of giving and exchanging. Based on my research in Mering Island, this paper looks into the process which, through the possession and distribution of resources, enables the social negotiations for symbiosis.

Keywords anthropology, small island nation, distribution of food

はじめに

バヌアツ共和国メリック島は人口が 15 人と極めて小さな共同体の島である。島の人たちは互いに協力しながら焼畑農耕などの生業を成り立たせている。畑に火を入れる作業や作物を植え付ける作業は全員でおこない、その収穫も一緒におこなうことが多い。結果に注目すると、共同で畑を作りそれを共同で消費していることになるが、過程に注目すると島の人はあくまでも、「自分の畑」、「自分のイモ」を作っていることがわかる。収穫したイモは他者に与えたり、他者からもらったりしながら、分け合って食べているのである。島の限られた資源を分かち合うためという機能的な意味を越えて、人びとは共に暮らしている“おもしろみ”を演出するように食物の分配をおこなっていることがわかる。

本論文で紹介するメリック島の事例は、文化的に特異な事例として紹介することを目的とはしていない。むしろ地球上に現存する自然環境を利用して暮らすさまざまな地域の共同体と普遍的に共通する点を見つけ出すことによって、人びとがコミュニティを維持したり創出したりする場で肝要なこととは何

か、分析と提案を試みるものである。

1. メリック島の概要

バヌアツ共和国（Republic of Vanuatu）は南太平洋のメラネシア地域に位置し、約 80 の島からなる島嶼国である。バヌアツ共和国の北方の海域にメリック島は位置する。メリック島は周囲が 2.2 キロメートルという小さな島だ。大小さまざまな有人島があるバヌアツ共和国内でも、小さな島に分類される。

2004 年の調査当時、メリック島の人口は 15 名（4 世帯）であった[1)]。訪問したとき、住民の少なさに驚いたものだ。島の人の話によると、半世紀前までは約 100 人が住んでいたという。かつては手漕ぎのカヌーを使って、約 20 キロメートル離れたガウア島、約 30 キロメートル離れたメレラバ島との行き来はあったが、メリック島も含めこれら島々は外洋に位置するため、極めて天候の良い日を選ばないと航海はできない。現在、ガウア島からメリック島に渡るには、船外機付きのボートをチャーターしなければならない。メリック島にボートの所有者はおらず、メリック島の住民はガウア島からの訪問者がない限り、自ら島を出る手段がほとんどないのである[2)]。

ガウア島に飛行場、学校、病院、教会などの施設が集中し、島を往来する交通も不便であることから、メリック島の過疎化が数十年のうちに急速に進んだと考えられる。

15 名のうち、大人 7 名、子ども 8 名である［図 1］。かつて 100 名が暮らす島は過密であったことが想像されるが、現在は使われていない家屋や畑が見られる状況であった。

2. 所有する―名前と来歴

2. 1. 土地と木の所有

メリック島では、焼畑耕作により主食のヤムイモ、キャッサバ、バナナ、サツマイモを作っている[3)]。パンノキ、ココヤシ、ナッツ類などの実が重要な樹木は、島内に点在する樹木ごとに持ち主が決まっている。

ひとつの畑は、縦横の長さがが 10 ～ 20 メートルほどの面積で、島内にパッチ状に点在している。「何歳から自分の畑を持つことができるのか」という筆者の問いに対して、「子どもが自分で畑の作業できるようになったら持つものだ」と A1 は答えた。

