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Positioning the HIV/Aids Menace: Challenges for Marketing Communications Led Behavioural Change in Zimbabwe

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Abstract

The medical sophistication of modern day has been rendered helpless in the face of HIV/AIDS. The incurable nature of the HIV/AIDS virus which changes its morphology is putting a huge strain on the various fronts of humanity. The economic and social devastation of the HIV/AIDS menace has meant that no progressive force on earth will not give this epidemic some attention. Zimbabwe is a developing country in Southern Africa which has been grappling with the menace whose spread has been largely due to ignorance and wanton denial of the devastating effects over the years. Multitudes of promotional programmes to change behaviour have met with mixed success. To this day 3 000 people die weekly with calamitous effects to the nation. There has been a reduction in the numbers affected and part of the argument is that promotions for preventive behaviour is bearing fruit. This study seeks to evaluate successes and failures of various programmes in the fight against HIV/AIDS with particular emphasis on whether marketing communications to promote good behaviour has had any significant impact. It can be argued that this process does not render itself to marketing communications. On the contrary it does. The experts in the area of marketing point out that goods, services ideas, places or persons can represent a product. In this regard the product is the idea of behavioural change. The direct benefit from the idea is to serve the human race from extinction. This paper will argue that it can be done, it can bear fruit, but it is a mammoth task and calls for collective and individual responsibility across the private, public, religious groupings, the donor community etc. It is the contention of this paper that the idea of changing behaviour in the fight against HIV/AIDS has to be sold to society and this paper argues that marketing communications can make a huge difference in serving millions of human lives. Ultimately the perception people have of HIV/AIDS will determine how they position it it vis-à-vis life.

Keywords: Health Crisis, HIV/AIDS, Behaviour Change, Perception and Positioning, Marketing Communications

1. Introduction

The World Health Organisation report on HIV/AIDS of May 2006 quotes UNFPA Executive Director, Thoraya Ahmed Obaid, (http://www.who.int/hiv/mediacentre/news60/en/index.html, Accessed 6.11.06)   "Prevention remains our first and most effective line of defence."

This statement strikes on the core of the HIV/AIS crisis the world is facing; put simply it is an incurable mass killer. It calls for behavioural change against rock old practices at the heart of human existence, that is, sex and medical practices in both the scientific and traditional medication which often include blood exchange or cutting or piercing the body one way or the other. Suffering from HIV/AIDS at the moment leaves the human race with only one definitive tool for prevention of contraction but not abstinence from the act of sex as that is an attempt to evade reality. The complication in this quagmire is that some religious sects would argue that the only way to avoid HIV/Aids is abstinence from sexual activities. This works perfectly but is unrealistic given the natural human desires for sex despite claims from quotas of society which have been shocked by their membership's HIV/Aids status.

Taylor (1997: 43) cited in Fourie and de Jager (2001: p 94) state:-

In the last two decades, the HIV (Human Immunodeficiency Virus) that causes AIDS (Acquired Immunodeficiency Syndrome), has spread swiftly and silently throughout the world profoundly affecting the lives of men and women, their families, business and societies.

This is the core of the problem that this paper seeks to engage from an influence perspective, ie., communications as a behavioural change tool. To the extent that HIV/AIDS has impacted lives with devastating effects makes it an enemy of humanity and needs to be engaged head on. To the extent that there is no known cure makes it complicated for health institutions in all spheres – public or private. Fourie and de Jager (2001) further present a teething question about the

incurable nature of HIV/AIDS making reference to the potential it has to destroy mankind, stating the old adage "prevention is better than cure". However, there are human practices that are at the core of human existence like the notion of sex and its related secrecy stigmas in societies like the developing world. In that respect the change of behaviour is paramount but complicated. It can be argued ultimately that the failure to contain the disease is a failure of communication. It is the need to change behaviour and survive or contain the menace of HIV/AIDS which underpin this study.

The tool to employ in the communication to fight HIV/AIDS O'Shaughnessy (1996: p 55) argues that "With greater certainty we can say that, although there is an element of substitutability, some social persuasion contexts favour the marketing approach and others would be better suited to propaganda." To the same end O'Shaughnessy (1996) argues that propaganda was originally defined as the dissemination of biased ideas and opinions usually aided by the use of lies and deception.

1.1 Study Objective

Debates in academic circles, the medical, political and economic fraternity are largely a reaction to a crisis in the face of this devastating plague. In view of the multitudes of deaths, economic, industry and family disintegration there are concerns in every sphere of life for the need to deal with the HIV/AIDS menace.   Adding the live debate on the best way to combat the menace created by the HIV/AIDS epidemic this study will seek to meet the following objectives:-

- Discuss the nature of HIV/AIDS, its impact on the different aspects of life and how behaviour change can be realised through marketing communications.
- Highlight the global impact of HIV/AIDS as projected by the various health institutions the world over
- Profile Zimbabwe's fight against HIV/AIDS in respect of the process and impact of the various programmes the country has embarked on
- Discuss the effects of the HIV/AIDS menace has had on the various aspects of business, society and families.
- Assess the impact of marketing communications in positioning the AIDS menace in the minds of the population of Zimbabwe.
- Project behavioural tendencies of Zimbabweans five years from now given the AIDS epidemic

In carrying out this study the author is aware of the need to be focused given the differences in behaviour. Obviously, there is need to take into account the fact that the study has to be culturally appropriate and that stage-specific strategies are urgently needed if the fight against HIV/AIDS was to be successful (Normal and Carr, 2003).

2. The HIV/AIDS Phenomenon

Shaluf et al (2003: 29) states that "a crisis is an abnormal situation which presents extraordinary, high risk to business..." In the case of HIV/AIDS the situation is a calamity of unequalled proportions. The human race has not faced a menace of this magnitude in recent times. The HIV/AIDS menace adversely affects every human process-health funding, productivity in industry, family bonding in the face of multitudes orphans, shortening life spans etc. The contention of this paper is that the HIV/AIDS epidemic calls for more cooperation by all progressive forces without which the calamity will continue and everybody will be at risk with or without changing behaviour.

The enormity of the HIV/ AIDS menace is best epitomised in a World Health Organisation report of May 2006 (http://www.who.int/hiv/mediacentre/news60/en/index.html, Accessed 6.11.06) which states:-

- An estimated 38.6 million [33.4 million – 46.0 million] living with HIV worldwide - 4.1 million [3.4 million – 6.2 million] newly infected in 2005 - 2.8 million [2.4 million to 3.3 million] died of AIDS in 2005

An estimated 38.6 million people are living with HIV worldwide. Approximately 4.1 million people became newly infected with HIV, while approximately 2.8 million people died of AIDS-related illnesses in 2005. While the epidemic's toll remains massive, experts find reasons for optimism, as well as guidance for how to improve the AIDS response. Sarah Tikiwa (2006) reporting for the Sundaymail in Zimbabwe states that, "Since the first cases of acquired immunodeficiency syndrome (Aids) were reported in 1981, infection with the human immunodeficiency virus (HIV) has grown to pandemic proportions, resulting in an estimated 65 million infections and 25 million deaths**."**

These figures paint a bleak picture about the menace created by the epidemic which threatens the long term sustenance of the human race. The situation is further complicated by the non-discriminatory nature of the epidemic. The HIV/Aids epidemic knows no age, race, wealth, location or any other differentiating factor for which it can spare humanity. Panic about the epidemic cuts across all human groups whatever the differentiating factor. The epidemic has revealed hidden practices where some cultures, religious groups or other values that have been communicated as either absolving or simply very strict on sexual acts have been victims of the epidemic. Men of the collar purported to observe celibacy have been victims to the amazement of their followers and some religions sects where acts of sex before marriage or

adultery are punishable by death have found cases of HIV/Aids increasing amongst their membership. This development is a true reality check against an act of humanity which is at the core of humanity.

3. Selling the Idea of Behaviour Change through Marketing Communications

For people to understand the importance of behavioural change in the fight against Aids there has to be an effort to sell the whole idea in a marketing sense. The people would always ask questions about the value of changing their behaviour especially given the various misconceptions of what Aids is all about.

According to Bathie and Sarker (2002 : p241) put forward factors required in the realisation of a marketing orientation as:-

- Recognise that organisational objectives are only achieved through exchanges with customers
- Recognise the primacy of customers in the exchange process
- Organise organisational activities around a focus on customers receiving value for exchange with the organisation
- Create an exchange relationship with customers that are mutually beneficial as a basis for continued relationships.

Bathie and Sarker (1996) further present a framework for the flow of value in marketing as illustrated in ***figure 1***. The main point is that the focus has to be on what the customer needs. The first phase in the framework is understanding customer value requirements that is to suggest that organisational marketing activities should be driven by the value that the customers expect from their business process. It is important to note that in this respect it is critical that organisations consider customer value deployment which seeks to inculcate the voice of the customer in corporate processes. Subsequent to understanding value requirements the next phase is the creation of customer value, then communicating value and ultimately delivering such value.   In the case of HIV/AIDS the core of the message is that there is value in staying healthy the opposite is that contracting HIV/AIDS leads to a painful death. For families the pain of bereavement may mean children dying or being left orphaned and living very painful lives. The point is that ultimately engaging in unprotected sex or sexual promiscuity is a risky act.

Kates (2002) raises the role of community based organisations in providing therapy to people living with HIV/AIDS as he points out that this incorporates contemporary social conditions and historical conditions in both societal practice and marketing theory. The core of this argument lies on the understanding that people's conditions can improve because of the environment around them. Equally the perception of these organisations has a huge effect on the influence they can have on the community. Campbell (2004) puts across the case of peer education where she observes that processes that underpin successful peer education include first, an environment for peer identity, given that sexuality is shaped; second, sex education should empower young people to take ownership of sex negotiations with confidence in health information and intervention. Campbell further contents that young people's lives have been blighted by unemployment, lack of education which undermine their confidence to make decisions and that success in peer education programmes can be enhanced by appropriate community partnerships of the various forces in the community.

In a study focusing on change in relation to recycling behaviour Mee and Clewes (2004) observed that there was need for segmentation research if the process of developing specific communications and messages directed at different segments were to be effective. There are various groups of people whose HIV/Aids risk is different, thus necessitating a clear understanding of each group hence the need for research into the behaviour of such groups which may need to change in the fight against HIV/Aids. In their study on HIV-related behavioural change in Trinidad and Tobago, Norman and Carr (2003) make a very important claim that a strong knowledge base about HIV transmission could promote protective behaviours which could minimise the menace of HIV/Aids to people at both secondary and primary levels of transmission. This would also reduce the transmission of other sexually transmitted infections.

Makin and Sutherland (1994) observed that individuals behave the way they do because of *internal* factors (as personality traits, attitudes, and moods) or *external* factors as culture, pressure associations etc).   In the case of the spread of HIV/AIDS there are both internal and external factors at play. The human desire for sex being a biological process is internal to the individual. However, the promotion of sex in films and commerce certainly is external but has a huge effect on the proliferation of sex activities. The idea of sex holidays, entertainment etc which ultimately create an atmosphere for engaging in sex are products of marketing pleasure. Given that marketing has a significant contribution to the proliferation of sex one would argue that marketing can equally contribute to the reduction of sex if the marketing message seeks to do so. Scriven and Stevenson (1998) highlight that issues regarding psychological development refer principally to the intrapersonal dimension, ie, social influences, and are concerned with factors intrinsic to the individual. And that adolescent health-related behaviour is influenced by a multitude of variables, hence interventions designed to shift behaviour must both appreciate and target these multidimensional factors.

The model by Norman and Carr (2003) ***figure 2*** is of particular interest in that it brings to the fore the key variables of concern. Knowledge has not necessarily led to behavioural change for if this had been the case there might not have been as many who perished from the disease over the years. It would appear the real problem lies in denial. With people denying the menace it would appear there is deliberate sexual promiscuity on the pretext that there will be no effect. Apparently this was and will continue to be a clear death warrant. Protection is key in the fight against the menace. In the same vein the clergy have called on people to abstain. Without attempting to be blasphemous the author will argue that this phenomenon is on the core of human existence and it is virtually impossible to deny people engaging in sex, be it single or married and making it even more complicated is the incidence of same sex couples engaging in sexual activities. While the model presents an objective analysis of the variables dictating the spread of knowledge about the HIV/Aids phenomenon there is a problem in the human practices and believes about the practices incorporated in the model. The sexual practices in the community are largely secretive and essentially the task of educating the community becomes more complicated. It would appear the groups which are most at risk as prostitutes and men mostly associated with sexual promiscuity are more amenable to talk about the menace openly than groups that are not normally associated with sexual promiscuity. The bulk of the Zimbabwean population lives on the rural side where there is limited access the more reliable means of mass communication such as newspapers and the television. The use of condoms and their possession is often frowned upon in   the community and that puts a strain on its usage. All these practices have been and continue to be tackled with the aid of marketing communications to change behaviour.

Sieg (2003) makes a case for sex education that it is of interest to society at large in view of HIV/AIDS and other sexually transmitted diseases and high teenage pregnancies, so that young people can develop appropriate attitudes and practices and make informed decisions about sexual practices.

Goodman (2006: p 197) argues that:

"A program in corporate communication…should focus on the strategic challenges that executives face:

- building trust;
- efficiency;
- building a culture of accountability;
- counselling the corporation and the CEO;
- managing the company reputation;
- managing the impact of globalization;
- transparency in media relations and reputation management;
- managing corporate citizenship and corporate social responsibility;
- managing issues and crises; and
- writing as the core skill for corporate communication;"

While the argument by Goodman is in respect of commercial operations the same is true in the public sector set up where the biggest challenge in the fight against HIV/AIDS lies. The public sector is often associated with red tape, lack of motivation and trust as most acts are mere political posturing. The practices of politicians adversely affect the image of public institutions hence the need for strong communications in the fight against HIV/AIDS.

The marketing communications process is carried out in a systematic manner and incorporates a number of steps as outlined by Rowley (1998: p 385)

• identify target audience;

• determine communication objectives;

• design the message;

• select communication channels;

• establish promotional budget;

• decide on promotional mix;

• measure results;

Marketing communications can yield results only if the communicator has a clear understanding of the audience and the meaning of symbols and words used in the message. Effective marketing communications will change consumer or human behaviour. In a study on whether the opinion leaders form a marketing communications segment Chaney (2001: p 307) concluded that "the statistical results indicate that opinion leaders are the magnetic core who can attract consumers' confidence. …   Influencing journalists ….is a viable indirect method of reaching the masses facilitated by

opinion leaders." In this study the main social concern has been the denial and concealment of the HIV/AIDS status fearing community isolation because any disease acquired because of sexual promiscuity attracts social disapproval and hence the desire not to divulge the positive HIV/AIDS status.

Kotler and Kelly have advanced the argument on the new orientation about marketing which is embracing and have called the approach the holistic marketing approach as illustrated in *figure 3*. The important aspect of this approach is that it takes into consideration both the internal and external dynamics about the phenomenon of marketing.

While the holistic marketing approach's applications are largely focused on commercial activities it is equally important in non- commercial situations and its elements fit in with the challenges for tackling the HIV/Aids epidemic. From the holistic marketing approach there are potential applications to the process of fighting the HIV/Aids epidemic in the following manner:-

- Internal Marketing would apply to the employees of the National Aids Council which is the government unit that is tasked with fighting the epidemic. They will need to be supported so that they can do a good job.

- Integrated Marketing would be relevant to the extent that it requires the different government departments and the private sector to co-ordinate their efforts in changing the behaviour of the society. This is a complex relationship and often difficult to secure the appropriate cooperation.

- Relationship Marketing is extremely important because it would mean that the message is well received because the government would maintain good links with the different stakeholders, among them hospitals, businesses, society in general and non-governmental organisations.

- Social Responsibility in respect of the HIV/Aids epidemic would apply to all levels of engagement from the individual, private and public organisations. All institutions and individuals have an obligation to fight the menace through a multitude of programmes and individual behaviour and attitudes.

4. HIV/AIDS Programmes in Zimbabwe

In the Uniting the World against AIDS, UNAIDS, Fact sheet 2006 it is stated that:

*"In **southern Africa**, HIV prevalence levels are exceptionally high (except for **Angola** – 3.7%). However, in **Zimbabwe**, where 1.7 million people are living with HIV, data have shown a decline in HIV prevalence which is currently estimated at 20.1%, down from 22.1% in 2003. This decline is twofold; studies have shown both a substantial increase in condom use since the early 1990's and that more young people have been delaying their*

sexual début and reducing the number of casual sexual partners; however, a significant factor in the decline is attributed to high-mortality rates."

While the figures provided by the UNAIDS report sound encouraging there is a dimension that has not been tackled in the discussion. A quarter of the Zimbabwean population has found its way out of the country to escape the crisis and which has afflicted the country since 1998. In the main the government of Zimbabwe has failed in a number of aspects that could have reduced the adverse effects of HIV/AIDS.

While these measures have had a positive impact, the Government's response to HIV and AIDS has ultimately been compromised by numerous other political and social crises that have dominated political attention and overshadowed the implementation of the national AIDS policy. The NAC has also been constrained by poor organisation and a lack of resources. The government should not be presented as innocent victims of inevitable problems, though; many of the struggles facing the country stem from their mistakes and failures. While political commitment towards fighting AIDS is apparent in Zimbabwe, the decisions made by Mugabe in dealing with other issues have led to a situation where the government is unable to adequately address the crisis.   (http://www.avert.org/aids-zimbabwe.htm accessed 31.07.07.)

The Zimbabwe government policies which have attracted international condemnation have seen a substantial reduction of the resources available for fighting HIV-AIDS. Other countries in the African Development Community (SADC) receive US$240 per capita and Zimbabwe receives only US$14 per person for HIV and AIDS response programmes from international donors. http://www.zimbabwejournalists.com/story.php?art_id=2584&cat=1 , accessed 14.07.07

The website http://www.avert.org/aids-zimbabwe.htm, accessed 08.12.07, points at some chilling scenarios about the crisis that the country faces in stating the following:-

> "Put simply, people are dying of AIDS before they can starve to death" The situation in Zimbabwe is now so bad that:
>
> - Between 2002 and 2006, the population is estimated to have decreased by four million people.
>
> - Infant mortality has doubled since 1990.
>
> - Average life expectancy for women, who are particularly affected by Zimbabwe's AIDS

> epidemic, is 34 - the lowest anywhere in the world. Officials from the World Health
> Organisation have admitted that since this figure is based on data collected two years ago,
> the real number may be as low as 30.
>
> - Zimbabwe has a higher number of orphans, in proportion to its population, than any other
>   country in the world, according to UNICEF. Most of these cases are a result of parents
>   dying from AIDS.

The HIV/Aids programmes in Zimbabwe have been hampered by a multitude of problems. The government unit tasked with the implementation of the relevant programmes has been fraught with corrupt acts which have deprived the programmes of important funds. The donor community in Zimbabwe has been stifled by a government that has become internationally isolated because of fear of spreading the message of democracy. The Zimbabwean economy has been in free fall since 1998 and has plummeted to a level where the exchange rate to the UK pound fell from ZW $5 : 1£ to ZW $10 million : 1£. The general poor health and subsequent deterioration in the quality of life has contributed to the worsening of the situation. Despite the multitudes of problems the country faces the various efforts have seen a reduction in the spread of the disease as acknowledged by the World Health Organisation.

4.1 The Scope of Social and Economic Losses in the HIV/AIDS menace

The HIV/Aids epidemic is simply a disaster of multiple proportions impacting an array of human facets among them social, health and economics. The notion of the HIV/Aids catastrophe has adversely impacted the development of nations especially the developing world where the provision of health services was weak and with the advent of HIV/Aids that has meant a huge strain that has brought the system to breaking point or melt down. The cost of the HIV/Aids epidemic that has been exacerbated by the political crisis bedevilling the country can be summarised as follows:-

- 1.7 million people are living with HIV, data have shown a decline in HIV prevalence which is currently estimated at 20.1%, down from 22.1% in 2003. The ripple effects of these figures include among other things reduced productivity in the workplace, the significant strain on the meagre resources for health by the government which were already limited.

- An estimated 38.6 million [33.4 million – 46.0 million] living with HIV worldwide - 4.1 million [3.4 million – 6.2 million] newly infected in 2005 - 2.8 million [2.4 million to 3.3 million] died of AIDS in 2005. The losses Zimbabwe suffers do not only relate to the Zimbabwean population but also the global impact which is constraining productivity across the world.