また、畑だけではなく、島内に生えている木もそれぞれ所有者が決まっている。所有されるのは家や

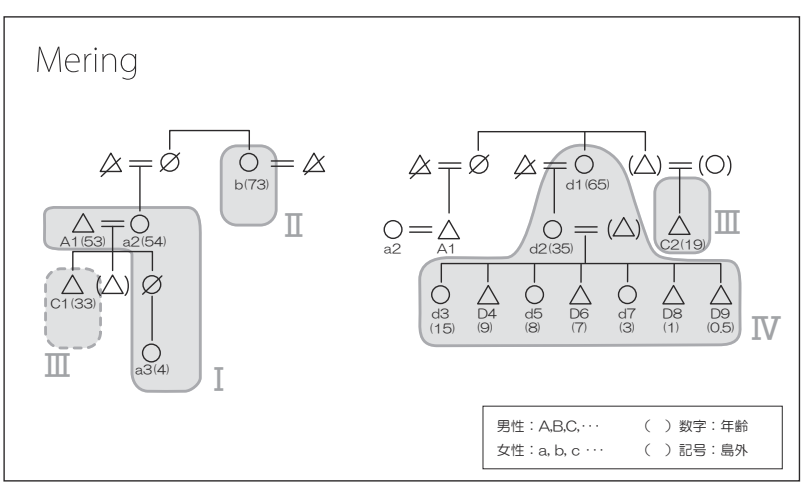

図 1　メリック島の人たち

カヌーなどをつくるための建材としての木や食用する実がなる木である。これらの木は所有者が決まっており、所有者に断らずに木を切ったり、実を落として採ったりすることはよくないとされている。島の人は自分が持っている木だけではなく、他者の木についてそれがだれの所有なのかわかっている。

現場に行かなくとも、自分の所有する木がどこにあるか、人びとは地名をそらんじることができる。例えば、b は「竹（lamor）は、自分の父と夫のものが、それぞれ Ma'tenok と Vari（共に地名）にある」という。b の父と夫はすでに亡くなっているので、その竹について b は自分のものといってもよさそうだが、b はその来歴から父と夫のものであると表現していた。だれの手をどのように渡ってきて自分が所有するにいたったのかという過程が重要視されている。すでに死亡している人や島を出て久しい人のものについても人びとはよく覚えていた。

2. 2. 家畜の所有

メリック島では、ブタ、ニワトリ、イヌといった家畜が飼われている。ブタは石垣で作った囲いの中で飼っているが、ニワトリは集落周辺に放し飼いにしている。大人 1 人当たり 30 ～ 40 羽飼っており、食べる頻度は 1 か月に 1 ～ 2 回程度である。

夕方近くになると「トケトケトケトケ」という呼び声で自分が飼っているニワトリ（特に幼鳥やヒヨコ）を集め、ココヤシの果肉を細かく削ったもの、残飯、シロアリなどを餌として与える。島の人は一瞥しただけで自分のニワトリや他の人のニワトリを識別できる。しかし、一応目印もつけている。ニワトリの 3 本あるツメのうち、真ん中の 1 本を切り落としたものが b、2 本落としたものが A1 と a2、右端を落としたのが C2、なにもしていないのが d2 である。だれのニワトリか判断がつかないときは、ツメを見れば確認できるようになっている。このようにニワトリの所有者はきちんと決まっているが、それを食べる場面、ニワトリを夕飯用につぶしたときなどは、他の家にも一皿ずつ「おすそわけ」に行く。以下の事例は、この放し飼いのニワトリに関する所有をめぐるやりとりである。

［事例 1］隣家のヒヨコ

9 月 28 日午前中、A1 が使っていない半壊の家屋の修繕をするという。その家屋に入ると、ちょうど奥の方で卵を抱いていたニワトリがヒヨコを 2 羽孵したところだった。放し飼いのニワトリはどこに卵を産んでいるかわからないことがよくあり、島の子どもたちは卵を探しているのが常である。このときも、A1 はニワトリがそこで卵を抱いているということをたまたま知ったのだった。