- There are 340 000 people living with HIV who needs ARVs but only 80 000 are getting the life-prolonging drugs. According to official figures an average of 3 000 people die of HIV-related illnesses every week in Zimbabwe although the number is thought to be much higher.
  http://www.zimbabwejournalists.com/story.php?art_id=2584&cat=1, accessed 14.07.07

- "A total of 16 499 deaths were registered at the Harare District Office of which 39 percent were people aged between 25 and 44.According to the 2005 council health department report, the number of deaths in Harare last year was lower than that of 2004 in which 17 365 deaths were recorded."
  http://www.herald.co.zw/inside.aspx?sectid=9812&cat=1   accessed 5.10.06

- "Suicides accounted for 112 deaths with 51 percent of the deaths occurring in the 25 to 44 age group. At least 35 percent of the suicides occurred in the 15 to 24 age group.   "The two age groups accounted for 85,6 percent of all suicides. As in previous years the most common method of suicides were ingestion of organophosphates, hanging and chloroquine overdose," reads part of the report. Malaria killed 129 people with 70 of the deaths occurring in the 25 to 44 age group."

http://www.herald.co.zw/inside.aspx?sectid=9812&cat=1, accessed 5.10.06

- It is reported that more than 600 000 people are in need of anti-retroviral because of their HIV/Aids status but only 120 000 are receiving it. That means that there is about 480 000 people at risk of death imminently because of lack of drugs and that is a big dent to both the social welfare for children and for the economic productivity of the country.

5. The Impact of Marketing Communications on Behavioural Change in Zimbabwe

Behavioural change related communication has had a positive impact on the spread of Aids in Zimbabwe and other countries as pointed in the UNAIDS Report 2006:-

The report notes some positive trends in young peoples' sexual behaviours. It says data shows increased use of condoms, delay of sexual debut and fewer partners. This has resulted in declines in HIV prevalence among young people between 2000 and 2005 in a number of African countries, including Botswana, Kenya and Zimbabwe.

(http://www.redbolivia.com/noticias/News%20in%20English/32880.html, Accessed 21.11.06)

Change in sexual behaviour in Zimbabwe has been difficult to achieve but ultimately sense has prevailed because of a range of things, among them, effective marketing communications. The following are some of the key developments and programmes that have helped in changing sexual practices in Zimbabwe:-

- It is a common experience for families to suffer HIV/AIDS related deaths which has made the society realise the importance of behavioural change because of the painful death and the reality of such death. Previously people would claim that they would not be affected as the disease was for those with weaker protective ancestral spirits.

- The government of Zimbabwe with the support of non-governmental organisations supported by the donor community has worked on a range of initiatives to bring home the calamity of the AIDS menace. The message has taken a variety of initiatives, among them informative advertisements, drama on national television, posters at hospitals. The programme had to be comprehensive given the potential for HIV/Aids to wipe out societies.

- Graveyards have filled up and new ones have been opened up for burial and that has sent chills down the spines of most Zimbabweans as evidence of the devastation of the AIDS menace. The common clique that "seeing is believing" has been observable in Zimbabwe. The sight of weak, thin and regretting friends or relatives waiting to die has led people to ask questions about the cost of sexual promiscuity and prompted them to consider their sexual practices in view of the possible consequences in case they contract the virus.

- The state of health for people with a full-blown HIV/AIDS condition is cause for concern as society tends to shun them and that has led people to think about the implications of being in that state.

- Promotional messages have helped people in take relevant informed precautionary measures to minimise the risk of contraction.

6. Conclusions

While efforts have been made at different levels across the country it is important to note that the spread of HIV/Aids is down to the individual behaviour – both the individual and the community at large change and arrest the devastation or perish in defiance. While in most cases the message has taken long to stick the reality of the matter is that the HIV/Aids phenomenon is a tragedy of the highest order. In the case of countries like Uganda, Zambia, Malawi, the Democratic Republic of Congo among others in Africa and the generality of the affected parts of the world the political climate hampered the spread of the promotional message and the distribution of the medicines was curtailed and allowed the situation to deteriorate into a catastrophe. The truth of the matter is that the HIV/Aids crisis cannot be left to chance and that the nations and the world at large face a big test in the protection of the human race and the sustenance of the human race. What is not debatable in this situation is the fact that without change there is peril driven by this epidemic and it is extremely important that action continues to be taken as the devastation of the disease continues to threaten not only humanity but the sustenance of livelihood given that the most affected proportion of the population is the most productive.

In the case of Zimbabwe it is clear that the message has been accepted rather gradually with a significant effect on the social and economic standing of the country. Apparently the political situation that has seen an economic meltdown has further exacerbated the catastrophe. In conclusion it can be argued that behavioural change is important in the fight against HIV/Aids. While in Zimbabwe significant efforts have been made in the quest to change behaviour towards practices and activities that are catalytic in the ad of the disease the corrupt behaviours, the economic meltdown and some retrogressive beliefs and practices have had an adverse effect in the fight against the epidemic.

The model by Norman and Carr (2003) is consistent with the situation prevailing in the case of Zimbabwe where knowledge drives subsequent programmes. The relevant variables about the spread of knowledge in the fight against HIV/Aids bring a number of challenges to the country and community at large. There are disagreements across the government, religious groups and social groups about the best way to redress the crisis. Some practices have been found not to work with some groups claiming abstinence from sexual activities have contracted the disease and ignorance about the means by which the disease spreads have also created unnecessary fears and unwarranted quarantining of the victims of HIV/Aids in society.

Ultimately the whole battle against the HIV/Aids menace comes down to the individual. The ordinary people need to be informed and health provisions should be improved to ensure appropriate medication where there is need. The idea of protection through avoidance and use of condoms are the two main means which can make a difference. From a marketing perspective the key is the promotion of positive behaviour that aids the reduction of the spread of the disease. In the main marketing communications to promote behavioural change is critical in the fight against HIV/Aids in Zimbabwe. While the efforts have met with mixed success the scope remains for continued efforts to make further reductions in the spread of HIV/Aids.

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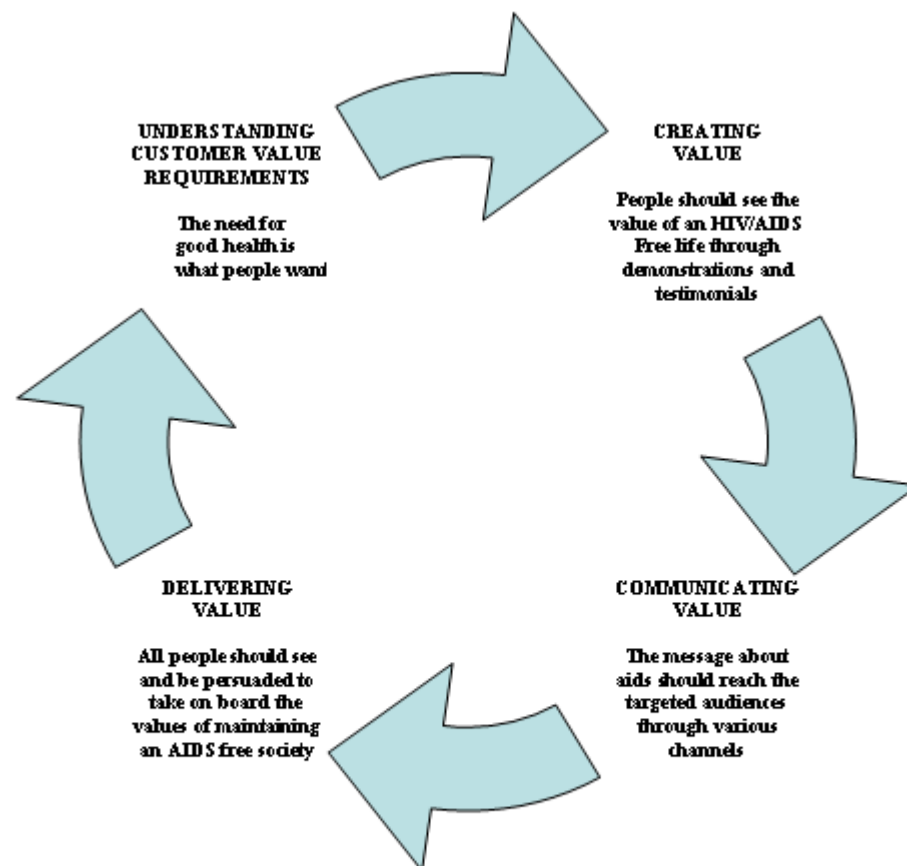
Source: Bathie and Sarkar (2002: p242)

Figure 1. Customer Focused Exchange
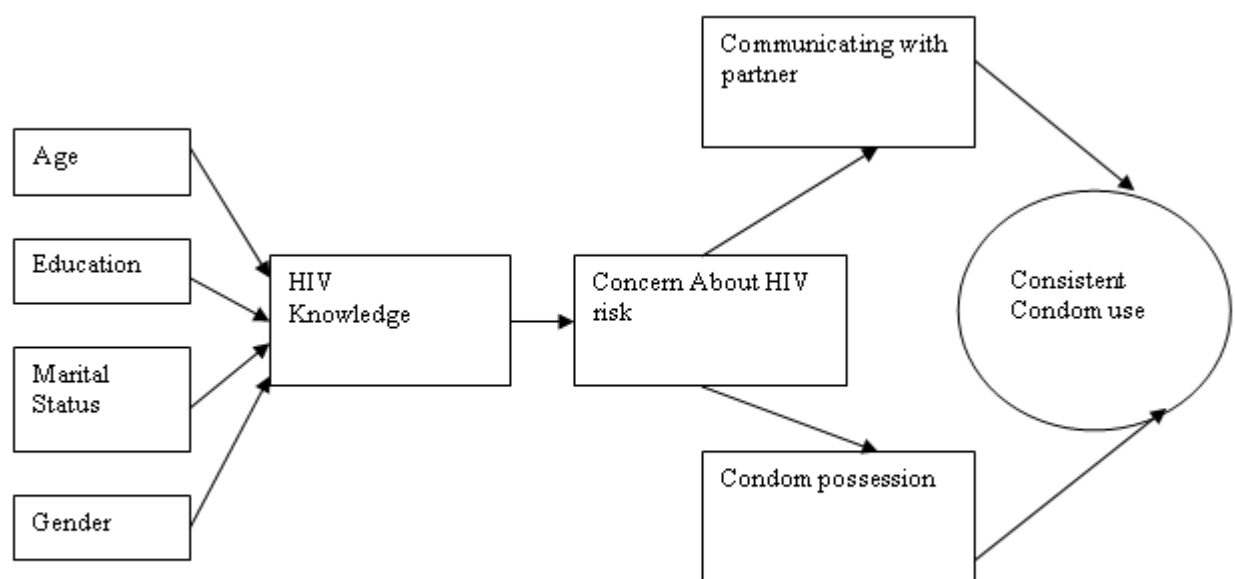
Norman and Carr (2003: p 150)

Figure 2. Explanatory Model
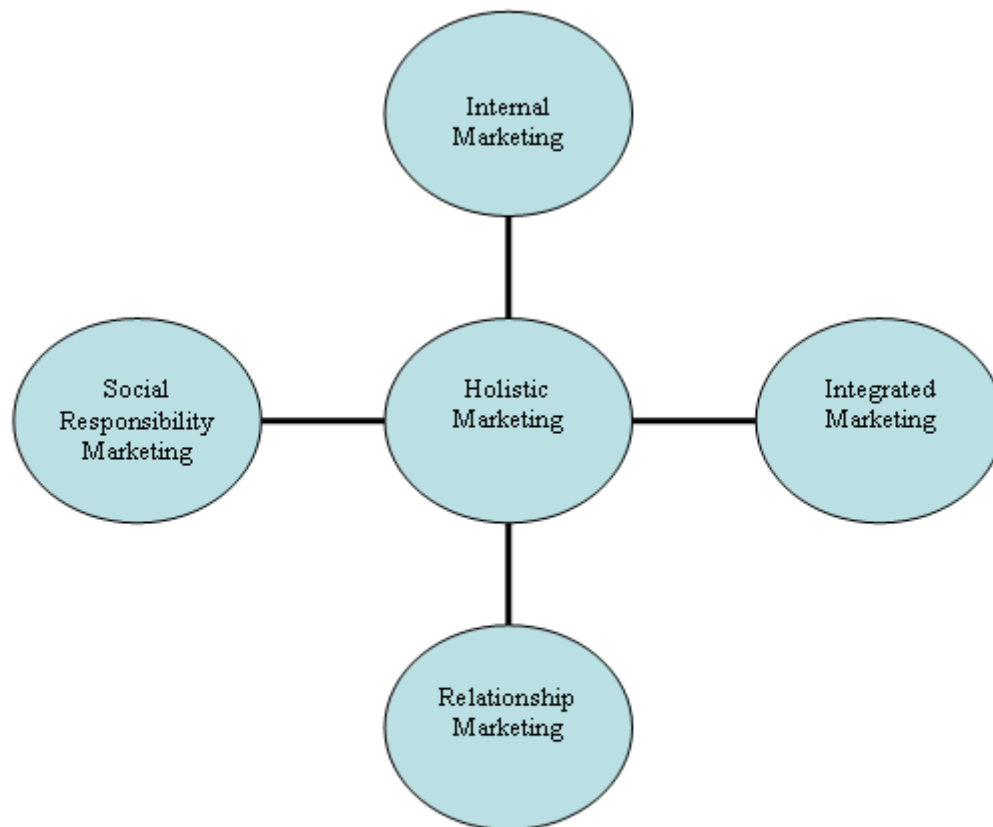
Source : Kotler and Keller (2006), Marketing Management, p18.

Figure 3. The Holistic Marketing Approach

Strategies of Implementing a Green Building Assessment System

in Mainland China

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Abstract

The application of green building assessment tools have been widely accepted as an useful way to promote sustainable construction. This paper has analyzed present status of green building assessment in Mainland China and pointed out the strategies of developing an effective assessment system in a large developing country.

Keywords: Green Building Assessment, Sustainable Construction, Sustainable Development

1. Introduction

Since the early 1990s, sustainable construction has been widely accepted in the construction industry. Building houses to meet the present need, we must take care of not compromising the ability of future generations to meet their needs. According to World Watch, one-tenth of the global economy is dedicated to constructing, operating and equipping homes and offices. This activity accounts for roughly 40% of the materials flow entering the world economy, with much of the rest destined for roads, bridges and vehicles to connect the buildings. In 1999, the International Council for Research and Innovation in Building and Construction (CIB) published the Agenda 21 on Sustainable Construction (CIB,1999), which has clarified the main concepts, aspects and challenges that sustainable development presents to civil construction.

To realize sustainable development in the construction industry, building environmental assessment methods, which are designed to promote environmental awareness amongst built environment professionals, have been perceived as effective tools. Cole et al. (2000) define building environmental assessment methods as tools for evaluating building performance with respect to a broad range of environmental considerations, organized into assessment criteria. That is, Building environmental assessment methods have emerged as a means to evaluate building performance across a broad range of environmental considerations. There are many assessment systems in different countries. It is hard to say one system is better than the others because they are all designed based on a national background, which induces the limited utilization of these systems. Therefore, to develop a world wide accepted green building assessment system has captured considerable attention.

2. Green building assessment system

The literature review of green building assessment tools shows a fruitful result. In the past several years, many environmental assessment systems for buildings have been built, including the BREEAM in U.K, the LEED in U.S.A, the QUANTUM in Netherlands, the PromisE in Finland, the ECO-PRO in Germany, the EQUER in France, the CASBEE in Japan and the Athena in Canada etc. These assessment methods vary in scope, structure, format and complexity. There is not any assessment tool which can be widely used although the world until the birth of GBTool. It can be traced back to the Green Building Challenge '98 (GBC '98). In order to develop a universal method for measuring building performance across a range of environmental issues, "The Green Building Tool (GBTool)" assessment framework came into being. Collaboratively developed by 19 countries, it can be regarded as an international building environmental assessment method and is applicable to different types of buildings as well. In GBTool assessment system, the building performance is structured hierarchically by criteria and sub-criteria based on

different performance issues and categories, including resource consumption, loading, indoor environmental quality, service quality, economics, pre-operation management and commuting transport etc. It addresses not only the biophysical environmental issues in the most comprehensible and dynamic manner of all the evaluated methods but also all building performance areas and all stages of the building lifecycle. The customization of benchmarks and weighting system provides opportunities to make GBTool adaptable in different circumstance.

Although GBTool undoubtedly provide a systematic and useful approach for green building assessment industry, many researchers have pointed out that green building assessment system should be adjusted according to the background of a certain country and region. Cooper (1999) contends that such current international attempts at developing a universal, standardized method for assessing the environmental performance of buildings are inherently flawed.   He argues that such methods are found wanting in that they are culturally implicit, and that such methods or tools "treat the sustainability [of the] wider built environment as simply a matter of energy and mass flows without due regard to the socio-economic and political dimensions of sustainability" (Cooper, 1999). In this context, Richard Hill et al. (2002) conducted research to answer the question whether building assessment tools originated from developed countries could satisfy the different environmental focus and socio-economic needs of South Africa. Recently, the name of GBTool has been changed to SBTool. All these research has shown that before using a universal green building assessment tool, it is necessary to analyze the local situation and identify the adaptability of using such a tool in a specific country and region.

In 2006, the government of China established the Green Building Assessment Standard. The main content consists of six indicators including land saving and outdoor environment, energy saving and efficiency, water saving and efficiency, material saving and efficiency, indoor environment quality, operation management. The assessment of each indicator is classified into three items, the controlling item, the normal item, and the optimizing item. The controlling item of each indicator must be met as a basic foundation. The normal item shows the general content of green building. The standard can be applied in residential and commercial buildings. The result of green building assessment is classified into 3 grades according to the amount of sub-items the building met.

3. The application of green building assessment system: advantages and disadvantages

3.1 Advantages

The main advantages for the application of green building assessment system in China are government support and awareness of the general public.

3.1.1 Government support

In 1994, the Chinese White Book named 'The 21 Century Agenda -Population, Environment and Development in China' has been put forward, which sets out the general strategy and action plan for sustainable development in China. Actually, as country with long civilized history, sustainable development concept is already identified in the old times. Xun Zi, a philosopher in Chinese history, has systematically put forward the theory that people should have respect for the ecologic rules and attach importance to the sustainable application of natural resources. Therefore, one of the advantages is the government support of using green building assessment tool because sustainable construction has already been taken as a basic policy in the construction industry. To realize sustainable construction, laws and policies have been made under the direction of sustainable strategy in Chinese construction sector. The Environmental Protection Law and the Construction Law can be regarded as the basic foundation of green building in China. On the based of these two laws, many regulations and rules have been made which cover different profiles of green building assessment, such as the Regulations on Environment Protection Management of Construction Project, the Energy Saving Management Regulation for Civilian Building and the Commercial House Performance Assessment institution etc. These regulations and rules have formed a basement to launch a life-cycle green building assessment system in the future.

3.1.2 Awareness of the general public

Another advantage is that more and more people gradually attach importance to sustainable construction. Compared with some developed countries, the percentage is not very high at present. However, the concept of green building has been widely accepted by the general public, especially in the urban area, which can be demonstrated by the urban housing market. Houses with better green building performance are usually sold with higher prices. Many people are apt to buy houses which can be good at energy saving and with good indoor environment quality. During the decoration stage of the houses, people no longer pay much attention to the luxury and honourable materials but the healthy ones. What they think about is how to make their home comfortable and healthy rather than to make them in the lap of luxury. Therefore, the awareness of green building by the general public will form the market-driven power for the application of green building assessment.

3.2 Disadvantages

The main difficulties found as to the application of green building assessment system are lack of basic data of implementing assessment, lack of professionals, as well as lack of interest from real estate developers. In addition, the difficulty of build a unified standard in a large country is another problem that should be solved in advance.

3.2.1   Lack of basic data of using assessment system

The main difficulties of using green building assessment system are related to the general lack of environmental data and standardization. There still does not exist a completed LCA database to easily access the environmental profiles for materials and products, which is the fundamental requirement for green building assessment. Moreover, it should take a long time to establish an energy performance reference which can be used throughout different climatic regions of China while directly using international databases is not available.

3.2.2   Lack of professionals

To implement green building assessment in the construction sector, there must exist a large number of professionals who are good at both construction and environmental knowledge. However, this requirement has not been met for the moment. Although there are many architects and engineers who are experienced in project design and construction, few of them have education or training background of sustainable construction, let alone green building assessment practice, which is an obstacle to push green building assessment forward in China.

3.2.3   Lack of interest from real estate developers

Although sustainable construction has been regarded as a good policy, the real estate developers, designers and contractors are only interested in if they can get more profit. Developing a project with high-level green building performance may not directly lead to an immediate payback. Except for some of the performance such as energy saving and indoor environment quality which are concerned by the consumers, the developers seldom really devote themselves to promote the life-cycle environmental loading performance of a building, notwithstanding they always boast they have develop a green building project in the advertisement. Without a definite reward, the developers are not really interested in using green building tool to assess and improve their project performance. Therefore, to push forward the application of green building assessment system, other related policies or institutions should be made such as definite tax reduction or exemption to the developers, designers and general contractors.

3.2.4   Difficulty of build a unified standard in a large country

As one of the largest countries in the world, the variance of climate, natural resources and economic situation etc. in different regions has made it difficult to develop a unified green building assessment system for the whole country. For example, water resource is now a really problem for the development in the north part while it is a light issue in the south region. In addition, the non-equilibrium of economic development in different regions has also made it difficult for the implementation of a unified green building assessment system.

4. Strategies

Based on advantages and disadvantages analysed above, strategies for the application of green building assessment system in China should be as follows:

4.1 The government should make policy to promote green building assessment

To promote the application of Green building assessment system, the government should make compulsory policies and institutions which can directly incorporate life-cycle green building assessment into the basic construction and operation process. Although there already exists a policy for environmental assessment in the feasibility study of a construction project, this assessment is limited in the feasibility phase and only concentrates on the assessment of environment pollution of the project. Therefore, a life-cycle green building assessment system should be employed for the assessment of the life-cycle green building performance of a construction project. Using such a system should be a compulsory requirement. At the same time, as a reward, corresponding tax reduction and exemption policy should be made which can be cooperated with the application of green building assessment system. In addition, in the government ranking system to the design and construction enterprises, achievement in building project with green building performance should be regarded as an assessment indicator.

4.2 Green building assessment should be in accordance with the international standard

The globalization of economy results in an oneness of standard. When establishing a green building assessment system in a certain country, it is very important to make it in accordance with the international standard. Therefore, the establishment of building an assessment system should be based on an international standard such as SBTool. That is, the indicators of the assessment system and the approach to use the system should both refer to the international standard. The advantage of referring an international system can not only make the assessment system more reasonable, but also make the result more acceptable.

4.3 Green building assessment standard needs to be customized

As the climate, natural resources and economic situation vary from region to region, customizing should be used according to the local and regional situation in the application of green building assessment system. The customizing process lies in two parts. one is that the indicator system should be adjusted according to the local situation, the other is the weight of each indicator must be defined based on its importance in a certain region. Moreover, since the assessment process of green building assessment system is onerous and usually takes a long time, it is recommended that green building assessment system can be divided into a two stages assessment system. The first stage is to assess the important inherent characteristics of a building such as resource consumption, loading, indoor environmental quality, service quality and economics etc. The second stage is to assess the performance of pre-operation management and commuting transport. The customer can choose the two assessment stages step by step.

4.4 Fundamental database needs to established in advance

Before the application of green building assessment system, the fundamental database for green building performance should be established. Although there exist some international databases, it cannot be directly employed in the Chinese context. The database must be built according to the situation in China. It should be a completed LCA database which includes the detail energy consumption and environment loading data of construction materials and products. This onerous work should be done as soon as possible because it will take a long time.

4.5 A large number of professionals of green building assessment needs to be developed

To push ahead with the application of green building assessment system, there must be enough professionals who are good at the knowledge of sustainable construction. Unfortunately there still lack of such professionals to carry out green building assessment work at present. The only way to get rid of this obstacle is by launching training and education program. This work should also be started immediately, as it is a major premise for the application of green building assessment system. Meantime, the assessment system to the professionals and organizations that will carry out green building assessment work should be gradually set up. The manage system for these assessment professionals and organizations should be mature, otherwise the green building assessment work cannot be implemented in perspective and the assessment result is meaningless.

5. Conclusion

Sustainable construction is the application of sustainable development in the construction industry. To realize sustainable construction, establishing green building assessment system is undoubtedly a right way. However, when choosing a green building assessment tool, we usually be puzzled by whether to use an international assessment tool or totally make a tool for our own. From the authors' point of view, the effective way is to choose an international tool as a basement and then make a custom-build tool according to Chinese situation. A good assessment tool should be judged according to its potential application. In other words, it must be designed according to the local and regional situation from the guideline system to the labeling tools as well as implementation strategies. And it must coordinate with the local laws, rules and standards. In this paper, the author has put forward a set of strategies for implementing green building assessment. Further research needs to be conducted based on this initial journey to promote green building in China.

6. Acknowledgement

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Relationship between Economic Value and Species

Diversity of Timber Resources in a Hill Forest in Peninsular Malaysia

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Abstract

Timber resource is a major component of tropical forest and usually undervalued economically. This paper attempts to examine the relationship between economic value and species diversity of a hill dipterocarp forest in Peninsular Malaysia. The rank-abundance curve described a lognormal distribution pattern, indicating high diversity communities. The species diversity indices obtained were high: Fisher's alpha diversity index ranged from 96.53 to 109.56, Shannon-Weiner index were 5.29 to 5.39, while values of Simpson Index ranged from 134.02 to 151.11. The estimated mean stumpage value per hectare was Malaysian Ringgit RM25 413 and the main contribution was from the family Dipterocarpaceae. The regression analysis showed that the relationship between stumpage value and species diversity was not significant at the 5% level ($p > 0.05$). Timber volume, size of trees and the presence of high timber value have great influence on the stumpage value for a given forest area.

Keywords: Economic value, Species diversity index, Regression analysis, Residual value technique

1. Introduction

Malaysia's forest essentially comprise of an evergreen rainforest with sixteen different types of natural climatic and edaphic forests ranging from the coasts to mountains (MOSTE, 1997). Her species diversity is one of the richest in the world and its contribution is very significant for the socio-economic development of the country. The diversity of forest goods and services provides timber and non-timber goods in the forestry sector, food and industrial crops in the agriculture sector and the regulation of good water, air, temperature and carbon sequestration amongst others. The lowland and hill forests provide many valuable timber species and predominate the international tropical timber market.

Numerous descriptive studies of species richness in lowland and hill forests have been used to analyse structure and diversity. Generally, these studies relied on data from various plot sizes ranging from one to four hectares. The economic value of timber resources has also been extensively analysed and has covered many different types of forest ecosystems. Despite numerous studies, there has been little effort to examine the relationship between the economic value measured by stumpage value and species diversity of tropical forests. The aim of this paper was to show the kind of relationship between stumpage value and species diversity in a tropical hill forest. This study is part of an on-going larger project entitled "Economic Valuation and Forest Resource Accounting in Peninsular Malaysia" commissioned by the Forestry Department Peninsular Malaysia in 2006 to the Faculty of Forestry, Universiti Putra Malaysia to determine the economic value of forest resources for six forest ecosystems viz., montane forest, hill forest, lowland forest, peat swamp forest, mangrove forest and coastal forest.

2. Materials and Methods

2.1 Study Area

This study was carried out in Tranum Forest Reserve, Pahang, Peninsular Malaysia during the year 2006. Five plots each of size 1 ha (100m x 100m) were established along a line transect from altitude 350 to 880 m a.s.l. Plots 1, 2, 3, 4 and 5 were further divided into 10m x 10m subplots for enumeration purposes. All trees greater than 1 cm dbh were measured and identified up to the specific level. The details of the plots' establishment are discussed in another paper (Faridah-Hanum *et al.,* 2007).

2.2 Species diversity

Species abundance times quadrat matrices were prepared and then exported for each two combination plots (e.g. plots 1 & 2, plots 1 & 3, etc) in order to calculate the means and variances of the species richness-estimators, based on 50 randomized quadrat orders for each data set. The program EstimateS was used to compute species richness-estimators (Colwell, 2006). The rank-abundance curve was then examined and plotted to describe the community structure based on the lognormal distribution model. The following formula were used to calculate various species richness and diversity indices (Waite, 2000):

a) Margalef's index of species richness: $R = (S_{obs}-1)/\ln N$, where $\ln N$ is the natural log of the number of individuals inventoried, S_{obs} is the total number of species recorded

b) Alpha Fisher's index of diversity: $S = \alpha \ln (1+N/\alpha)$

c) Shannon-Wiener index of diversity: $H' = -\Sigma p_i * \ln p_i$, where p is relative percentage cover value of species expressed as a proportion

d) Simpson's (inverse) index of diversity: $S = 1/D$, where D is the sum of relative percentage (i.e. Σp_i , that is the index of dominance), D ranges from $1 - S_{obs}$)

e) Pielou's measure of evenness: $E = H'/\ln S_{obs}$

2.3 Estimating Economic Value of Timber Species

The economic value of timber resources i.e. standing tree is called stumpage value and can be calculated using the residual value technique. Stumpage value is calculated by taking the difference between the selling value of the products made from it and the stump-to-market processing costs (including margin for profit and risk) (Davis & Johnson, 2000; Klemperer, 2003). The following formula is used to calculate stumpage value for each tree inventoried (Awang Noor et al., 1992; Awang Noor & Mohd. Shahwahid, 1995):

$SV_{i,j} = (P_{i,j} – C – PM_{i,j})*V_{i,j}$ where, SV is stumpage value per hectare (RM), P is ex-forest log price (RM/m3), C is logging cost (RM/m3), PM is profit margin (RM/m3), V is volume of standing tree (m3), i is index of species, j is the index of diameter class. The margin for profit and risk (PM) is computed as follows:

$PM_{ij} = (P_{ij} * PR) / (1+PR)$, where PR is profit ratio. The profit ratio used here was 0.3.

The total stumpage value is obtained by summing up the stumpage value for all individual trees in the study area, i.e.

$$\text{Total SV} = \sum_{i=1}^{n} \sum_{j=1}^{k} SV_{i,j} = \sum_{i=1}^{n} \sum_{j=1}^{k} [(P_{i,j} - C - PM_{i,j}) * V_{i,j}]$$

The volume of individual tree inventoried was estimated using local volume table developed by Awang Noor *et al.* (2001) and given as follows:

$$V_i = 0.0015086 * DBH_i^{1.882311}, \quad \text{where V is volume of standing tree (m}^3\text{), DBH is tree dbh and } i \text{ is index of tree.}$$

Data on log prices (in Malaysian Ringgit RM) by species and diameter classes were obtained from ASPA (2004) log price report. The ex-forest log prices per cubic meter were reported for individual species and species groups. The average logging cost used was RM120/m^3 and the profit ratio was 0.3.

2.4 Relationship Between Economic Value and Species Diversity

The relationship between stumpage value and species diversity can be written as follows:

$SV_i = \alpha + \beta * SDI_i + \varepsilon_i$, where SV is stumpage value (RM) in each quadrat i (20m x 20m), SDI is Shannon-Wiener diversity index (for all trees above 1 cm), α and β are parameters and ε is random error with mean zero and common variance, $\varepsilon_i \sim N(0,\sigma^2)$. The estimated model was:

$\hat{SV}_i = \hat{\alpha} + \hat{\beta} * SDI_i$

The model was estimated using the ordinary least square technique (OLS). Two situations were evaluated: (a) trees greater than 30 cm dbh, and (b) trees above the cutting limit (50 cm for dipterocarps, and 45 cm for the non-dipterocarps). These are the minimum diameter cutting limits for trees to be harvested under the sustainable forest management (SFM) practices in Peninsular Malaysia.

3. Results and Discussion

3.1 Species Diversity

There were 22 374 stems comprising   446 tree species included in 176 genera and 64 families   identified from all the plots. Results on the floristic composition, tree families and species dominance were discussed in detail in a separate paper (Faridah-Hanum *et al.,* 2007). The rank-abundance curve in Figure 1 describes a lognormal distribution pattern, indicating how varied the community was. The density dependent measures showed that the study area had   high diversity in all plots (Table 1). The Fisher's alpha diversity index (α) range from 96.53 to 109.56 and the average for all plots is 102.27. The Shannon-Weiner index (H') gave a very high value ranging from 5.29 to 5.39; while the average for all five plots gave H' = 5.36. The values of H' increased with species but they rarely exceed 5.0 (Waite,   2000). The Simpson index (D) range from 134.02 to 151.11 and the average is 144.04 which is a measure of index of dominance and gives the probability that two individuals drawn randomly from a sample will belong to the same species. The distribution of the individuals among the species was even in all plots (E > 0.9). The significant difference of the Shannon-Wiener index between   two plots can be compared using the Student's t-test, which is given by (Waite, 2000) is shown   in Table 2.   The Shannon-Wiener index were not significantly different among plots 3, 4 and 5 (p>0.05). All other comparisons of Shannon-Wiener index were found to be significantly different at the 5% level (p<0.05).

3.2 Economic Value

It was found that the average stumpage value per ha for commercial trees above the cutting limit (trees above cutting limit: $\geq$ 50 cm for dipterocarps and $\geq$ 45 cm for non-dipterocarps) was RM 25 413 per ha (Table 3). More than half (57%) of the stumpage values was contributed by the family Dipterocarpaceae followed by Myristicaceae (11.1 %), Sapotaceae (7.7%), Guttiferae (5.8%) and Myrtaceae (4.1%). This was due to the contribution by larger sized trees of three major species of the family Dipterocarpaceae which were *Shorea platyclados*, *S. ovata* and *S. parvifolia*   which contributed about   47% of the total stumpage value per hectare (Table 4). For trees $\geq$ 30 cm the dipterocarps present contributed an average per ha of 66% of the total stumpage value (Table 5). The stumpage value also varied by diameter class. About half (47%) of the total stumpage was from the diameter class 50-80 cm. The results also indicated that higher diameter class had contributed the large proportion of stumpage value. This shows that in terms of economic value of timber resources, its contribution depends on the extent of the   timber volume, the size of trees and the presence of high value timber.   When compared to the stumpage value estimated from previous studies, the stumpage value estimated in this study site was relatively high and in most cases greater than the other forest areas (Table 6). This study hence proved that commercial sized trees gave a higher stumpage value.

3.3 Relationship Between Economic Value and Species Diversity

The scatter plot of stumpage value and one of the species diversity indices is shown in Figure 2.   It can be seen that the relationship is positive but it is observed that a large variation of stumpage value exists as the diversity index increases. The large variation of stumpage value at higher values of diversity index might indicate the presence of heteroskedasticity in the sample (Gujarti, 2003). Using the Breusch-Pagan-Godfrey heteroskedasticity test of software STATA 8.0, we obtained the χ^2 value of   0.92 at 5% level of significance. Therefore, we conclude that there was   no heteroskedasticity of error variance (p >   0.05) and the parameter estimates were done using the ordinary least square (OLS) method.

The results of the regression analysis for OLS are presented in Table 7. There is a   positive relationship between stumpage value and species diversity in the study area   for trees above 30cm dbh and above the cutting limit. However, the variation of stumpage value is explained as a small percentage of species diversity (3 percent for trees greater than 30 cm and less than 1 percent for trees above the cutting limit). The coefficients of the regression indicate that an increase of one point of diversity index increases the stumpage value by Malaysian Ringgit RM456 and RM956 for trees $\geq$ 30 cm dbh and 45 cm dbh,   respectively.   However, the regression coefficients in   the two dbh situations are not significantly different at 5% level (p > 0.05). Therefore, the results of the study showed that the economic value of timber resources did not depend on species diversity in a   hill forest. As mentioned in the preceding section, stumpage value depends on the extent of timber volume, the size of trees and the presence of high value timber not on whether the forest is highly diverse or has high species richness.

4. Conclusion

The Tranum Forest Reserve, Pahang shows both high species diversity and   economic value.   However, the results of regression analysis suggest stumpage value was not affected by species diversity. The low variation of this

relationship is attributed to different factors affecting stumpage value and species diversity. While the stumpage value is affected by timber volume and market condition of log, species diversity is affected by many related factors such as historical factors of the area, spatial heterogeneity, competition, climatic, productivity and disturbance of the area. Further analysis is required to examine the relationship between economic value and species diversity under various market conditions. Incorporating economic and ecological perspectives in forest management will enhance sustainable forest management.

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Table 1. Diversity dependent measures for each 1-ha plot calculated based on tree density, Tranum Forest   Reserve, Pahang (trees $\geq$ 1 cm dbh)

Diversity dependent measure	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Average All Plots
N	3924	3577	4952	5002	4919	4475
S_{obs}	360	355	388	421	417	388
Basal Area	70.45	56.30	130.13	126.89	99.83	96.72
R	43.38	43.26	45.49	49.31	48.94	46.08
α	96.53	97.93	98.56	109.56	108.78	102.27
	(2.89)	(3.02)	(2.74)	(2.97)	(2.97)	
H'	5.29	5.33	5.4	5.38	5.39	5.36
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	
S	134.02	148.04	151.11	143.45	143.58	144.04
	(0.61)	(0.58)	(0.74)	(0.70)	(0.69)	
E	0.90	0.91	0.91	0.89	0.89	0.90

Table 2. Results of t-tests for comparison of Shannon-Wiener Index among plots in Tranum Forest Reserve,   Pahang (** significant at the 5% level; ns not significant at the 5% level)

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Plot 1	-	-2.0**	-5.5**	-4.5**	-5**
Plot 2		-	-3.5**	-2.5**	-3**
Plot 3			-	1.0ns	0.50ns
Plot 4				-	-0.50ns
Plot 5					-

Table 3. Average stumpage value per hectare (RM/ha) by   families in   Tranum Forest Reserve, Pahang (trees above cutting limit: ≥ 50 cm for dipterocarp; ≥ 45 cm for non-dipterocarp)

Family	Stumpage Value (RM)	Percentage
Dipterocarpaceae	14485	57.00%
Myristicaceae	2812	11.07%
Sapotaceae	1947	7.66%
Guttiferae	1453	5.72%
Myrtaceae	1041	4.10%
Lauraceae	462	1.82%
Tiliaceae	408	1.61%
Thymelaeaceae	307	1.21%
Moraceae	241	0.95%
Polygalaceae	241	0.95%
Meliaceae	192	0.75%
Ebenaceae	181	0.71%
Anacardiaceae	153	0.60%
Burseraceae	141	0.55%
Fagaceae	118	0.46%
Rubiaceae	102	0.40%
Flacourtiaceae	89	0.35%
Icacinaceae	86	0.34%
Apocynaceae	82	0.32%
Leguminosae	82	0.32%
Euphorbiaceae	78	0.31%
Ulmaceae	77	0.30%
Rosaceae	74	0.29%
Proteaceae	60	0.24%
Verbenaceae	57	0.23%
Juglandaceae	51	0.20%
Araucariaceae	45	0.18%
Sapindaceae	45	0.18%
Elaeocarpaceae	44	0.17%
Podocarpaceae	38	0.15%
Symplocaceae	36	0.12%
Sterculiaceae	28	0.11%
Rhizophoraceae	21	0.08%
Ochnaceae	21	0.08%
Theaceae	20	0.08%
Myrsinaceae	20	0.08%
Magnoliaceae	17	0.07%
Pandanaceae	14	0.05%
Meliosmaceae	10	0.04%
Ericaceae	10	0.04%
Melastomataceae	7	0.03%

Lecythidaceae	6	0.02%
Staphyleaceae	6	0.02%
Annonaceae	6	0.02%
Actinidiaceae	3	0.01%
Celastraceae	3	0.01%
Total	RM 25413	100.00%

Table 4. Top 20 Most High Stumpage Value Timber Species (RM/ha), Tranum Forest Reserve, Pahang (trees above cutting limit: ≥ 50 cm dbh for dipterocarp; ≥ 45 cm dbh for non-dipterocarp)

Species	Family	Stumpage Value Per ha	Percentage
Shorea platyclados	Dipterocarp	8254	32.5%
Shorea ovata	Dipterocarp	1905	7.5%
Shorea parvifolia	Dipterocarp	1807	7.1%
Knema intermedia	Non-Dipterocarp	1394	5.5%
Dipterocarpus crinitus	Dipterocarp	1303	5.1%
Shorea maxima	Dipterocarp	951	3.7%
Payena dasyphylla	Non-Dipterocarp	642	2.5%
Calophyllum fraseri	Non-Dipterocarp	557	2.2%
Calophyllum symingtonianum	Non-Dipterocarp	452	1.8%
Pouteria malaccensis	Non-Dipterocarp	418	1.6%
Pentace curtisii	Non-Dipterocarp	408	1.6%
Knema scortechinii	Non-Dipterocarp	368	1.4%
Gonystylus maingayi	Non-Dipterocarp	307	1.2%
Horsfieldia crassifolia	Non-Dipterocarp	279	1.1%
Syzygium sp.12	Non-Dipterocarp	242	1.0%
Palaquium sp.	Non-Dipterocarp	231	0.9%
Palaquium rostratum	Non-Dipterocarp	195	0.8%
Palaquium obovatum	Non-Dipterocarp	161	0.6%
Cratoxylum arborescens	Non-Dipterocarp	155	0.6%
Xanthophyllum palembanicum	Non-Dipterocarp	143	0.6%
Subtotal	All groups	20,173	79%
	Dipterocarp	(14,221)	(70%)
	Non-dipterocarp	(5,951)	(30%)
Remaining species		5,241	21%
Total		RM 25,413	100%