卵を抱いていたニワトリは b のものだった。しかし、A1 は、そこで卵を抱いていることは b も知らないだろうと思い、先に孵った 2 羽のヒヨコを自分の台所に持ってきて、ココヤシの殻（ヒヨコ用の巣箱）に入れようとした。それを見た妻の a2 が A1 の行動をあやしんで「ヒヨコはどこから持ってきたの？」と尋ねた。A1 はヒヨコのツメをナイフで落とす（自分の目印を入れる）ところだった。A1 は一通りヒヨコを手に入れた経緯を説明した。すると a2 は元に戻すべきだと A1 に言う。2 人は終始小声で話していた。結局、A1 はヒヨコを元の場所に戻し、b には「お宅のニワトリがうちの家で卵を産んでいたよ」と教えてあげた。

a2 は b のものであるニワトリが孵したヒヨコを、こっそり横領しようとする A1 を非難した。島では実際にニワトリを食べる場面では、積極的に他の家にも分配する。しかし、このように、所有者をごまかすような行為は、とがめられる。

一方、島内のブッシュ（畑が点在する雑木林）には「野良ニワトリ」がいる。集落周辺で放し飼いにしていたものが野良となり、家屋の周囲に住まなくなったニワトリである。野良ニワトリは畑の作物を食い荒すこともあり、見つけた人が獲ってよいことになっている。ヒヨコを連れている場合は、ヒヨコは捕獲してココヤシの殻に入れ連れて帰る。

ヤムイモや有用植物である木、家畜など、島の人たちは互いに「だれのものか」を認め合っている。以下にその特徴をまとめる。

1．個人ごとに所有を認める
2．所有するに至った来歴は重要視され、記憶されている
3．所有を一方的にごまかすことはよくない

では次章は、このように所有するものを他の人とやりとりする場面、分配の事例を紹介する。ここまでは人びとが厳密に所有を認め合っていることを示したが、一方、所有が決まったものに関しては、気前よく他の人に与えているように見えるのが、分配の場面である。

3．共同作業について

筆者がメリック島に滞在していた8月後半から9月の前半にかけては、年に1度のヤムイモの植え付け作業が始まった時期であった。畑作りの作業は、まず畑に生い茂った雑木を打ち払い、火を入れるところから始まる。数年の間休耕していた畑には、熱帯性の植物が勢いよくのびており、足を踏み入れられない藪となっている。これを刃渡り50センチメートルくらいのブッシュナイフ（山刀）で切り倒していく。その後、雨が降らない日を選び、よく燃えるココヤシの乾いた葉と共に火を入れて、打ち払った木を焼く。天候が良ければ4～5日でこの作業は終わる。次に、種芋を植えるための穴を畑全体に等間隔に掘る。イモが大きくなりやすいよう、イモ堀り用の棒で植える場所を1メートルくらいの深さで掲いて柔らかくし、土を盛っておく。これは力仕事である。男性1人で1～2日かかる。土を掘り終わるとあとは種芋を植えるだけである。これは半日～1日程度で終わる。

焼畑の火入れから穴を掘るところまで、島の人は家族単位で作業をおこなう。しかし、雑木が生い茂って藪になったところを切り拓いたり、穴を掘ったりする力仕事は、取りかかる数日のうちの1～2日は他の人を誘い、一緒に作業をおこなう。種芋を植えるまでの畑の準備が整ったら、島の人を全員誘って植え付け作業がおこなわれる。

［事例2］種芋の植え付け作業においてC2がゲームを用意する

9月2日午前8時45分、子どもも含め島の人全員がC2のヤム畑に集まった。畑には種芋が用意されていた。通常の畑仕事とは異なり、人びとはパンダナスのマットを敷いた上にくつろいで座って、談笑しながら種芋の準備をする。

畑の持ち主でありこの日のホストであるC2は「ワラグ（walag)」というゲームを用意していた。ワラグは参加者が歌を歌いながら、あらかじめC2が畑に生えている木の幹にはさんでおいた飴玉を探して追いかけっこをするという遊びである。交通の便の悪いメリックでは飴玉は日常ではほとんど目にしない貴重な嗜好品である。

最初は子どもがゲームに参加して走り回っていたが、そのうち大人も参加して一緒に走って飴玉を探した。大人が走り回るのを見て、みなで大笑いをする。C2は全員に行き渡るよう十分な量の飴玉を畑に隠して置いていた。みな飴玉を食べながら作業をおこない、種芋の植え付けは2時間で終わった。

島では人が少ないため、みな自分の畑の作業をしつつだれかの畑の手伝いを常にしている状態である。これは結果だけ見ると全員で共同作業によってヤムイモを作っているともいえるが、畑そのものは共同のものはなく、それぞれが自分の畑でヤムイモを作っている。各人が畑を持つことによって、他の人の畑を手伝うことはまた自分も手伝ってもらうという互酬性の基本になっているようだ。しかし、年齢、性別によって働き手の能力には個人差があるため、実際には体力のあるC2やC1は他の人より多く手伝いに行っている。

C2 が用意したこのゲームは、ヤムイモ植え付け作業の最終日に演出した「お祭り」のようなものであった。

4. 分配する

4. 1. ヤムイモと魚の分配

ヤムイモは島の人にとって最も重要な作物である。収穫後ヤムイモベッド（畑につくったヤムイモ保存のための棚）に置いて 1 年間保存することができる主食である。

筆者の滞在中には、ヤムイモの他にも調理された食べものが各家の間でさかんにやりとりされていた。ヤムイモはいろいろな作物のなかでも特別なものであるという話を聞いた。

［事例 3］ヤムイモの渡し方

ヤムイモに関する昔からのメリック島の慣習として A1 が教えてくれたことがある。「ある人がだれかにヤムイモが欲しいと頼んだら、頼まれた方はヤムイモを依頼者に直接渡さずに、依頼者が見ていないところで、そっと地面に置いて渡さなければならない。夜のうちにこっそり置いておくように」。これはヤムイモに関わる決まりであるという。直接「見えるところ」で「見えるように」渡すことは非常によくないということであった。

この話を聞いたのは筆者が島を発つための荷造りをしているときであった。この日の朝、5 種類のヤムイモが袋に入れて台所に置いてあった。袋の中身がヤムイモであることを確認して、「紫色のヤムイモは珍しいから日本に持って帰りたい」と日頃から話していた筆者に誰かがくれたものだろうかと、A1 に尋ねたのである。A1 はこれこそがまさにヤムイモを人に渡すということであると話し始めた。このヤムイモは a2 が用意してくれたものだった。結局その後も a2 は筆者にこのヤムイモについて説明はしなかった。A1 の説明によって、a2 がヤムイモを筆者にくれたことがわかったのだ。

筆者は A1 と a2 の家に住み、毎日一緒に食事をしていたので、ヤムイモに関してわざわざこのように a2 が渡してくれるとは思っていなかった。A1 が話す通り、メリック島の慣習によるものだが、そこからは、与える側が与えるということを誇示してはいけない、という倫理がうかがえる。例えば、日本では現金をそのまま相手に手渡すのではなく見えないように祝儀袋などに入れることに似ているかもしれない。

次に紹介する魚の分配のやりかたに関しても、ヤムイモで見られる受け取る側への配慮が同じようにあることがわかる。

［事例 4］魚を吊るして驚かす

C1 と C2 は 2 人で夜間のダイビングによるモリ突き漁や釣り漁、コウモリ猟に行き、獲れた獲物は他の人に分けている。これもヤムイモのときになされた説明と同様、夜中に獲ってきた場合、台所にだまって吊るしておくことが多かった。

当初、筆者がいたのは a2 の台所なので、C1 にとっては母親の台所だからだまって魚を置いているのかと思っていたが、ある日、b と一緒に畑に出かけたときに、b の畑の前に魚が吊るしてあったのに驚いた。先回りして C1 と C2 が魚を置いていたようだ。家に帰ってきてから、2 人に会った b は感謝を伝えた。それからその日の夕飯を食べ終わった後、b が a2 の台所に遊びに来たのだが、b は a2 や A1 に対して、畑に行ったら大きな魚が吊るしてあって驚いたことを身振りと顔で演じるようにおもしろく語って聞かせた。