Table 5. Average stumpage value per hectare by diameter class and species group (RM/ha), Tranum Forest   Reserve, Pahang (trees ≥ 30 cm dbh)

Diameter Class	Dipterocarp		Non-dipterocarp		Total	
	Stumpage Value	Percentage	Stumpage Value	Percentage	Stumpage Value	Percentage
30-40	1741	9.1%	-	-	1741	6.0%
40-50	2893	15.2%	53	0.5%	2946	10.2%
50-60	3586	18.8%	1752	17.6%	5338	18.4%
60-70	2559	13.4%	1975	19.8%	4534	15.6%
70-80	2105	11.0%	1810	18.2%	3915	13.5%
80-90	941	4.9%	1165	11.7%	2106	7.3%
90-100	524	2.8%	638	6.4%	1162	4.0%
100-110	1774	9.3%	104	1.0%	1878	6.5%
110>	2934	15.4%	2454	24.7%	5389	18.6%
Total	19058	100.0%	9951	100.0%	29009	100.0%

Table 6. Estimated total stumpage value from previous studies in Peninsular Malaysia (RM/ha) (trees ≥ 30 cm   dbh)

Forest Type	State	Forest Reserve/ Compartment	Year of study	Average stumpage value per ha (RM/ha)	Source
Hill Forest	Pahang	Lesong FR/ C88 &89	1989	25,235	Awang Noor *et al.* (1992)
Hill Forest	Pahang	Bencah FR/C15	1989	11,200	Awang Noor *et al.* (1992)
Hill Forest	Pahang	Berkelah FR/C50	1999	12106	Nur Hajar (1999)
Hill Forest	Pahang	Tekai Tembeling FR/C77	2003	13,992	Awang Noor & Mohd. Shahwahid (2003)
Hill Forest	Pahang	Lesong FR	2003	42,532	Awang Noor & Mohd. Shahwahid (2003)
Hill Forest	Kelantan	Balah FR/Block 95	1996	26,271	Che Roslan (1996)
Hill Forest	Terengganu	Jengai FR/C86	1989	17,172	Awang Noor *et al.* (1992)
Hill Forest	Kedah	Ulu Muda FR/C27	1994	26,710	Faridah-Hanum *et al.* (1999a)
Hill Forest	Johor	Lenggor FR/C225	1994	23,038	Dominic (1995)
Lowland Forest	Selangor	Ayer Hitam FR/	1995	26,362	Faridah-Hanum *et al.* (1999b)
Hill Forest	**Pahang**	**Tranum Forest Reserve**	**2006**	**28,962**	**This study**

Table 7. Results of regression analysis for stumpage value (SV) and Shannon diversity index (SDI)

(ns – not significant at the 5% level)

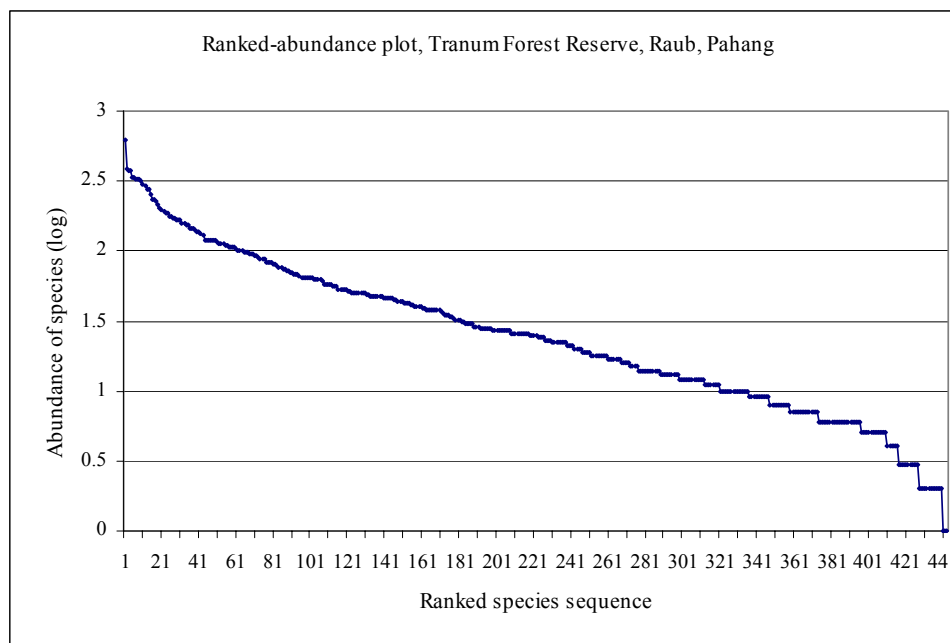| Variable	Parameter	Trees ≥ 30 cm dbh	Trees above cutting limit
(constant)	$\widehat{\alpha}$	-3419.766ns (2555.561)	-1309.244ns (2057.498)
SDI	$\widehat{\beta}$	954.503ns (574.312)	455.856ns (462.761)
N		93	110
R square		0.029	0.009
F value		2.762ns	0.928ns

Figure 1. Ranked-abundance plot, Tranum Forest Reserve, Pahang (trees ≥ 1 cm dbh)
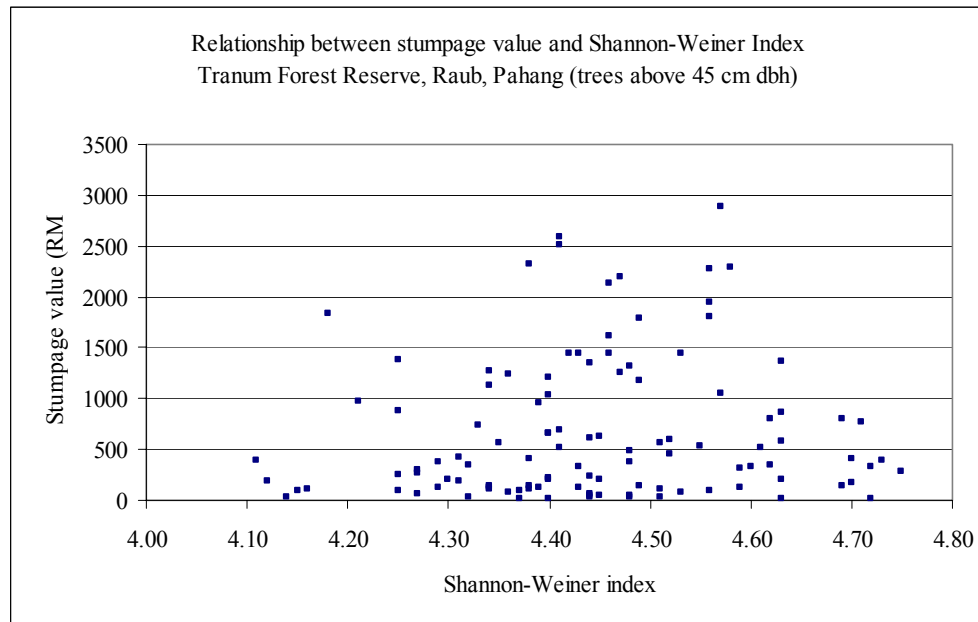
Figure 2. Relationship between stumpage value and Shannon-Wiener Index, Tranum Forest Reserve, Pahang   (trees ≥ 45 cm dbh)

The Dynamic Optimization Model of Industrial Structure

with Energy-saving and Emission-reducing Constraint

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Abstract

In recent years, because of China's rapid economic growth, the contradiction between energy consumption, environmental pollution and economic development has become acute increasingly. Energy-saving and ejection-decreasing has become an important strategy target in China's "11th Five-Year Plan". The research on the industrial structure optimization of China, should be given full consideration to all current energy and environmental problems. The industrial structure optimization model in this paper containing energy-saving and ejection-decreasing, shows its simulation results that through optimization of the industrial structure it would be realized that meeting energy reduction demand, and also to maintain high economic growth rate.

Keywords: Optimization of industrial structure, Dynamic optimization, Energy-saving and emission-reducing

1. Introduction

China has made a tremendous achievement on economy since the reform and opening, the Gross of National Product has been growing, and the people's standard of living has been markedly improving. Optimization of the industrial structure aiming at economic growth enable the economic resources flowing from the low relatively productivity to high relatively productivity of industries, and which will also drives the total economy efficiency growing, and promotes the national economy. However, in recent years, at the same time of rapidly growing in economy, the conflict between economy growing with energy consumption and environmental pollution has been become increasingly vigorous, and therefore energy-saving and emission-reducing have been become a strategy target in China's "11th Five-Year Plan". As thus, the study up on multi-objective optimization of China's industrial structure has been with important theoretical and practical significance.

This paper constructs a dynamic optimization model of industrial structure with energy-saving and emission-reducing constraints based on "11th Five-Year Plan"; optimizes the industrial structure to resolve the current problems of China's economic development, energy and environmental issues.

2. Model Design

2.1 Objective Function

In this paper, the industrial structure optimization model continues to target for economic growth, and aims at meeting the energy-saving and emission-reducing constraints of "11th Five-Year Plan" on the binding nature of energy-saving emission reduction targets, while achieving higher levels of economic growth. So here set economic growth targets for the total GDP maximization in the planning period, that is,

$$\max \quad f(x_t) = \sum_{t=1}^{T} e'(x_t - A_t x_t)$$

where $x_t = (x_{1t}, x_{2t}, \cdots, x_{nt})'$ stands for the industry's gross output vector of period t, A stands for direct consumption coefficient matrix, and $e = (1,1,\cdots,1)'$ stands for unit column vector.

2.2 Constraint Conditions

2.2.1 Energy Consumption Constraints

$$C_t \geq c_t' x_t$$

where $c_t = (c_{1t}, c_{2t}, \cdots, c_{nt})'$ stands for energy consumption of the industry's unit gross output of period t, and C_t stands for the indices of energy consumption of period t.

2.2.2 Environment Pollution Constraints

$$W_t \geq \alpha_t' x_t$$
$$G_t \geq \beta_t' x_t$$
$$S_t \geq \gamma_t' x_t$$

where $\alpha_t = (\alpha_{1t}, \alpha_{2t}, \cdots, \alpha_{nt})'$, $\beta_t = (\beta_{1t}, \beta_{2t}, \cdots, \beta_{nt})'$, $\gamma_t = (\gamma_{1t}, \gamma_{2t}, \cdots, \gamma_{nt})'$ stand for pollution emission of the industry's unit gross output of period t, and W_t, G_t, S_t stand for the indices of pollution emission, in wastewater, waste gas and waste solid.

In addition, the economic operation is decided by inherent connection of the economic variables. The actual economic operation mechanism decides the structure of model. So the model should include the economic operation constrains as follows:

2.2.3 Dynamic Input-output Balance Constrains

$$x_t = A_t x_t + B_t (x_{t+1} - x_t) + y_{1_t} + y_{2_t}$$

where $B_t = (b_{ij})_{n \times n}$ stands for investment coefficient matrix, b_{ij} stands for investment of the industry "i" to increase the unit output of industry "j", $B_t(x_{t+1} - x_t)$ stands for capital formation vector, y_{1_t} stands for final consumption vector, and y_{2_t} stands for net export vector.

2.2.4 Capital Formation Constrains

$$(s_t + s_{f_t}) e'(x_t - A_t x_t) \geq e' B_t (x_{t+1} - x_t)$$

where s_t stands for saving rate, s_{f_t} stands for the GDP proportion of foreign capital inflow. The constraints show that investment capital of next period composes of national savings and foreign capital inflow.

2.2.5 Consumer Demand Constrains

$$(1 - s_t) e'(x_t - A_t x_t) \geq e' y_{1_t}$$

2.2.6 Net Exports Constrains

$$s_{f_t} e'(x_t - A_t x_t) \geq -e' y_{2_t}$$

2.2.7 Production Capacity Constrains

$$q_1 x_{t-1} \geq x_t \geq q_2 x_{t-1}$$

where $q_1 > 1 > q_2 > 0$. The constraints will limit the industry's rapid growth or recession. First, the short-term industry production capacity will not change too much; secondly, the excessive growth or recession of a particular industry will lead to considerable changes in industrial structure, thus cause fluctuations in economic growth.

2.2.8 Nonnegative Constraints

$$x_t, y_{1_t} \geq 0$$

3. Data Processing

Industry classification of this paper is consistent with the 17 sector input-output table of the National Bureau of Statistics. The data of model are from the "China Statistic Yearbook," 2005 as annual base period. According to historical data, the main parameters in model are set as follows:

$$s_t = s_0 = 0.43$$

$$s_{f_t} = s_{f_0} = 0.05$$

$$q_1 = 0.8, \quad q_2 = 1.2$$

According to the goal of "11th Five-Year Plan", we set C_t 4% annual increase and W_t, G_t, S_t 2% annual decline. In addition, $A_t = A_0$ and $B_t = B_0$ need to be calculated according with the relevant data.

3.1 Direct Consumption Coefficient Matrix

Direct consumption coefficient is very important in the input-output model, particularly dynamic input-output model. It reflects economic and technical relations among industries, and changes with economic environment, technical level, etc. So, direct consumption coefficient of different periods is different. In practice, because of the lag of input-output tables, the input-output analysis usually assumes that the industrial input-output relations have maintained a long period of unchanged. Clearly, it is in contradiction with actual economic changing. Therefore, Direct Consumption Coefficient matrix needs to be revised effectively.

Based on the RAS method, we construct diagonal matrix $\mathbf{R}$ and $\mathbf{S}$ representing the fabrication and substitution effects, and set up the modification model of direct consumption coefficient matrix as follows:

$$
\begin{cases}
\min & \sum_{i,j} a_{ij}^{05} \log\left(\dfrac{a_{ij}^{05}}{a_{ij}^{02}}\right) \\
\text{s.t.} & A_{05} = RA_{02}S \\
& A_{05}x_{05} = v_{05}
\end{cases}
$$

This model uses data of the gross output (x_{05}) and added value (v_{05}) to revise direct consumption coefficient matrix, makes a breakthrough to the continuity assumptions in changing of the relationship between input and output, and can use known data farthest.

3.2 Investment coefficient matrix

In static input-output model, the investment as a final demand is exogenous variables, which dissevers production targets and production capacity, can not accurately reflect the expand production of social product. Dynamic input-output model makes variables exogenous by introducing investment coefficient matrix, and reflects the intrinsic link between reproduction and productive investment. In the dynamic input-output analysis and application of the model, the investment coefficient matrix is the key role; the accuracy of input-output analysis depends largely on investment coefficient. We determine investment coefficient matrix as follows:

$$b_{ij_t} = \frac{\Delta s_{i_t} a_{ij_t}}{\Delta x_{j_{t+1}} \sum_{j=1}^{n} a_{ij_t}}$$

where Δs_{i_t} stands for the investment-increment of industry "i" of period t. The input-output model relates the static and dynamic input-output model, and reflects the relationship between the investment allocation and the output-increment.

4. Simulation Results

Table 1 gives the simulation results. In 2010 China's GDP will reach 29.72 trillion, in 2015 will rise to 46.64 trillion, in 2020 continued to rise to 71.85 trillion, with an average annual growth rate to reach 9-10%. Total energy consumption and pollutant emissions are scheduled to meet the binding targets, in 2020 alone than the total energy consumption in 2005 increased by 75.1%, while the GDP increased by nearly three times. The three major industrial pollutant emissions are achieved a slight decline, from 2010 to 2015 the average annual industrial waste solid discharge fell 5.6%, from 2015 to 2020 the average annual decline 6.1%, emission of pollutants has been effectively controlled.

From the changes of added value proportion of three industries, in 2010, the proportion of three industries were 19.3%, 33.7% and 47.0%, compared with 2005 the proportion of primary industry rose 6.8 percentage point decline in the proportion of secondary industry 13.8% proportion of the tertiary industry rose 7.1 percentage points. By 2015, the primary industry, the proportion of secondary industry continues to decline, respectively, 10.4%, 29.8%, while the tertiary industry rose to 59.8. 2020, the proportion of primary industry dropped to 3.0%, the secondary industry accounted for by small pick-up , To 32.8%, the proportion of the tertiary industry continued to rise to 64.2%, the three-industry structure is close to the level of developed countries.

Table 2 gives the simulation results of added value structure of 17 sectors. In 17 sectors, increased proportion of larger

industries are Textile, Sewing, Leather and Furs Products; Construction; Transportation, Postal and Telecommunication Services; Real Estate, Leasing and Business Services; Other Services. And the remaining nine sectors largely decline in the proportion. We can see that the 10 sectors, only Textile, Sewing, Leather and Furs Products increased proportion, and 3 sectors have increased the proportion in the tertiary industry, and the increase in larger, industrial structure softening trend is very clear.

This trend of industrial structure indicates that China's industrial structure in recent decades through the development and adjustment, the overall already in the middle stage of industrialization, economic growth too dependent on the input of capital and resources, high-value, low-power the tertiary industry development has been slow and the increasingly serious environmental pollution, the development of sustainable capacity is not strong. In China's industrialization process, the main driving force behind economic growth in the industry are mainly from the secondary industry, while the secondary industry is the largest energy consuming industries, but also has brought more emissions. Therefore, the energy of the emission reduction targets to achieve, is bound to accelerate the development of the tertiary industry, in general, the tertiary industry in achieving rapid development, we do not need too many resources into, is in need of more human capital and technical input . Although the reform and opening up, the Chinese Government has been vigorously develop the tertiary industry, tertiary industry in the proportion of the national economy has maintained an upward trend, from 1978's 24.2% rise in 2005 to 39.9%; However, from this model to optimize results, The goal of reducing emissions and energy requirements, and the tertiary industry in the national economy as the proportion is still low.

5. Conclusion

To change China's current economic development in the high energy consumption, high emission problem, we should start from industrial structure optimization, optimize the industrial structure by reasonable policies and measures, the realization of China's economic growth mode from the side of the extensive growth resources to the partial knowledge Technology-intensive growth change. China's industrial structure optimization of the overall trend should be "softening", that is, in the industry in the development of tangible products and resources and other production factors reduce the growing role and knowledge, technology, services and information such as the role of soft factors of production increasing, In various industries in the rapidly increasing input. High-tech industries and the continuous development of the tertiary industry, especially the rapid development of information industry, China's economy should become the future development trend. China's industrial structure optimization, to control the growth, speed up and eliminate backward production capacity, improve the promotion of industrial restructuring policies and measures to actively promote energy restructuring. On the one hand we must vigorously develop the tertiary industry, to improve the professional division of labor and social efficiency, with the focus on positive developments in the production of services; meet people's needs and to facilitate the life of the masses as the center and enhance the development of life and services; On the other hand we must vigorously Development of high-tech industry, adhering to a new road to industrialization and promoting the upgrading of traditional industries, improving high-tech industries in the proportion of industries.

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Table 1. Industrial Structure and the Main Macroeconomic Indicators (100 million Yuan, %)

	2005	2010	2015	2020
Gross Output	496791	665584	888193	1255387
GDP	183868	297150	466433	718471
Proportion of Primary Industry	12.5%	19.3%	10.4%	3.0%
Proportion of Secondary Industry	47.5%	33.7%	29.8%	32.8%
Proportion of Tertiary Industry	39.9%	47.0%	59.8%	64.2%
Growth Rate of Gross Output		6.0%	5.9%	7.2%
Growth Rate of GDP		10.1%	9.4%	9.0%
Energy Consumption	199926	243240	295939	350440
Industrial Wastewater Discharge	145344	131379	118757	107347
Industrial Waste Gas Discharge	265203	239723	216690	195871
Industrial Waste Solid Discharge	1490	1347	1007	734

Table 2. Changes of Industrial Added Value and the Proportion of 17 Sectors (100 million Yuan)

	2005		2010		2015		2020	
	Added value	%	Added value	%	Added value	%	Added value	%
Agriculture	23070	12.5	57407	19.3	48322	10.4	21839	3.0
Mining and Quarrying	10318	5.6	9133	3.1	4563	1.0	1495	0.2
Foodstuff	7499	4.1	9012	3.0	6037	1.3	1978	0.3
Textile, Sewing, Leather and Furs Products	5887	3.2	14649	4.9	35548	7.6	51637	7.2
Other Manufacturing	3693	2.0	1221	0.4	400	0.1	131	0.0
Production and Supply of Electric Power, Heat Power and Water	2082	1.1	682	0.2	335	0.1	834	0.1
Coking, Gas and Petroleum Refining	8692	4.7	5842	2.0	1943	0.4	637	0.1
Chemical Industry	2950	1.6	967	0.3	317	0.1	104	0.0
Building Materials and Non-metal Mineral Products	9874	5.4	15740	5.3	21428	4.6	20636	2.9
Metal Products	19442	10.6	12335	4.2	4170	0.9	1366	0.2
Machinery and Equipment	6795	3.7	5272	1.8	1727	0.4	566	0.1
Construction	10134	5.5	25216	8.5	62746	13.5	156132	21.7
Transportation, Postal and Telecommunication Services	10836	5.9	25352	8.5	32279	6.9	30681	4.3
Wholesale and Retail Trades, Hotels and Catering Services	17728	9.6	9630	3.2	3156	0.7	1034	0.1
Real Estate, Leasing and Business Services	11156	6.1	27760	9.3	69077	14.8	171885	23.9
Banking and Insurance	6307	3.4	8738	2.9	7034	1.5	2305	0.3
Other Services	27406	14.9	68194	22.9	167353	35.9	255211	35.5

Analyses of Dynamic Stakeholder Views for CNPC

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Abstract

This paper tries to analyze the stakeholder view development of CNPC and explain the way in which CNPC grew up by analyzing the historical situation of company and Chinese special changing political and economic environment in which CNPC was run. After analyzing, this report will explain why some stakeholders counted while others did not during periods. Then CNPC's stakeholders in different periods will be analyzed under certain circumstances in Chinese oil and gas industry backgrounds. What were the guidelines for CNPC to prioritize various stakeholders? Did the framework about stakeholders work in CNPC considering the fact that CNPC was run in much more different political regime from western countries, especially North America and European countries. Subsequently, the paper will analyze challenges about the how to resolve the stakeholder issues which CNPC has to face when it implements its globalization strategy.