魚を獲った場合、面と向かって渡すのではなく、渡す相手に会わないようにしていた。これもヤムイモと同様、与える側が誇示しないように振る舞っているといえる。与えることは隠すようにおこなわれているが、b がお喋りによって A1 や a2 にも出来事を伝えていたように、受け取った側によってその出来事はコミュニティ全体に伝わるようになっていた。

このように、獲物を獲ったハンター自身が分配の場で誇示しない、威信を持たないようにふるまうというのは、アフリカの狩猟採集民についても報告されている［市川　1991］。メリック島では、分配の場で誇示しないどころか､分配相手の家や畑に「こっそり吊るしておく」ことによって、分配の場から与え手のハンターは完全に姿を消しているのである。

また、黒田［1999］が、人が喜ぶ食べものを分配することには格別の喜びがともなう、と指摘しているように、メリック島でも格別な喜びがともなうもの＝大きな魚などについて、より積極的に人に分けているといえる。メリック島では、魚の分配について、他の人に比べて C1 と C2 からおこなわれることが多いが、彼らが獲物を分配した相手からの見返りを期待しておこなっているようには見えない。しかし、分配したという出来事が「おしゃべり」によって島の他の人に流通することは、彼らに喜びを感じさせるものではないかと考える。

4. 2.　共食に見られる分かち合い―饗宴の開催

15 人の島の暮らしは、顔を合わせる人がいつも同じで単調になりやすい。そのような日常の中に「ハレの日」を設けている。教会に集まる日曜日や聖人の日、筆者の歓送迎会などの折に、食材を持ち寄って調理をおこない、分け合って食べる。島で共食のための調理方法は石焼き調理である。焚火で 1 時間以上かけて熱した石で、葉で包んだ食材をはさみ 2 ～ 3 時間置く。一度に大量の食事を用意することができる効率の良い調理方法である。

ヤムイモや魚の分配が起こる前提として所有者が決まっているように、共食の場である「饗宴」にも、主催者（ホスト）と客（ゲスト）の 2 つの立場がある。共食の場でおこなわれることは、結果として「集まった人がみなで調理し同じものを食べる」という行為であり、その場においては主催者も客も同じように振る舞う。主催者がおこなうことは「会を呼びかける」「主な食材を提供する」ということである。

客の正しい態度として、a2 によると「共同作業に参加する人は、手ぶら（正確には作業用ナイフのみを携帯する）で行くことが当然で、食べもののことを心配するのはマナーに反する」という。しかし客といっても、共同作業の場では主催者と客は区別なく作業をおこない、共食の場での調理も同様である。実際に調理した食べものを分配する場面では、「その場に参加する人がみな同じであること」が目的とされるため、主催者も客も平等に同じ量が分配される。

5. メリック島における所有と分配

孤島であるメリック島ではほぼ自給自足の生活がおこなわれている。人びとは自然環境を利用し資源が枯渇しないように日々の糧を得て生活している。そのような中で、資源管理の基本となっているのは、有用な資源については個人が所有するということであった。焼畑耕作について共同作業をおこなう場面が多いとはいえ、共有地は存在しなかった。

大変な作業のときには他の人を誘い合って協力しておこなっていた。畑を所有している者で、自分の畑のみの手入れをおこなうものはいなかった。特に、ヤムイモの植え付けについては全員で集まって作業をおこなっていた。結果だけ見ると、島の人は全員で協力してヤムイモをつくり、また消費する場面では全員で分配し合っているため、ヤムイモは最初から最後まで、つまり生産から消費まで共有されているようだが、実際には「自分の畑」を各人が個人的に持つことによって、互いに「手伝ったり」「手伝ってもらったり」する状況をつくっていた。「自分の畑」を持つことによって、「やってあげる人(与える側)」と「してもらう人（受け取る側)」という 2 つの立場が明らかになる。分配が相互行為として繰り返されるために、この 2 つの立場を明確にすることは重要である。