Keywords: CNPC, Stakeholder View, Oil Industry Globalization

CNPC was the focus of mass media of all over the world in 1998 because CNPC lay off more than three hundred thousand employees dramatically. The downsizing was the fuse of the riot in Daqing in 2002, the most important oil and gas city in China and this riot spread quickly throughout oil and gas industry. That event really made CNPC in big trouble. After five years, CNPC was the focus again in 2003 because of the gas well blowout in Kai county Chongqing City. That disaster in which more than 243 rural people who lived close to the gas well died and several thousand of people were injured made CNPC more famous than any other corporation in China and even in the world. Again the gas well blowout pulled CNPC into trouble. However after two years, in November 13, Jilin Petrochemical Plant explosion (Jilin Petrochemical Plant, the largest chemical Plant of PetroChina, a subsidiary of CNPC) contaminated the Songhuajiang River which is one of the largest river in the North-East China and also the main drinking-water resource of residents of Harbin city, the capital of Heilongjiang province and of Khabarovsk city of the Russian. This water contamination caused Harbin to suspend tap water for more than 4 days and made residents panic. This event affected 9 million people in two countries. Many people who really concern about CNPC were wondering what were going on with CNPC.

In order to analyze CNPC's stakeholder view development, firstly, I would like to review the literature about shareholder theories so that they can be applied to interpret the behavior of CNPC.

1. Literature review

The view of stakeholder is developing for a long time. The debate of the conception is very hot between scholars and strategist and most of them are not convincible. Generally, there are two points of review. One is the broad definition and the other is the narrow one. The broad definition held by Freeman (1984:46) is that a stakeholder in an organization is any group or individual who can affect or is affected by the achievement of the organization's objectives. The narrow definition held by Clarkson (1994.5) is that voluntary stakeholders bear some form of risk as a result of having invested some form of capital, human or financial, something of value, in a firm. Involuntary stakeholders are placed at risk as a result of a firm's activities. But without the element of risk there is no stake. Comparing both definitions, we can find major difference between them, narrow views---based on the practical reality of limited resources---attempt to define

relevant groups in terms of their direct relevance to the firm's core economic interests---some scholars narrow the field of relevant groups in terms of moral claims. While broad views---based on the empirical reality that company can affect or be affected by everyone---is difficult to apply by managers (Ronald K Mitchell: 1997). Both of them can not precisely explain the meaning of stakeholder. The broad one would include all groups because everything is relevant to and affect each other.

Therefore Ronald K Mitchell (1997) developed a new theory to identify different categories of stakeholders. According to his theory, three contributes of stakeholders should be considered in sorting stakeholders. These three contributes are power, legitimacy and urgency. Stakeholders who possess different attributes will be sorted into dormant, dominant, discretionary, definitive, dangerous and dependent and demanding. (See the figure 1) then he sort all these stakeholders into three classes: latent stakeholders who possess only one attribute, expectant stakeholders who possess two attributes and definitive stakeholders who possess three attributes completely.

Figure 1

Simultaneously, there is still another view to the stakeholders. James E. Post, Lee E. Preston, and Sybille Sachs (2002) hold that managers should manage the extended enterprise. From their point of review, the extended enterprise concept is enlarged to include not only the focal firm interactions with other businesses but also its relationship with stakeholders, both internal and external. They classify stakeholders into three categories, resource-based, industry structure-based and social political-based stakeholders. In this theory, manager should integrate all stakeholders and view companies as extended enterprise to make strategies and implement them so that the companies can minimize the risk that they would face in the future development.

At the same time, Jeremy Hall and Harrie Vredenburg point out that all companies should realize the stakeholder ambiguity and manage stakeholder ambiguity to minimize the managerial risk. Especially to the multi-national companies, they should cautiously direct the stakeholder ambiguity developing and decide which direction they will develop.

However, do all these stakeholder theory successfully explain the way in which CNPC is operated?   Should we apply them with some modification to match the special situation in china? What should CNPC adjust its views of shareholders to face the challenges coming from other unpredictable stakeholders so that CNPC enables itself to be sustainable?

Firstly, I would like to take a quick look at the background of CNPC.

2. Backgrounds of CNPC

China National Petroleum Corporation is the largest oil and gas producer in China. CNPC was founded in 1988 based on the petroleum industry ministry founded in 1949 as soon as People's Republic of China was founded. At that time the main mission of CNPC was to produce crude oil and gas to meet the energy demand of Chinese domestic industry according to the central government's economic plan. One of its subsidiaries, PetroChina was listed both in Hong Kong and New York Stock Exchange in April 2004. During the more than two decades development, CNPC is one of the world-wide leading oil and gas integrated companies with a revenue of 570.68 billion *Yuan* and profit of 72.48 billion *Yuan* in 2004.   Now CNPC ranked in the top ten in the world fifty largest integrated oil and gas companies. Through more than two decades development, CNPC expanded internationally. Now, it has been present in Africa, Mid-East, Middle-Asia, Europe, North America and South America.

China is one of largest developing country in the world. In these years, China's economy is developing very stably and quickly. The GDP growth rate is keeping above 8%, last years it even exceeded 9% and this year it is expected to be 9.2%. The tremendous growth rate attributes to the economic and political reforms. Strong GDP growth rate is forcing the energy demand increasing quickly. Now China is the second largest oil and gas consumer only after United States. However, the domestic oil and gas production is far lower than the energy demand. The bullish demand is luring oil and gas companies to expand internationally to acquire the reserve and strategic assets all over the world. Therefore CNPC, Sinopec and CNOOC (China National Offshore Oil Corporation), three largest state holding oil and gas companies are experiencing to acquire assets in the world. In 2005 October, CNPC successfully acquired Calgary-based PK Company and purchased the Ecuador assets from EnCana, the largest energy company in Canada. CNOOC failed to acquire California-based Unocal in 2004.

3. The Stakeholder view of CNPC in 1988-1998

Because of the special political environment and economy, CNPC in 1988, actually was not only a company but also official organization. CNPC was founded at the base of the Petroleum Ministry. It took over most of the social responsibilities that Petroleum Ministry used to take during 1949 to 1988. A conclusion can be made that CNPC was not an independent company at all. At that time, the entire senior managers were appointed by the government. Actually CNPC's did not behavior in the way a normal company did. CNPC fully financially sponsored and managed many

universities, colleges and technical schools which should be financially sponsored by government according to Chinese laws and policies. At the same time, CNPC also paid medical insurance and pension plan for all employees after they retired.

From the economic perspective, the main task of CNPC at that time was to meet the demand of national energy demand under the command economy system. Each year, the central government made an oil and gas consumption budget plan which would guide the operation of CNPC. CNPC just acted as an implementer with very little freedom. All it would do was just to follow the plan. Therefore CNPC could pursue production increasing without considering expenses. This was somewhat ridiculous in eyes of westerners.

In fact, in that period, CNPC had a very heavy burden of social responsibilities. The main task of CNPC at that time was to meet the energy budget of central government based on the self-reliance policy of central government. If we analyze the behavior of CNPC of that period of time, we can conclude that CNPC only concerned one stakeholder, that is, government. Chinese central government had three attributes according to stakeholder theory of Ronald K Mitchell (1997). Government had sovereign power to influence and control the company. All senior officers were appointed by the central government and all of them were viewed as officials by the ordinary people other than businessmen. Certainly, the central government could dismiss anyone in the senior management who did not run business in the way government desired. The president of CNPC was treated equally to the minister. In most of employees' minds, the president still was the minister of oil ministry that actually had not existed since 1988.

The other attribute of stakeholder was also possessed by the government. Legitimacy was the most powerful attribute of government. At that time, government claimed that it dedicate to creating a communism society in which everyone was treated equally and paid by the need eventually although the first phase was paid according to contribution of citizens to the development of society. In the early 1980's almost no one doubted this great dream. What the government did was broadly accepted by ordinary people with out any suspicion. Since CNPC inherited the responsibilities, in the ordinary citizens, they were used to view CNPC as a governmental organization other than a real company whose aim was to maximize shareholders' value. Above all, CNPC itself also assumed it was a governmental organization.

The government also obviously has the attribute of urgency. From CNPC perspective, the government was the policy maker and supervisor. In the CNPC's priority, the government was in the first place to satisfy. All operations were centered on the central government's economic plan made in the very beginning of each year. Therefore, all the decision about production and price of product made by CNPC absolutely based on the central government's annual economic plan.

Therefore we can conclude that the government was the definitive stakeholder according to the stakeholder theory of Ronald K Mitchell (1997). Then we can understand why CNPC run businesses in this way which was not understandable from the view of westerners. For CNPC, the most important stakeholder was the government. Were there some other stakeholders? How about other stakeholders at that time?

Now let us take a look at other stakeholders. Firstly, we take a look at the first category of stakeholders, employees, investors, lenders and shareholders customers and users. At that time, employees of CNPC were registered employees who were pride of being members of CNPC. All workers were regarded as owners of the state-owned enterprises as well as the owners of the country. If CNPC satisfied the government which represented all people in this country, it also satisfied the workers employees of CNPC. Actually, during 1988-1998, there were very a few investors other than the government or banks owned by government. Like most of the industry which were critical to the economy development, such as electricity, and coal industry, were directly invested and sponsored by the government. All these industries could be very easily financed by the state-owned investing banks once they had a need to develop new projects.

During this period, Chinese government conducted self-reliance oil and gas policy so that all oil and gas production had only one aim of meeting the domestic demand from other industries. Therefore most of the stakeholders were state-owned organizations which also directly or indirectly controlled by different levels governments. We can conclude that the most important customer was government.

Judging from analysis above, we can come up a conclusion that all the resource-based stakeholders eventually converged on the government. This is why CNPC run business this way.

This is the case for the rest of categories of stakeholders, such as structure-based and political and social-based stakeholders.

In fact, the stakeholder view affected the operation of CNPC dramatically. During that period, the entire decision making was based on appealing to the government. CNPC did not consider economic equally to the social responsibilities. Actually CNPC had to suffer the heavy burden of social responsibilities the expense of the economic value. This was why CNPC was perceived as not being competitive by the western company although in term of the reserves and the number of employees, CNPC should be listed in the world-wide largest companies and should be known and recognized by   at least energy industry in the world. Actually, it was not. In eyes of western, CNPC was

agency of government other than a real company which should had an aim to maximize the shareholders' value. They noticed that CNPC put so much money into the public infrastructure, such as road construction, city utilities and in education and in the pension plan.

Therefore, CNPC had an excellent reputation and no one suspected it was socially responsible during that period. All other industry was called on to learn from petroleum industry because of the highly praised socially responsible image. Even now, the "Iron Man", Wang Jinxi who was a hero because he successfully avoided a disaster by stopping an oil well blowout by jumping into the well is still highly praised by contemporary and still encouraging all citizens to work hard for economic development. He saved many people lives and created economic value for the Daqing oil Field and positive externalities for CNPC.

4. The Stakeholder View of CNPC in 1998-2003

However, with time going on and economic and political reforming, the business environment was changing gradually. Simultaneously, with opening policy, influx of foreign companies made Chinese companies reconsider their situation and had to figure out strategies of how to compete with giants from outside China. CNPC was not exceptional. It faced the challenges from huge competitors, such as BP, Royal Dutch Shell, and Exxonmobil. In 1998, Chinese government was negotiating with the members of WTO and it seemed China would be a member of WTO any time after great progress in the negotiation. Many multi-national companies were ready to enter the huge potential market to extend the operation in China. CNPC had to face the powerful competition from giants on the same stage. Actually, these companies demonstrated strong presence throughout China with advanced technology and managerial skills. CNPC was dwarfed by them. CNPC realized that the gaps were unimaginably broad both in term of economic value and management. CNPC began to worry about situations. How would CNPC compete with giants from outside China and what would CNPC compete with them on?

After painful consideration, CNPC found out it was time to change right now in 1998. CNPC had no choice but reform the outdate management style and fundamental philosophy of doing businesses. CNPC realized that it was not a government agency any more since it was founded in 1988 and it had no obligation to undertake tremendous social burden which should be considered by government which collected tax from all companies and citizens. Since CNPC was taxed by the government under laws, CNPC should not have been imposed dual obligation to be socially responsible. Simultaneously Chinese government also realized that Chinese major state holding companies were losing the competitiveness. Both knew something should happen to better the position CNPC now facing.

Therefore, CNPC supported by the central government began to implement policies which aimed to improve the efficiency and economic value of the company. First thing that CNPC and central government figured out was that the size of the company was unimaginably huge in terms of its employment and social burdens in eyes of the counterparts outside China although in terms of annual production and reserves, CNPC was one of the largest petroleum companies in the world. While in term of the productivity, CNPC was on the bottom of the largest oil and gas companies in the world. That position was really embarrassed and made CNPC less attractive to raise capital in the world capital market.

A campaign that was designed to enhance the competitiveness of major state owned companies including CNPC and Sinopec, two largest oil and gas companies in energy sector, was launched in 1998. In 1998, CNPC was transformed from upstream oil and gas producer into a vertically integrated petroleum company operating in the upstream and middle stream as well as downstream. In order to inject viability to CNPC so that CNPC was more competitive, Chinese government permitted CNPC to implement downsizing plan which was unlikely to happen in the past fifty years since 1949. That event symbolized that CNPC began to reconsider its stakeholders rather than only considering the government's stake.

This downsizing reduced more than three hundred thousand employees, nearly one fourth of the total number of employees. Simultaneously it has embarked on a new company, PetroChina, was created. This company controls CNPC's exploration and production activities in China, the production and sale of oil products and petrochemicals and the supply and transmission of gas within China while overseas investments, the service companies and much of the social burden were retained by the parent company CNPC. CNPC took it for granted that PetroChina would be easier to raise capital, given integration enabled it grow quickly and would be renowned in the world compared to the parent company CNPC. However it was not the case. In 2000, the IPO (Initial Public Offering) of PetroChina was launched in the Hong Kong and New York Stock Exchange. Opposite to the expectation, the response to the IPO of PetroCHina was surprisingly lukewarm. CNPC had to reconsider itself. What was wrong with CNPC?

Disasters usually do not happen solely. After the unexpected IPO result, in 2002, the riot broke out because of the consequence of the downsizing conducted three years ago. Laid-off employees in Daqing oil field as well as other oil fields claimed that CNPC laid off them by cheating and taking advantages of the unbalance information sources. In that downsizing, CNPC only offered compensation of maximum amount of one hundred thousand Yuan to employees who were willing to quit from the CNPC. Because of the economic and political situation, many employees, who

usually were older and not skillful and uneducated while were the first generation of the oil and gas industry, were scared by the unpromising future and did not want to lose this chance to exercise the option of getting some immediate money back. Otherwise, they would really be in trouble to raise the family and support children to complete education. However, their dream did not come true. They were stressful because of increasing medical insurance and pension plan. According to the downsizing policy of CNPC, once employees quitted from the company, they had to pay medical insurance and pension plan themselves. In 2002, CNPC was accused of cheating them to lure them to quit from the company without adequate compensation. That riot made CNPC in trouble deeply.

Why did that happen? Now, we can analyze it by analyzing the stakeholder view of CNPC.

Why did CNPC conduct reforms to restructure the company and downsize the company?   Initially, it was directed by the policies of central government. Before China became a member of WTO, Chinese government had a strong desire to arm Chinese companies and make them more competitive so that they could more likely survive in the sever competition from multinational companies. The up-down policy enabled CNPC easier to implement the downsizing and restructuring. However, CNPC made mistakes that time. CNPC overlooked the stake of these laid-off employees in the downsizing. CNPC emphasize too much on the economic value of the company. The most important factors for CNPC were to enhance the competitive advantage over the competitors all over the world. The CNPC thought that government would take over the consequence of downsizing, such as pension and medical insurance. However, the government was not ready to do that. Therefore conflicts came up. The employees used to be regarded as the owners of this nation while now they were on the edge of surviving. The huge difference made them really uncomfortable. On the CNPC side, they assumed that they were laid-off willingly with compensation and it was fair to them. CNPC failed to realize that the society was not ready to accept them and accommodate them. It was not the right time for CNPC to get rid of the social burden away immediately. The complexity was not realized by the company. The employees and society were interdependent. CNPC had to consider them together instead of separately.

Simultaneously, "the lukewarm response to PetroChina's IPO reflected a wide range of concerns from the stakeholders out side China. Foremost among these was a lack of confidence in the ability of the management to cut costs and deliver shareholder value in what was a large and outdated corporation; and the absence of clarity about how the funds raised would be used. These realistic commercial concerns were supplemented by political ones. Shareholders could not believe that CNPC would run business with best interest of shareholders given that government still was the biggest stakeholder. CNPC holds 90% shares of PetroChina. They naturally linked CNPC with government and suspected that CNPC would perhaps have an intention to appeal to the Chinese government at the expense of the other shareholders' value.

In advance of the issue, human rights groups succeeded in stirring up vocal protest at CNPC's investments in Sudan and its potential investments in Tibet. This event indicated that stakeholder ambiguity began to affect CNPC. Human rights were never an issue in its history.

All these events forced CNPC to redefine its stakeholders. The stakeholder was more than government. And the mission of the company was not only to pursue economic value or undertake too many social burdens. CNPC had to extend its stakeholder views. Otherwise, CNPC could not be sustainable not only in domestic market but also in the oversea market.

During this period, CNPC added giants from outside china as important stakeholders as well as government in term of power, urgency and legitimacy. They are powerful to influence CNPC. Once they are ready to compete with CNPC in Chinese market or make a decision to formulate strategy alliances with CNPC, CNPC would be challenged or beneficial from them. Judging from CNPC's side, these international oil and gas companies are powerful and urgent. According to the stakeholder theory, they are dangerous stakeholder. CNPC had to consider it actively. At the same time, laid-off employees were also stake to CNPC. However, CNPC overlooked stakes of them. Actually, they possessed two attributes of the stakeholder: power and legitimacy. Because laid-off employees could not be accepted by the society, they were hard to maintain their normal life. They had to turn to the CNPC which they had contributed a lot with almost whole life from the very beginning of development of the oil industry. Actually, most of the people in China sympathized with these laid-off employees and could not understand these facts. The combination of sympathies from other people and laid-off employees' strong desire to maintain a normal life imposed significant influential power and legitimacy to CNPC.CNPC failed to realize that so that the riot spread quickly and eventually was solved with help of central government with offering solution package to them.

5. The Stakeholder view in 2003-2005

After unexpected result of IPO both in the Hong Kong market and New York market, CNPC desired to enhance investors' confidence. Therefore, they tried various ways to cut the cost. During this period, CNPC emphasize more on the economic value of the company. This policy really worked. In 2003, CNPC achieved record profit and more confident information was transferred to investors. It seemed that CNPC was on the right track. But December 23, 2003,

gas well blowout accident had a huge impact on stakeholders. They realized that CNPC was far from on the right track. It might be on the other extreme, emphasizing too much on the economic value and overlooking the society in which it was operating. This tragedy killed 243 people and injured several thousand of people who live around the well. That accident was enough to ruin the good social reputation accumulated in the past years. Many social scientists exclaimed that CNPC was not a socially responsible enterprise any more although it used to be high praised for its social responsibilities.

In order to enhance the competitive advantage, CNPC launched a campaign to reduce the cost. Therefore, many costs which should occur were avoided. The hidden troubles were generated. After the gas well blowout, many experts pointed out that operating teams of that gas well never explained dangers and the way to escape from the well blowing to residents around the gas well because they were tied up by the tight work schedule. Because of the high risk, there should not be any residents one kilometer in circumference around the well. CNPC should relocate them after the well was put into operation. At least, CNPC should have informed them of the dangers and how to deal with accidents which would happen. However, CNPC failed to do what it should have been done.

If we take a deep look at the disaster, we can find out deep reason is that CNPC began to overlook social responsibilities and pursue economic value unilaterally. Therefore, CNPC just appealed to shareholders and did everything possible to maximize shareholders value. That symbolized that CNPC emphasized on all shareholders other than government only.

Government still was the most important stakeholder in term of the power, urgency and legitimacy. However, CNPC, as a public company, it had to maximize the all shareholders' value to obtain good reputation and change the original image of inefficiency in operation. This time, CNPC destroyed itself by overlooking social responsibilities and over concentrating on the economic value. British Petroleum Corporation sold out all shares it held as soon as it was informed of the accident. Share price began to slip quickly in one day. Shell and Exxonmobil was ready to withdraw investment in West-East gas pipeline which was the longest pipeline invested by CNPC. CNPC was isolated again because of its overlooking social responsibilities.

CNPC failed to realize that communities in which it operates is stake. CNPC should care about them and involve them into the management and understand what they care most. Then CNPC can understand their behaviors and tries to satisfy them as possible. CNPC has to modify its stakeholder view and make the communities and other stakeholders inclusive in the extended enterprise.

In the future, CNPC would face more and more stakeholders all over the world. Many latent and expected stakeholders will count, such as US government, European Union, Green Peace, all of which are powerful to influence operation of CNPC. Environment issues, human rights issues will be on the table of president of CNPC. CNPC has to consider all of them and analyze by stakeholder theories to find out attributes they have and sort them so that CNPC can satisfy and deal with them successfully. By doing so, CNPC would be developing with sustainability.

6. Conclusion

From analysis above, we can conclude that the stakeholder view of CNPC is dynamic over time. CNPC cares different stakeholders during different periods. At the very beginning, CNPC only cared one stakeholder-government because government stands all other stakeholders' interest. Government had all attributes of stakeholders. Once CNPC cared government and satisfied government, it satisfied all the stakeholders. Therefore, CNPC had to take so many social responsibilities. However, after China became a member of WTO, things were different. Government could not stand for all stakeholders any more. CNPC had to adjust its stakeholder view. However, CNPC stakeholders' view was over adjusted. During this period, CNPC focused too much on the economic value, overlooking the stakeholders who were really important to CNPC. This was why so many tragic accidents happened during this period.

Now, CNPC is experiencing a period of adjusting stakeholder views. Now CNPC is aggressively expanding all over the world. And this year, CNPC successfully acquired Calgary-based PetroKazakhstan Inc. This acquisition indicated that CNPC stakeholder view was becoming mature now. In this acquisition, CNPC really considered all stakeholders who might care about this deal, For example, Kazakhstan government, Kazakhstan National Oil Company and other bidders. CNPC satisfied Kazakhstan government by offering to sell 33% shares to Kazakhstan national oil company and to set up a join venture with Shymkent Oil Refinery which is a subsidiary of Kazakhstan National Oil Company. This offer was quite important to succeed in this deal.

However, we can not neglect that CNPC is a state-owned company and government has majority stake in the company. This fact weakens the competitive advantage of CNPC. Some analysts claimed why CNOOC failed to acquire the Unocal is because Chinese government holds too many shares. This fact makes investors less confident in the CNOOC. This would be the case for CNPC. Government is also the most important stakeholders of CNPC. If CNPC will be continuing to expand all over the world, CNPC should consider it seriously. CNPC should learn something from the lesson of failure of acquiring Unocal.

With the expansion of CNPC, it has to face some complexity. Human rights, culture factors and developed countries, undeveloped countries would be more important to shape the stakeholder view of CNPC. Actually, CNPC was already criticized for failing to protect the human rights in Sudan. Therefore, CNPC will be required to consider not only social responsibility in China but also in other countries where it is operating. Therefore, in the future, CNPC should manage latent and expected stakeholders and manage them ambiguity to mitigate risks.

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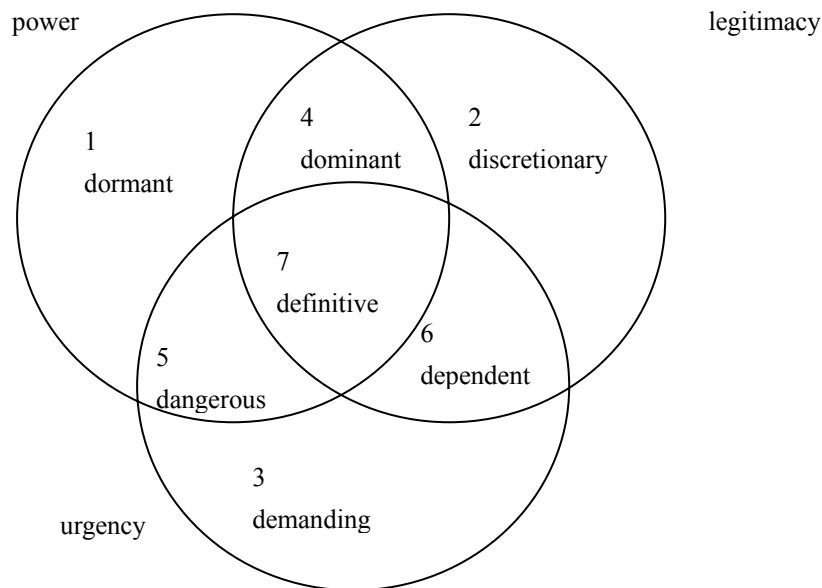
Figure 1.

UrusSisa: An Intelligent System for Integrated Solid Waste Management

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Abstract

UrusSisa is an expert system for selecting and designing solid waste technology. It can improve the process of selecting the best solid waste technology, and to make the knowledge of preliminary design of solid waste technology available. Knowledge based of *UrusSisa* consists of priority ranking using Analytical Hierarchy Process (AHP), and preliminary design of recommendation technology. AHP involves structuring multiple choice criteria into a hierarchy, assessing the relative importance of these criteria, and determining an overall ranking of the alternatives. Preliminary design of solid waste technology includes recycling, composting, incineration, and sanitary landfill. The performance of prototype has been tested by using case study.

Keywords: Integrated solid waste management, Analytical Hierarchy Process

1. Introduction

Solid waste can be classified as unwanted materials left over from manufacturing process, or refuse from places of human habitation. Solid waste management is an integral part of urban and environmental management of each city. In developing countries, these services fall short from the desired level as the system being adopted are outdated and inefficient. Extremely low priority is given to the area of waste handling and disposal resulting in budgetary limitations and weak infrastructure to handle one of the most important problems in most urban areas.

The total amount of solid waste generated in Malaysia was about 16,000 tons per day with the average per capita generation rate of about 0.88 kg/day (Ministry of Housing and Local Government 2002). The amount generated is expected to increase due to rapid economic and population growth. At present, landfilling is the only method for disposal and most of these landfill sites are open dumps which is nearly full. To develop a new landfill site is difficult because of land scarcity and increasing of land prices especially in urban areas.

Today, an integrated solid waste management requires a more formal structure of facilities and political actions, not only within the community but also the state and federal governments. Armed with technical and economic resources, managers of solid waste system must integrate of all aspects solid waste management activities, from generation through disposal. Therefore, Integrated Solid Waste Management Program has been developed in Malaysia to divert municipal solid waste from disposal sites.

2. Analytical Hierarchy Process in Solid Waste Management

Analytical Hierarchy Process (AHP) is amongst the most well known methods of Multi Criteria Decision Making, introduced by Saaty (1980). AHP can be defined as a hierarchical analysis methodology supporting rational decision making by simplifying a complicated problem (Saaty 1995).

Decision making in solid waste management involved a complex problems. Both tangible and intangible criteria need to be prioritized in a decision making process. Intangible criteria such as political and social factors take precedence over tangibles criteria such as economic and technical factors. AHP is methods that improve the understanding of complex decisions by decomposing the problem in a hierarchical structure. The incorporation of all relevant decision criteria, and their pair wise comparison allows the decision maker to determine the trade-offs among objectives.

A major strength of AHP is the pairwise comparison where the influence of the elements of a particular level over those of a lower level is measured. The comparison is based on an expert's opinion and experience gained from the observation and continuous learning of system behavior. Other advantage of AHP is that it has the ability to checking the consistency of judgments. This consistency ratio is important to ensure the judgments were consistent and that the final decision is made well.

The AHP is based on three principles: decomposition of the decision problem; comparative judgments of the elements; and synthesis of the priorities. The first step is to structure the decisions of the problem in a hierarchy (Fig. 1). The goal of the decision, "to choose the best technology for solid waste management", is at the top level of the hierarchy. The next level consists of the criteria relevant for this goal and at the bottom level are the alternatives to be evaluated.

The second step is the pairwise comparison between elements in structural hierarchy. For this relative comparison, the fundamental scale is as in Table 1 can be used.   It allows expressing the comparisons in verbal terms, which are then translated to the corresponding numbers.

In the third step, the comparisons are being synthesized to get the priorities of the alternatives with respect to each criterion and the weights of each criterion with respect to the goal. The validity of pairing comparisons outcome is obtained by checking consistency, in which the consistency ratio is less than 0.1 can be accepted. However, if the consistency ratio is more than 0.1, the pairwise comparison needs to be reevaluated. The consistency ratio is considered important as it indirectly able to control bias evaluation made by the domain expert that may inclined towards their own respective experiences, during the process of pair wise comparison. This is mainly due to expert's background in certain areas may highly influence the evaluation process.   Even though there are some differences made by the experts, the consistency value that is less than 0.1 can be accepted.

2.1 Criteria in Decision Making

To extend the life span of landfills sites, the reduction of amount of wastes to be disposed off is crucial. Solid waste diversion could be implemented by technologies such as recycling, composting or incineration. The effectiveness of these technologies depends on many criteria such as political support, technical expertise, environmental impact, market for end-products and community involvement.

(1) Political support criteria

A political support is important because the final decision to select a technology is very much depended on it. A strong political support will ensure that the chosen technology is acceptable for a long time. Normally, technology selection is indirectly affected by the current political situations, whereby the leader developed their own favourite technologies.

(2) Technical expertise criteria

Technical expertise is referred to the high level of workers qualifications. Normally incinerator, a higher-end technology, requires workers with higher technical expertise to operate the system. Some waste technologies such as recycling and composting are relatively less complicated process and the requirement of technical expertise is not too critical.

(3) Environmental impact criteria

Technologies for solid waste management should be able to eliminate or reduce any potential environmental hazard to the environment.   Environmental impact is potential to create problem such as public health nuisance and pollution to the environment. As an example, the principal potential negative impacts of a compost operation on the environment would be the lowering of the quality of water and air resources and the compromising of the public health and well being by attracting and breeding vectors and rodents. It should be emphasised that these impacts are potential impacts and that they would become actual only when an inadequate technology or methodology was used, a normally adequate management was improperly applied, and preventive or corrective measures were not taken.

(4) Market of end-product criteria

Marketability of the end-products is an important criterion to ensure the success of an integrated solid waste management. Various end-products will be generated by solid waste technologies. Valuable materials will be recovered by recycling, compost product is produced by aerobic composting process, methane gas is obtained during anaerobic digestion process and renewable energy is produced by Refuse Derived Fuel (RDF). Marketability of the end-products should be analysed before a technology is to be selected to ensure that there will be demands for the products.

(5) Community involvement criteria

Community involvement is also considered crucial and should not be denied. There were cases of closing down various waste facilities due to objections from the community surrounding. It was shown that technologies which require intensive community participation such as segregation at source will pose a higher risk of failure especially in most developing countries. Certain technology, for example incineration, requires that the feedstock to be separated well to ensure the process runs smoothly.

2.2 Solid Waste Management Alternatives

A wide variety of alternative programs and technologies are presently available for the management of solid wastes. Due to the large number of participants in a decision-making process, the selection of proper mixture of alternatives technologies has become a more difficult task.

Based on hierarchy of integrated solid waste management, three technologies were chosen as alternatives; they are recycling, composting and incineration. However, sanitary landfill is not considered as an alternative because it must be developed in whatever system being chosen. Landfilling is always required no matter what intermediate treatment process is introduced. Be it incineration, composting, separation or recycling, there will always be residue left that has to be landfilled.

(1) Recycling technology

In most developing countries recycling activities are done informally mainly by scavengers at landfill sites. Recycling process started by the collection of valuable waste from waste generators, followed by processing and reprocessing phase. The recyclables are collected from curbsides, drop-off or buy-back centers. Recycling technology is considered important because it able reduce 20 percent of waste that must be disposed off in landfills. There are many benefits offer by recycling technology, such as to save the current exchange, to conserve the nature, to save the energy use, and to reduce the landfill life span. Among the valuable materials to recycle are aluminum, paper and cardboard, plastic, glass, and metal. Recycling is not a new a technology even in Malaysia. The recycling campaign was launched throughout the region in 1993. However the program failed in many regions due to lack of involvement from the public and factories. Therefore, on the 2nd December 2000, the Ministry of Housing and Local Authority re-launched the campaign for the second phase. The date 11th November was selected as the National Recycling Day.

(2) Composting technology

Composting is a control process where the organic material was biodegrade by the microorganisms to produce the black and stable compost. Composting process can be done as a passives piles, turned windrow, aerated static piles or in-vessel systems. All the systems have the same biological principles, but they differ by the aeration system. Composting offers many benefits such as to increase diversion rate from the waste disposal areas (50%), compost products for soil amendments, promotion to an environmentally friendly practice and to reduce transportation costs. In Malaysia, composting is a one of the common practice to handle agriculture waste. However, presently there is no application for municipal solid waste, although almost 50 percent of the waste is organic materials.

(3) Incineration technology

Incineration is a chemical process where carbon, hydrogen and a few elements mix together with oxygen to produce heat energy. This technology is able to reduce toxicity, reactivity and high volume of waste effectively (can divert 85% of municipal waste from disposal site). However, it is very costly and must be operated by highly technical expertise. The three common incineration technologies available currently are mass burning, refuse-derived fuel and modular systems. Incineration is not a new technology in Malaysia as it is being used to treat hazardous waste as well. However, the implementation of incineration technology to treat municipal solid waste received strong objections from the public mainly due to health and environmental risks, high capital and operation costs and higher risks of technological failure due to the imported technology from abroad that has not been proven successful in the region.

3. Components of UrusSisa Knowledge Base

UrusSisa, prototype of expert system, is designed to aid the development of an effective solid waste management for Malaysia. The prototype was developed by phases; knowledge acquisition process from literature study initially, then interaction with the human experts who posses wide experience in the related areas, and eventually site observations. The knowledge gathered was then codified using an open source programming language (Preprocessor Hypertext –

PHP) and MySQL as a database. An internet-based programming language was selected for easy access and usage in various locations worldwide.

The three broad categories of expertise sources were identified and selected to extract the knowledge base for prototype UrusSisa [a] textbooks and manuals; [b] domain experts; and [c] research publications. A complete understanding of the whole domain required a combination of multiple sources of expertise. Furthermore, multiple sources of expertise also important to increase the quality of knowledge base by avoid bias towards a single view, conflicting views manifested by several different experts, and handicapped by availability constraints of any one source of expertise..

The knowledge acquisition process for development prototype UrusSisa could be categorised into three phases:

o   Phase I

Text analysis was done in Phase I to extract the contents from 22 textbooks and manuals related to the domain area. An understanding on the concepts, techniques, and the requirements of solid waste management especially recycling, composting and incineration is obtained in this phase. The knowledge extracted was then organized according to their respective tasks and become the foundation of the prototype knowledge base. Any conflicting information was rationalized and resolved.

o   Phase II

Phase II included interview sessions with 11 selected human experts and site observations. The acquired knowledge was used to strengthen, improve and expand the knowledge base of the prototype. By this process, the knowledge on solid waste management acquired were adapted to the Malaysian conditions. This is due to the reason that most textual knowledge sources acquired in Phase I were originated from abroad.

Site observations were done by observing the daily tasks for solid waste management activities.   This method is more flexible as it does not take too much of the experts' valuable time, which is done naturally during their daily work.

o   Phase III

Phase III involved analysis of recent research publications such as journals and proceedings of conferences. This was done to strengthen, improve and expand the knowledge base by adding the latest findings and experiences.

In general, the UrusSisa architecture consists of two main components; priority ranking of technology using AHP technique, and the preliminary design of solid waste management technology. This division was taken place so that the explanation regarding their roles and functions could be done without many problems. In addition, the division was also important to help the users to understand the expert system architecture.

a.   Priority ranking of technology using AHP

Consultation session using AHP initially started with six phases of pairwise comparison process; [1] criteria against objectives, [2] alternatives against political support, [3] alternatives against technical expertise, [4] alternatives against environmental impacts, [5] alternatives against marketability of products, [6] alternatives against public participation, and further with the process of identifying the benefit priority value.   These are the core components of UrusSisa knowledge base. Figure 2 shows the main modules in priority ranking of technology using AHP, which include:

❑ matrix of comparison module;

❑ priority analysis module;

❑ cost analysis module; and

❑ benefit-cost ratio module.

b. Preliminary design of technology

Preliminary design of a solid waste management is the major component of the knowledge base prototype, which includes:

❑   preliminary design for recycling

❑   preliminary design for composting

❑   preliminary design for incineration

❑   preliminary design for sanitary landfill

From the four components above, each component will have their own individual modules.   Basically the modules developed for the preliminary design of recycling are similar to the modules for composting, and incineration. For example, modules for preliminary design of recycling consists of (Fig. 3):

❑   collection systems

❑   area design

❑   storage

❑   operation and equipment

❑   material preparation

❑   processing

❑   environmental issues

❑   siting location

❑   market planning

Production rules was used to represent the knowledge of modules. A production rule resembles a simple sentence. It consists of a condition part, IF, on the left hand side, and an action part (THEN) on the right hand side. If the condition of a rule is satisfied by the working memory, the rule becomes applicable and will be fired by the inference engine. Therefore prototype UrusSisa can act and mimic like human experts in order to give recommendation and suggestion on preliminary design of technology. The following are examples of selecting a suitable recycling collection system using production rules technique:

If   ($public == yes)

{echo "frequency of collection recommended is weekly because this will increase the percentage of participation by the community and the rate of recycling.   Research done by EPA (1994), shows that the recycling program that capable of achieving high percentage of community participation recycling rate practise a weekly collection frequency during their operations"}

else if ($public == no)

{"frequency of collection recommended is <font color=red> twice weekly < because this will reduce cost for the whole recycling program, instead it will be spent for public education."}

else   {echo "No data input.   Please re-enter.";}

4. Prototype Verification and Validation Using Case Studies

There is currently no formal approach for assessing prototype performance which is applicable universally. Many prototypes were tested based on case studies, the results of which were analysed internally by the system developers themselves (Berrais 1992). In the case of the UrusSisa, its performance was evaluated internally by the system developer herself and solid waste management experts. One case study was performed; Port Dickson Municipal Council; to evaluate the conceptual design for solid waste management technology. This gave some measure of the accuracy of its knowledge base. Finally, the user-friendliness of the prototype's user interface was evaluated.

4.1 Case Study: Port Dickson Municipal Council

Port Dickson Municipal Council – MPPD (formerly known as Port Dickson District Council) is located in Negeri Sembilan. The total area for this municipality is 40 km^2 and serves a population of 106,000. Solid waste generation is mixed at the rate 70 tonnes per day and it was collected by the municipality and contracted company. Solid waste will be disposed at Bukit Palong (64.7 acre), Sua Betong (6 acre) or Pengkalan Kempas (3 acre). However these disposals area is nearly filled and new disposal site must be identified. Implementation of solid waste technology such as recycling, composting and incineration is important to make life span of disposal site is longer.

Expert from MPPD was consulted to get the pairwise comparison value and solid waste input.   Analysis AHP shows that the combination of two or three technology such as A4, A7, A6 and A5 have the most   benefits, with relative weights of 0.165, 0.159, 0.153 and 0.144, respectively.   On the other hand the single technology such as A1, A2 and A3 have much lower values of relative weights in the range of 0.122 – 0.129. It is based on benefit hierarchy which indicates that technical expertise has the highest relative weight of 0.420 among all other criterias considered. It is followed by political support (0.315), environmental impact (0.127), market of end-product (0.100) and community involvement (0.038).