15 人 4 世帯が暮らすメリック島では、一見すると資源を共有し、共同作業によって食物を得て公平に分配しているように見える。結果として、現実に

おこっていることはそれに限りなく等しい。しかし、島の資源を公平に分配するには、モノを共有するという方法ではなく、モノを個人が所有するという方法が実践されていた。人びとは所有者が決まっているものについては、積極的に分かち合う行為に乗り出すことができる。所有者が決まっているモノには、来歴があり出来事が付随している。来歴と出来事は分配を経る度に加算され流通し、コミュニティ全体に共有される。それが分配によってモノが公平に共同体全体に行き渡ることと同時に起こっていることであった。

メリック島では15人という極めて小さな共同体の暮らしにおいて、個人がモノを所有することを起点として、積極的な分配行為がおこなわれていた。人のコミュニティにおいて個人と個人が協力して資源を共有し生活することを可能にするためには、前提として個人の所有を認めることが重要であると指摘できる。人は食べものを目の前にして「自分のものにしてしまいたい」という欲望がある。自分の所有しているものを確かめるときにもこの欲望がはたらいている。しかし、その我欲を超えて、なぜ自分のものを他者に与えようとするのか。「私」や「あなた」に潜在的に欲望があるとわかっているからこそ、あえて分け合うという行為が、あなたと関係をつくりたいという意味を帯びるからである。

おわりに

メリック島が近年急速に過疎化したということは冒頭に紹介した。小さな島嶼社会において人口が過密であったときには、資源管理のための規則もより厳密であったことが想像される。しかし、その後過疎が起こったメリック島だが、所有の形態については事例の通り、すでに亡くなった者や島に不在の者に関わる来歴の記憶を途切れさせることなく語り継ぎ、土地や木の所有者を認め、その上で日々の生活に必要な資源のやりとりをおこなっていた。「自分のヤムイモ」を育てること、そのために必要な作業を互いに協力しあうこと、収穫した「自分のヤムイモ」を分け合ってみなで食べること、それがメリック島という人びとの集まり、コミュニティの根幹にある。人びとが集まる、共在するための動機を生むこと、そこには最初から資源を共有するのではなく、前提として個人の所有を認め合うということが肝要であることがわかった。

現在の日本において、都市部に人口が集まることによって過疎化が進む地方の地域社会や、災害の影響により人口が流出した被災地の社会において、コミュニティを維持したり新しく創出したりする課題を前に、どのような仕組みを設けることが有効か、人びとが自律的に集まるような場にすることができるか、議論しなければならない。

そこで一見かけ離れているようだが、南太平洋の島嶼環境で数千年、環境利用や葛藤解決などにおいて持続可能な社会システムを構築し暮らしてきた人たちの文化的な方法の中に、現代社会のコミュニティをめぐる課題を解決するために重要なアイディアがあると考えている。

注

1）本論文に使われているデータは、2004年7月から9月にかけてバヌアツ共和国における約3か月間のフィールドワークから得たものである。

2）2004年メリック島から筆者が出発するとき、依頼していたガウア島の船外機付きボートの持ち主が迎えに来なかったため、メリック島の男性2人がカヌーでガウア島に迎えを呼びに行ってくれた。手漕ぎのカヌーではガウア島まで7時間かかった。カヌーは島の近くで釣りを行うのには日常的に使用しているが、このように隣に島にまで航海することはほとんどないということであった。

3）以前はタロイモも作っていたが、島の人口が減ってから陸性のカニ類が増え、タロイモへの食害がひどくなり生産が落ちているという。

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