Cost hierarchy shows that combination of recycling and incineration (A7) technology has the most benefits having a relative weight of 0.255. It is followed by A7, A3, A6, A4, A1 and A2; their corresponding relative weights are 0.170, 0.169, 0.150, 0.135, 0.095 and 0.091.

In order to give the complete picture the overall benefit priorities (relative weights) were divided by the cost priorities. An overall normalized benefit-to-cost ratio was obtained for each system. Benefit-tocost ratio is shown that composting (A2) technology have the highest overall benefit-to-cost ratio, with a relative weight value of 0.189. Recycling (A1) technology have the second relative weight of about 0.184. The best system with highest benefit-to-cost ratios are A4, followed by A6, A7, A5 and A3, having relative weights of 0.165, 0.137, 0.126, 0.102 and 0.097.

From AHP analysis, composting is recommended to manage solid waste problem from Port Dickson area. This recommendation is supported by the solid waste composition where 54% of Port Dickson waste is organic material. Beside residential area, tourism activities also contributed to highly composition of organic material. Composting technology can diverse 50% of waste generation rate from disposed to disposal site.

The next consultation session is a preliminary design of composting technology where users need to complete their Input Data first. This component is important to help user design a composting technology. There are 10 modules in this component which includes:

❑ composting system module;

❑ site design module;

❑ operation and quipment module;

❑ storage module;

❑ feedstock condition module;

❑ control parameter modul;

❑ parameter control module;

❑ environmental impact module;

❑ site requirement module; and

❑ marketing plan module.

5. Conclusion

UrusSisa is a prototype of expert system which can assists the decision maker to establish the most appropriate solid waste technology in an integrated manner. The critical decisions at the planning stage are strived by applying a state-of-the-art Multi Criteria Decision Making (MCDM) technique call the modified Analytical Hierarchy Process (AHP). This ensures that the solid waste management system will take into account the numerous relevant criteria such as political support, technical expertise, environmental impact, end-product market, community involvement, and cost of technology, and their relative importance in an objective manner.

Besides assists in selecting the best technology, UrusSisa also can helps in a preliminary design of the technology. Expertise in the knowledge base was acquired from 22 textual sources, reputed journal publications and solid waste practitioners in Malaysia. The intelligent system was developed using an internet-based platform, hence making it to be very easily accessible to users all over the world. In developing countries where expertise and resources are scarce, this inexpensive system is particularly useful in avoiding ad-hoc or ill-informed decisions which can be unnecessarily costly.

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Table 1. Translation of verbal scale into numerical scale (Saaty 1980)

Verbal Scale	Numerical Scale
One element equally important to other	1
One element moderately more important to other	3
One element strongly more important to other	5
One element very strongly more important to other	7
One element extremely more important to other	9
Intermediate values between two scales	2, 4, 6, 8

where:

A1 :   Recycling
A2 :   Composting
A3 :   Incineration
A4 :   Combinations of recycling + composting
A5 :   Combinations of recycling + incineration
A6 :   Combinations of composting + incineration
A7 :   Combinations of recycling + composting + incineration
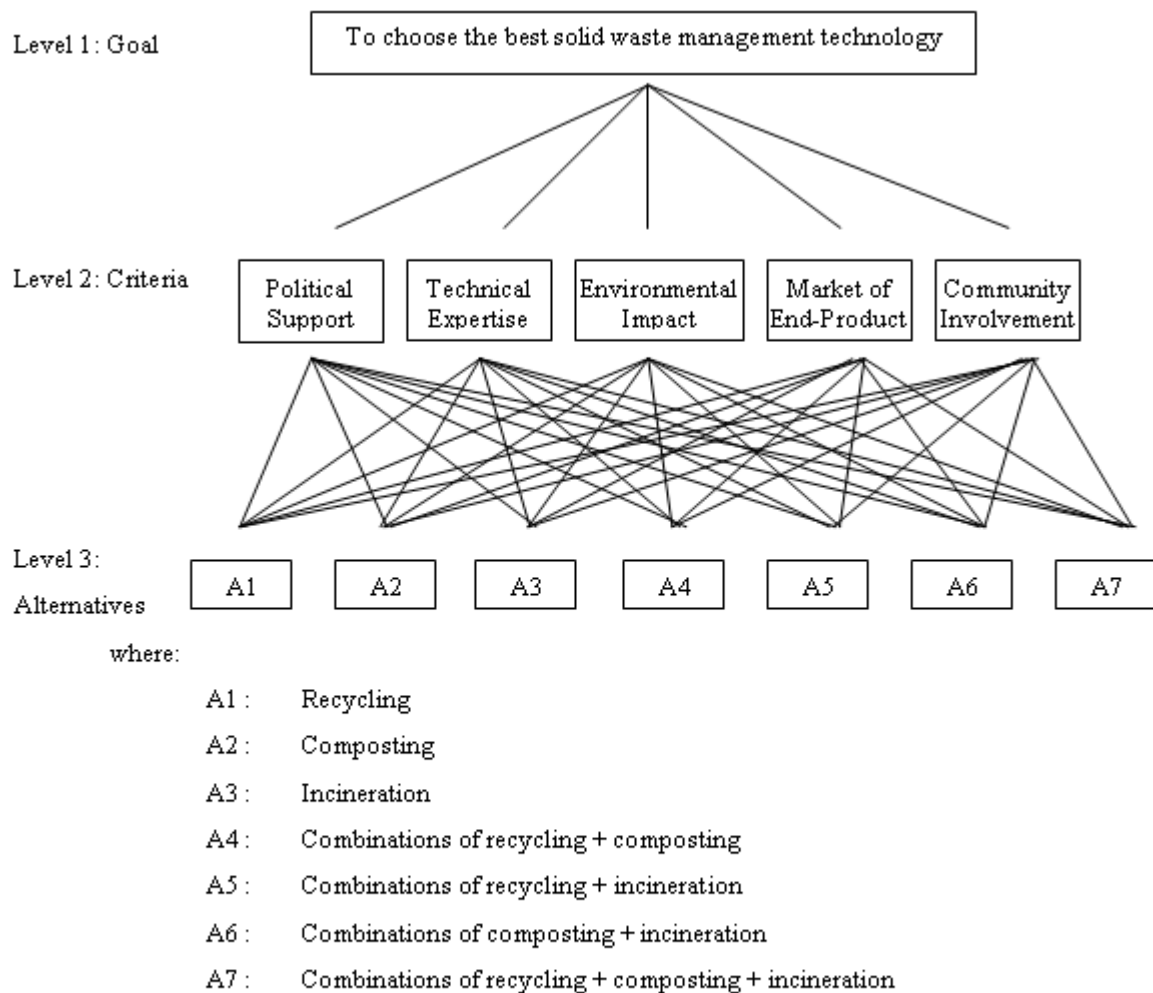
Figure 1.   Hierarchy structure of solid waste management technology
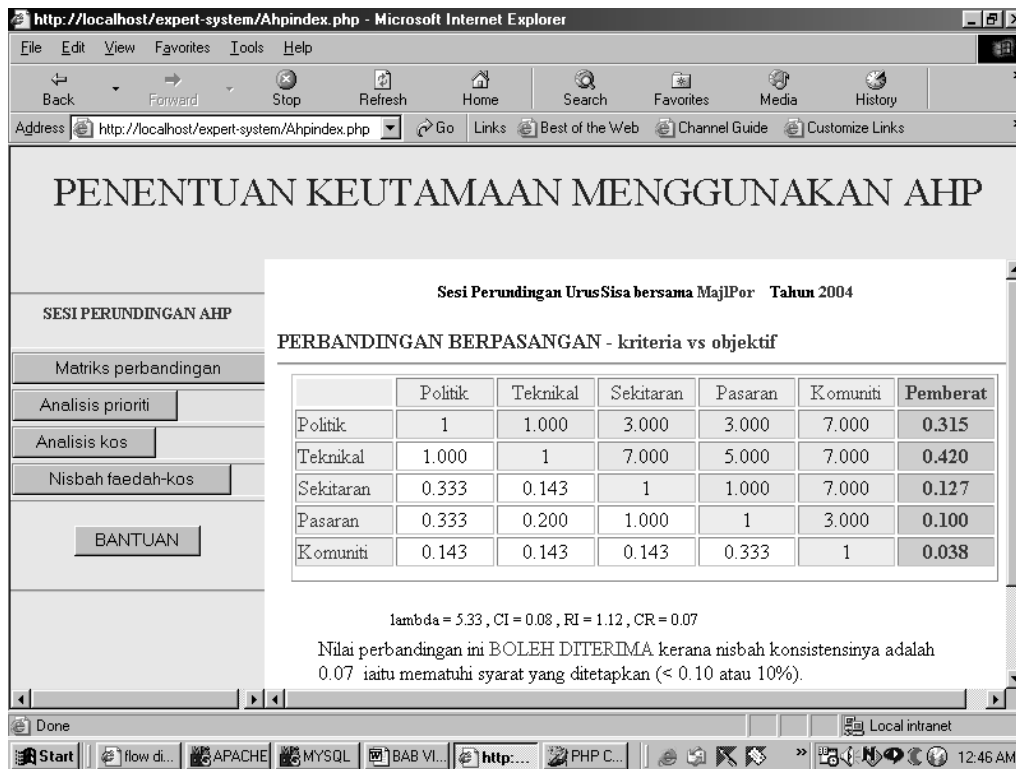
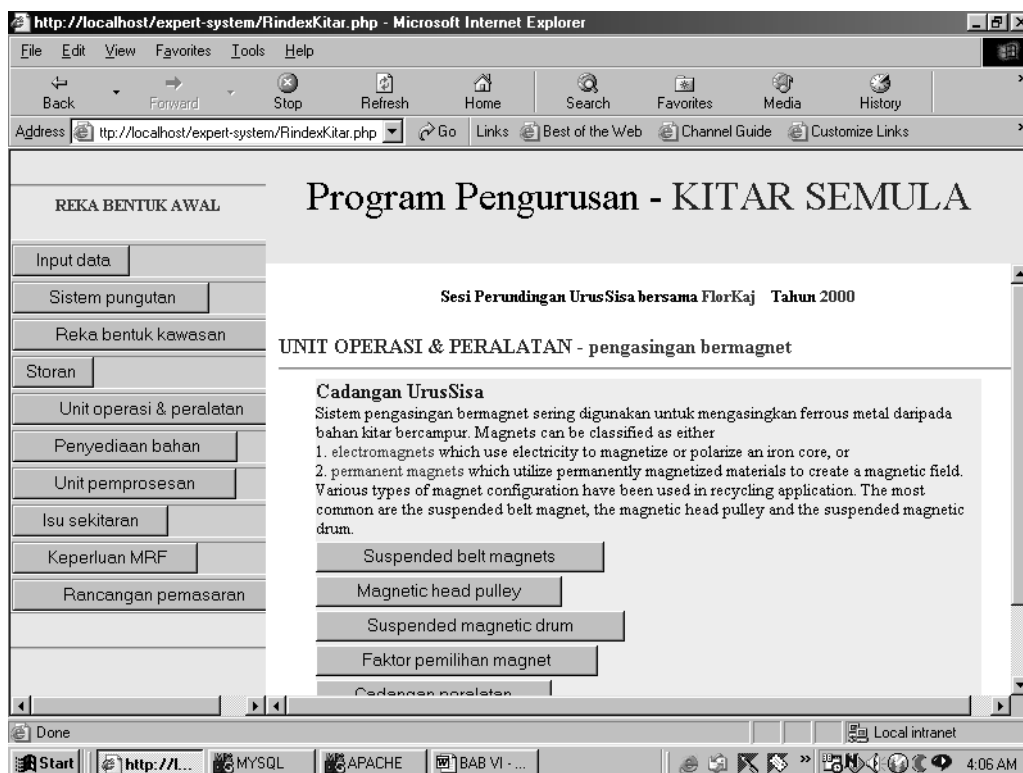Figure 2. An example window for the priority ranking of the technology

Figure 3. An example window for the preliminary design components of recycling

On the Challenge of Accounting Standards for Enterprise

towards Enterprise Internal Control

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Abstract

With arrival of the information age, as well as the ever-changing and complicated capital and financial markets and financial instruments, the policy –making requirements of the enterprises on the faithful, accurate, reasonable, and effective financial and accounting information become more demanding. Enterprise internal control proves to be the basic safeguard to ensure the regular and reliable operation of the accounting information system. At the same time, the Ministry of Finance issued the *Internal Control Standards - the Basic Norms* and opinion-open drafts for 17 norms. The promulgation of accounting standards for enterprise has brought tougher internal control challenges.

Keywords: Accounting Standards for Enterprise, Enterprise Internal Control, Challenge

2006 witnessed the sustained development of china's economy and the rise of China's accounting system. On February 15, Accounting Standards for Enterprises was promulgated; afterwards, the Ministry of Finance issued the *Enterprise Internal Control Standards - the Basic Norms* and opinion-open drafts for 17 norms. How to understand the challenges of internal control brought by the accounting standards for enterprises at the moment is in deepening the reform of China's accounting system, which needs of the needs resolving urgently.

Guided by the basic norms and standardized by specific norms and application directions, Chinese accounting standards for enterprises cover the common business of all sectors.   It will not only provide Chinese accounting with a unified standard, but also increase the quality of accounting information. The enterprise internal control has brought more severe challenges as follow:

1. The introduction of fair value makes the problem highlighted that "how to obtain fair value in reasonable ways, to ensure the reliability of accounting information, as well as how to define and prevent enterprises   from making use of fair value measurement standards to manipulate profit ". The fair value of asset and liability projects will directly affect the overall business profits, thereby informing users of the overall benefit information. It can be presumed that with the further application of fair value measurement, using fair value measurement model to manipulate profits will become another important means of profits regulation besides accounting policy and estimate. Moreover, the accounting standards for enterprises merely make principal regulation, and leave more space for enterprises with choices and flexible application of accounting policies. A considerable number of matters require accounting professionals' judgments to resolve the accounting treatment of specific issues, such as the application of fixed asset depreciation, residual value and disposal costs, asset impairment and fair value. The professional judgments of accounting staff and the quality of accounting information are closely linked.

However, due to the lack of accounting integrity, the selectivity of accounting standard on the business may also allow for the existence of fake information. The phenomena of listed companies manipulating earnings impairment have posed a challenge for the implementation of accounting standard for enterprises. A lack of supervision will result in a further deterioration of the quality of accounting information. Therefore, we must conscientiously strengthen the

effective supervision of accounting information and improve the internal control, which is a severe touchstone to the development of enterprise internal control.

2. Accounting standards have introduced a modern financial theory, and established the time value of money, the effective interest method and asset valuation theory, such as deferred payment in the purchase of fixed assets and intangible assets, disposal of residual value estimates, the economic business of extension receivables, the confirmation and measurement of financial instruments, all of which extensively applied time value and asset valuation theory, making accounting results more truthfully reflect the company assets and liabilities and operating results. However, the accounting fundamentals have changed greatly and it will increase the difficulty of the audit statements and put forward higher requirements on audit institutions and audit staff and bring new challenges to external supervisors of internal control. At the same time, the company will also face with the uncertainness of the assets and liabilities refreshment and future operating results at the beginning of implementation of accounting standards. In addition, the changes will bring a good few difficulties to the implementation of accounting standards to supervision, which will be a real test of the effectiveness of internal control.

3. The improvement and implementation of accounting standards will directly affect enterprise financial management policy and have profound impacts on the strategic positioning of sustainable development. In many aspects such as target profits, investment and financing plans, financial budgeting, profit distribution policy, cost accounting and analysis, performance evaluation, asset pricing, revenue recognition, measurement attribute choice, accounting methods judgment, customer credit management, risk financial assets, tax costs, cash flow and financial risk warning, enterprises are affected by accounting standards with a long-lasting effects, and some problems are to be disclosed after authorization in the future. Thereby, it sets up a high demand for the determination of control strategies of corporate finance, and further affects their internal control strategies.

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Bamboo as an Eco-friendly Material for Use

in Aquaculture Industry in Malaysia

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Abstract

Aquaculture industry has contributed 10% which equal to 1,400 metric ton of the overall fish production in Malaysia. It has undergone a transition stage from small scale family oriented business to large scale operations managed by corporate bodies. Currently, the cost of constructing the basic structure of a floating cage using plastic drums or other foreign materials which is considered as a non-environmental friendly is rather expensive. This also means that such business ventures would not be affordable by the rural community. With the introduction of bamboo as the material in constructing floating cages, cost could be reduced and maintenance should be made much easier. Rural community is expected to benefit from this cost-saving material by setting up aquaculture business through village cooperatives. This paper outlines the concept of using bamboo as the main building material in the fishing industry. The cost and benefit of substituting foreign material with bamboo is examined too.

Keywords: Aquaculture, Floatation material, Bamboo, Economic aspect

1. Introduction

Aquaculture industry in Malaysia has undergone a transition stage from small scale family oriented business to large scale operations managed by corporate bodies. This is discernible from the total aquaculture production of 1400 metric tons (valued between RM 700-900 million), compared to the overall fish production of 1.4 million metric tons in 2004. Though aquaculture production constituted only 10 % of the total fish production, with the bulk of the fish production or closed to 90 % came from captured fisheries sector. With the declining catch rates from coastal and inland fisheries, there is a need to promote extensive development of aquaculture industry in the country.

As a cheap source of animal protein fish is considered an important food item by local people. Due to easy access to fish and fish products, Malaysia is among the country with highest fish consumption in the world. Estimate put that on average per capita consumption was 49 kg per capita in year 2000. This was further increased to 53 kg per capita in the year 2005 and is expected to rise further to 56 kg per capita in the year 2010. The important of fish as food is further reflected in expenditure of the household. On average this was about 20 percent of their food budget. With the increase in number of population of the country and increase in health consciousness among the people apparently current local

production will not able to meet the goal of self sufficiency within these coming years. Basically, the self sufficiency was only 89 percent in year 2000. This was slightly increased to about 90 percent in year 2005 and expected to be slightly increase to 94.3 percent in 2010 (Utama and Ahmad, 2005).

Aquaculture is a farming of aquatic organisms in salt, brackish or fresh water. Fishes, crustaceans, mollusks, algae, and aquatic plants are among popular variety of aquatic organisms that are produced through aquaculture. Unlike capture fisheries, aquaculture requires deliberate human intervention in the organisms' productivity and results in yields that exceed those from the natural environment alone. Such intervention includes stocking water with juvenile organisms, fertilizing the water, feeding the organisms, and maintaining water quality. Aquaculturists need to manage their production to ensure that water quality does not deteriorate and become stressful to the culture organisms. Aquaculture is considered an agricultural activity, despite the many differences between aquaculture and terrestrial agriculture. Aquaculture mainly produces protein crops, while starchy staple crops are the primary products of terrestrial agriculture.

  The present costs of constructing and maintaining the floating rafts for cage culture sheltered inshore water are quite high. As a result only those with big capital investment can afford to get involved in the business while the rural communities staying near the coastal areas are left behind.

The cost of constructing a single floating raft with four cages consisting of several fish species and using timber as the basic material is around RM2,500.00 (Shukur *et al.* 1992). This figure multiplied by 20 fish-cages (an economic number of cages for profitable venture in business) will come to a total of RM50,000.00. Therefore a minimum of RM50,000.00 is required to start a business in aquaculture industry. Kamaruzaman and Rabihah (1989) quoted a much lower cost of about RM43,128 for 40 units of floating cages (RM1,078.20 per cage). Another study quoted an average cost of RM 2,071 per cage (Azlan and Rahim, 1982). However, the cost of building up the floating cage could easily be reduced if timber and plastic or polystyrofoam could be substituted with other cheap but durable material such as bamboo.

The type of aquaculture system that can be adapted using bamboo as the floating material are penaeid or marine prawn culture, crab culture or fattening, culture of coastal fin-fishes in brackish water and culture of coastal finfishes in net-cages.

2. Bamboo and its preservation for marine use

Bamboo is well known for its strong and versatile properties due to its incredible strength. However, the selection of the right species, age and preservative treatment is very important especially for marine uses. Bamboo is susceptible to micro-organism and fungal attacks. The durability of bamboo is dependent on the environmental conditions in which it is exposed. To prolong its service life, bamboo needs to be treated with preservatives. This is particularly true since the untreated bamboo has a service-life of less than one year if exposed to sea water (Liese, 1985). With proper treatment, however, it can be expected to last up to 3-5 years depending on the age and species.

Although bamboo has been used as a construction material in marine environment for centuries, not much research has been conducted to seek ways of protecting it from the activities of degrading marine organisms. Although micro-organisms deteriorate the surfaces of bamboo when exposed to seawater, the primary agents of attack are the marine wood boring animals – the mollusks and crustaceans. It seems that the establishment of superficial microbial decay will enhance the settlement of marine borers on the bamboo surface. This being so, the problem of protecting bamboo from attack must also be considered in terms of the softening of bamboo surfaces by bacteria and fungi.

There are many ways to treat the bamboo, but for effective treatment, the bamboo is treated with selected preservatives such as creosote, copper-chrome-arsenic (CCA), copper-chrome-boric (CCB), ammoniacal-copper-arsenite (ACA) and zinc-copper-chrome-arsenic (ZCCA) (Georgia, 1982) by means of high pressure sap-displacement method or pressurized treatment. However, the use of heat treatment process is another alternative that is highly recommended here to enhance the bamboo durability (Razak *et al.* 2005).   Furthermore this technique is eco-friendly and does not pose threat to the environment.

Bamboo is relatively cheap and adaptable for long service marine uses. It has many applications and has been used in the fishing industry for decades, although no documented information is available.

3. Construction of bamboo floating rafts and cages

3.1 Frame of raft

The bamboo frame of the raft floats on the surface using bamboo for the flotation.

    i.   Types of bamboo with service life 18 -36 months (after heat treatment, chemical treatment or painted with marine paints):

        a)   *Gigantochloa scortechinii* (buluh semantan),

        b)   *Bambusa vulgaris* (buluh minyak),

    c)   *Bambusa blumeana* (buluh duri),

    d)   *Gigantochloa levis* (buluh beting).

ii.   Materials for frame:

    a)   Bamboo for frame (20' length),

    b)   Floor planks (20' length),

    c)   Side planks (20' length),

    d)   Bolts and nuts (36 pieces),

    e)   Nails (2 kg),

    f)   Nylon strings.

3.2 Flotation

As has been mentioned, bamboo is used for the purpose of floatation, its durability and ease in which it can be maintained and replaced. The current price of bamboo pole is between RM2.00 to RM5.00 for one culm (15 m).

3.3 Cages

This section deals with the cutting and shaping of the netting to form four net cages, each 3 x 3 x 3 m.

i.   Netting

Knotted polyethylene is recommended and the following specifications regarding the ply and the mesh size are equated with various fry stocking sizes.

Size for fry (cm)	Mesh size (cm)	Ply
09 - 12	2.5	18
10 - 22	2.5	21
25 - 32	3.8	30
more than 32	6.3	48

ii.   Cage construction

For stocking size of 10 – 22 cm, polyethylene net with a 2.5 cm mesh and a ply of 21 is suggested. For one raft with 4 cages, 30 m of netting with a width of 300 mesh is required.

3.4   Anchorage

To maintain the raft and the nets in position, anchorage is necessary. For this purpose concrete weights are used.

Figures 1 and 2, shows a single bamboo fish floating cage.

4. Economic aspect

The current cost of constructing a single floating raft consisting of four (4) cages is RM2,620.00. This includes the cost of buying timber, netting as well as wages paid to laborers involved in constructing the cage. The cost breakdown is given in Table 1. an increase especially in timber price from an average of only RM500/ ton to RM8700/ ton has made the cost of constructing the cage much more costly than before.

Detailed breakdown of items required in setting up commercial cage culture is provided in Table 2. Except for the cost of the floating cage, the rest of the costs involved in the initial investment of the project are adopted from Kamaruzaman and Rabihah (1989). With a total initial investment of about RM102,900, the project is expected to generate a Net Present Value (NPV) of RM75,720 after 10 years of operation. The Internal Rate of Return (IRR) would be about 28%. The IRR was much lower than the assessment made by Kamaruzaman and Rabihah (1989). They estimated an IRR of about 55%.

If bamboo is used as a substitute for timber structure as well as floats, then for every floating raft we could save about RM457.20. With the new cost structure, not only will it save the initial investment of building the floating cage but also help to improve the IRR of the project. This will make the project more lucrative than other investments. The total cost that could be saved by substituting with bamboo as building material is estimated to be about 18%. Table 3 provides the cost of substituting timber with bamboo.

5. Advantages

The advantages of using bamboo are:

    1.   Cheap and readily available;

2. Easy to maintain/ replace;

3. Easily to dispose once damaged; and

4. No threat to environment.

6. Recommendations and conclusion

From the information and analyzed data presented above, it was found that bamboo could easily substitute timber as the basic material in aquaculture and other fishing industries. The costs involved are much cheaper compared to timber.

In the face of diminishing returns from our heavily-exploited natural fish resources, bamboo aquacultures with the necessary technical and financial inputs from both government and the private sectors can play an increasingly important role in the production of protein food supply within the country, in generating employment opportunities, and in gaining a considerable amount of foreign exchange through the export of some aquaculture products and saving on fish import.

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Table 1. Fish production from marine landings and marine aquaculture in the year 2000 to 2004

Year	Landing		Aquaculture		Total	
	Volume (metric ton)	Value (RM million)	Volume (metric ton)	Value (RM million)	Volume (metric ton)	Value (RM million)
2000	1,285,696	4399.23	117,205.56	665.34	1,402,901.56	5,064.57
2001	1,231,289	4166.11	133,562.79	958.01	1,364,851.79	5,124.12
2002	1,272,078	4206.81	145,439.81	843.49	1,417,517.81	5,050.30
2003	1,283,256	4013.62	146,926.82	931.09	1,430,182.82	4,944.71
2004	1,331,645	4241.45	146,668.04	903.38	1,478,313.04	5,144.83

Source: Anoymous 2004.

Table 2. The current cost in constructing a single fish floating cage

	RM
Timber (*Dryobalanops* spp.) 2'' x 3'' x 20' x 12 pieces - 0.2 ton x RM800 / ton	160.00
Timber (*Dryobalanops* spp.) 1'' x 6'' x 20' x 12 pieces - 0.2 ton x RM800 / ton	160.00
Timber (*Dryobalanops* spp.) 2'' x 2'' x 20' x 3 pieces - 0.03 ton x RM800 / ton	24.00
Nails 3'', bolts and nuts	30.00
Floatation (plastic drum) 8 unit x RM80.00 / unit	640.00
A complete set of net	1,356.00
Labor	250.00
Total	2,620.00

Table 3. Initial investment of commercial cage culture*

Variable	Unit Cost	Total unit	Total cost (RM)	Economic life (yr)
Floating cage (complete unit)	2260	40	90400	10
High pressure pump	4500	1	4500	6
Feed chopper/blender	2000	1	2000	6
Generator	2000	1	2000	6
Fish boxes	250	2	500	6
Boat	1000	1	1000	6
Out-board engine	2000	1	2000	5
Other equipment	500		500	5
Total			102,900	

* Kamaruzaman & Rabihah 1989.

Table 4. The cost of using bamboo in constructing a single fish floating cage

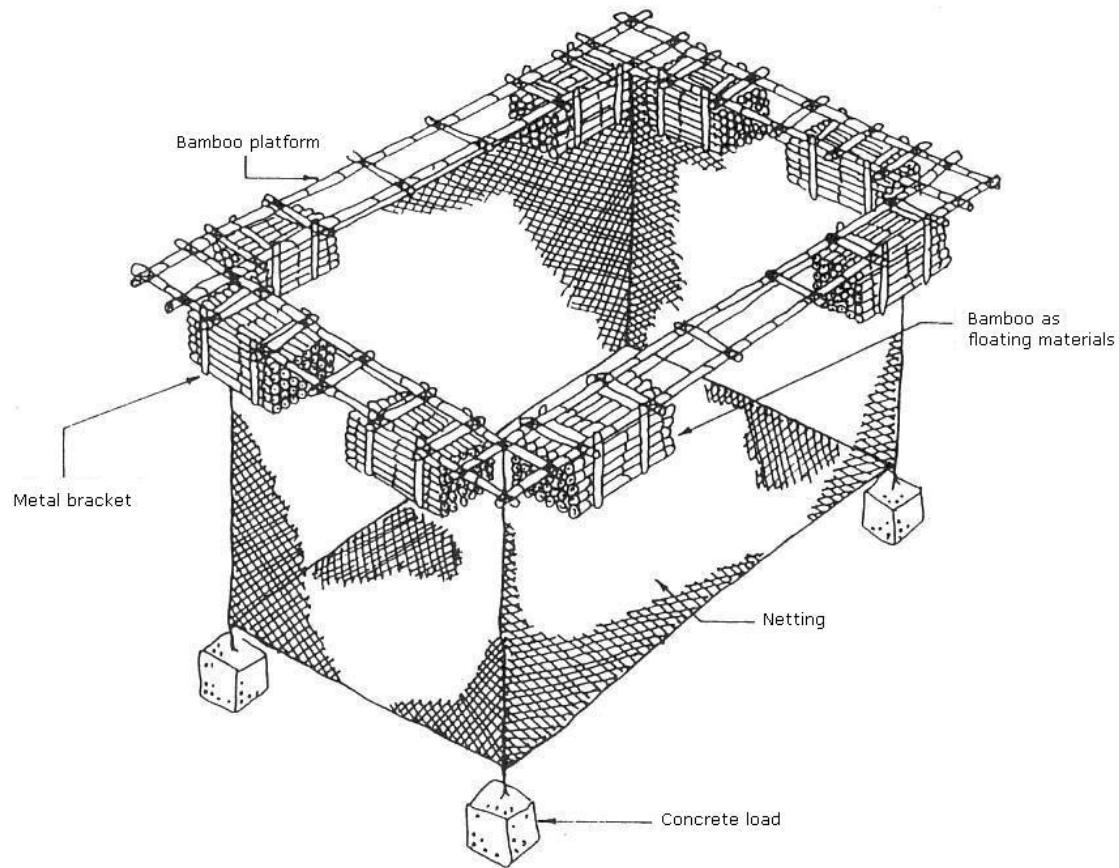|	RM
Bamboo pole 20' in length – 32 pieces x RM2.00 / pole	64.00
Timber (*Dryobalanops* spp.) 1'' x 6'' x 20' x 12 pieces – 0.2 ton x RM800 / ton	160.00
Nail 3'', nylon rope	60.00
Bamboo for floatation 4' – 288 pieces x RM0.60 / piece	172.80
A complete set of net	1,356.00
Bamboo heat treatment to enhance durability	500.00
Labor	250.00
Total	2,562.80

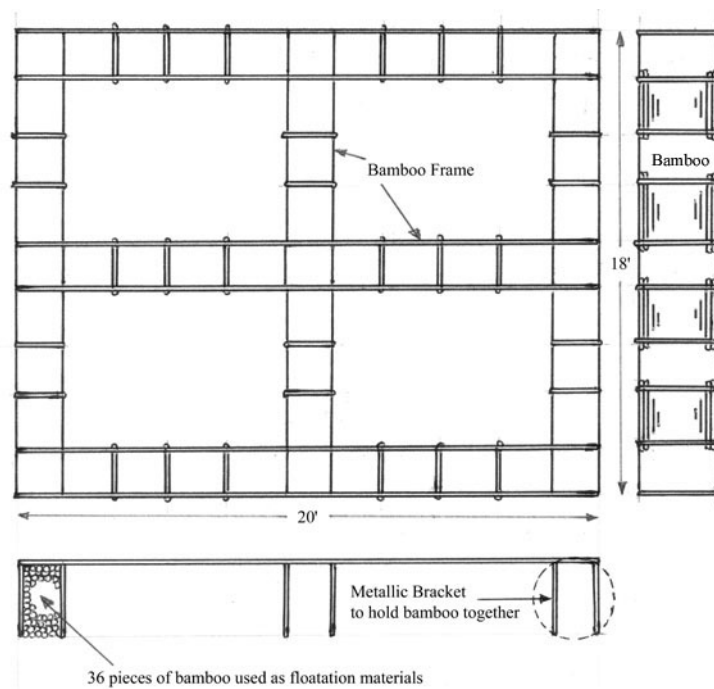Figure 1. Fishing cage with bamboo used as floatation materials

Figure 2. The plan (top) and side (bottom) elevation of bamboo fishing cages.

Research on Prediction of China's Population Development

from 2008 to 2050

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Abstract

Population system is a typical grey system. In this paper, we establish two new grey models of population prediction: discrete grey increment model(DGIM) and grey increment model with new initial value(NGIM). By contrasting, we did simulation and test prediction through utilizing a large amount of data. The results indicate that the two new models prove more accurate than GM(1, 1) model and other models. According to the latest statistical data of China's population from 1949 to 2007, we predict the population development of China up to the year 2050 based on the two new models. Evidence shows that at the end of 2008, 2010, 2020, 2030, 2040 and 2050 the total population will reach 1.32789, 1.3403, 1.3917, 1.428, 1.454 and 1.472 billion, respectively.

Keywords: China's population, Discrete grey increment model(DGIM), Grey increment model with new initial value(NGIM), Prediction of population

1. Introduction

China has the largest population in the world, reaching 1.32129 billion at the end of 2007(except Hongkong, Macao and Taiwan), which makes up one fifth of the world's total. The immense population acts as the leading factor controlling the socio-economic development. During the 58 years after the foundation of People's Republic of China, it has experienced a 21-year high-increment stage and a following 37-year low-increase stage (see Table 1and Figure 1). 1949 to 1970 was a stage of high birth and low mortality rate instead of high birth and great mortality rates prior to 1949 and thus a period of sharp drop of crude mortality compared to the high birth rate of >30‰ to 37‰, where the sharp fluctuation is an exception in 1959 to1961 for natural disaster-hit years. The yearly increment of Chinese population had reached the first population peak of 23.21 million, when the yearly growth rate was 28.77‰ till 1980. The period from 1971 to present is one dominated by birth rate, which had formed a second population peak of 17.93 million till 1987, with mortality reduced to < 7‰, showing that the fast increase in population is suppressed, leading to significant decrease in the birth rate and natural augmentation. Total fertility rate (TFR) of women has been reduced from 5.8 to 1.8 since 1970s, which makes China enter into the low level of birth country half a century ahead of other developing countries (PRC, 2006).

Till the end of the 1990s the reproduction of population reached a stage of low birth rate, low mortality rate and low augmentation rate, an eventful change of the problem that China took a bit more than 30 years to realize compared to

the period of nearly 200 years taken by foreign countries. China has achieved the struggling goals successfully, which are demanded by the white book "*Population and development for the 21st century in China* " of PRC State Council and the Fifteen Planning, to control the total population in 1.33 billion and to control the annual natural growth rate in 9‰ at the end of 2005 (Research, 2007). China has added up to reduce 400 million population after carrying out the policy of family planning 30 plus years, which delayed the world population date of 6 billion 4 years, suppressed the fast increase in population effectively, promoted the development of economy and society, strengthened the comprehensive national power and improved the living standard of people. We also made solid foundation for modernization construction and implement the well-off society in all round way. Meanwhile, we have made outstanding contribution for the world population's development and control. However, the problem of population's increase is still terribly grimness, as china has oversize population. In the period of the eleventh five-years planning, China will receive the forth birth population peak. From 1990 to 1999, the average annual net increase population was 12.73 million, and from 2000 to 2006 it was about 8.09 million. Those people will consume about thirty or forty percent of new increasing GDP, which exerts great pressure on socio-economic development. China's modernization requires population's increase in harmony with economy, society, resources and environment on a sustainable basis. Thus, the current basic tasks of most importance and urgency for building the overall society in all round way are to make a stabilization of low birth rate, to improve their quality and structure, to redistribute the population and to ensure the security of population. Consequently, scientific prediction of the future population situation is of great significance to the strategic decision-making for socio-economic development in our country.

2. Establishment of two new grey-increment models

We usually adopt the model of self-regression or the processing calculation method of population's age on the basis of time sequence analysis for the prediction of population. The premise of the self-regression model must be a smooth sequence. If not, the prediction precision might not be great, even lack of the prediction function as the irrational choice of the expositive variables or unreasonable design (Zhao, 2003, Fan, 2003). The processing calculation method of population's age is hard to calculate precisely, because it involves the structure of population's age, the mode of women's bearing, the mode of population's death and so on. Theory on grey systems has as its research object "uncertain systems with information partially known and partially unknown" that are small-sampled and poor-information, and the research is undertaken largely by extracting useful information from the generation and exploitation of the part of known information to realize the correct understanding of the system's operation pattern and viable control(Liu, 2004). The population system is a typical grey system and is thus suitable for being studied by using a grey model to extract and gain insight into an inherent law contained in synthesized greyness factors of primitive time series. The literatures (Men,2004, Men,2005) first brought forward the grey increment model of population's prediction, which gave full play in the contribution of increment information to the population increase. Thus, we got higher prediction precision. This article is based on the grey increment model, and is trying to establish two new grey prediction models with higher precision and more stability for extended and long-range predictions.

Assume the output of the population's system to be non-negative time series

$$P^{(0)} = [p^{(0)}(1), p^{(0)}(2), \cdots, p^{(0)}(n)]$$

To make the economic increment information contribute as much as possible to economic growth and get still higher prediction precision, the authors do not construct a prognostic model based on the total population sequence shown in Table 1 but a special treatment of the raw series, i.e., a first-order accumulative subtraction operator, in order to separate the increment part.

$$x^{(0)}(t) = \Delta p^{(0)}(t+1) = p^{(0)}(t+1) - p^{(0)}(t)$$

Followed by first-order accumulative addition of the increment time series $x^{(0)}$ through 1-AGO (accumulating generation operator) to get a newly-generated sequence $x^{(1)}$, namely,

$$x^{(1)}(k) = \sum_{i=1}^{k} x^{(0)}(i) \quad (k = 1, 2, \cdots, n)$$

2. 1 Establishment of discrete gray increment prediction model (DGIM)

Make a discrete GM (1, 1) prediction model

$$x^{(1)}(k+1) = \beta_1 x^{(1)}(k) + \beta_2$$

where β_1 and β_2 are coefficients to be determined, obtained through the following expression via the least squares method $\hat{\beta} = (\beta_1, \beta_2)^T = (B^T B)^{-1} B^T Y$,

in which
$$B = \begin{pmatrix} x^{(1)}(1), & 1 \\ x^{(1)}(2), & 1 \\ \cdots & \cdots \\ x^{(1)}(n-1), & 1 \end{pmatrix}$$

$$Y_n = (x^{(0)}(2), x^{(0)}(3), \cdots, x^{(0)}(n))^T$$

Where $x^{(1)}(1) = x^{(0)}(1)$, the solution is the time response function in the form

$$\begin{cases} \hat{x}^{(1)}(k+1) = \beta_1^k x^{(0)}(1) + \dfrac{1-\beta_1^k}{1-\beta_1}\beta_2 \\ \hat{x}^{(0)}(k+1) = \hat{x}^{(1)}(k+1) - \hat{x}^{(1)}(k) \end{cases}$$

And then the result is retrieved to the total by means of $p^{(0)}(t+1) = p^{(0)}(t) + x^{(0)}(t)$. The model presented here is called a discrete grey increment model(DGIM). When setting up a general GM(1, 1), the basic form $x^{(0)}(k) + az^{(1)}(k) = b$ is a discrete equation, while the whitenization equation $dx^{(1)}/dt + ax^{(1)} = b$ is a continuous one. The parameters got from the basic form are put into the whitenization equation, which makes prediction precision degradation from the discrete form to the continuous form. Therefore, a general GM(1, 1) can get a high prediction precision only when the model is used for short-range prediction or the development coefficient $-a$ is small. The model of discrete grey not only conquers this problem, but also solves the problem of GM(1, 1) about stability on a certain extent(Xie,2005).

2. 2 Establishment of grey increment model with new initial value (NGIM)

Make $Z^{(1)}$ mean generation of consecutive neighbors sequence of $X^{(1)}$,

$$Z^{(1)} = (z^{(1)}(2), z^{(1)}(3), \cdots, z^{(1)}(n))$$

where $z^{(1)}(k) = \alpha x^{(1)}(k-1) + (1-\alpha)x^{(1)}(k)$ $(k = 2,3,\cdots,n)$. We usually get $\alpha = 0.5$ and establish the grey model $x^{(0)}(k) + az^{(1)}(k) = b$. Where a and b are coefficients to be determined, obtained through the following expression via the least squares method

$$\hat{a} = (a,b)^T = (B^T B)^{-1} B^T Y_n \ ,$$

in which
$$B = \begin{pmatrix} -z(2), & 1 \\ -z(n), & 1 \\ \cdots & \cdots \\ -z(n), & 1 \end{pmatrix},$$

$$Y_n = (x^{(0)}(2), x^{(0)}(3), \cdots, x^{(0)}(n))^T .$$

The solution is the response function in the form

$$\begin{cases} \hat{x}^{(1)}(k+1) = (x^{(1)}(m)d - \dfrac{b}{a})e^{-a(k+1-m)} + \dfrac{b}{a} \\ \hat{x}^{(1)}(k+1) = (1-e^a)(x^{(1)}(m)d - \dfrac{b}{a})e^{-a(k+1-m)} \end{cases}$$

Where $x^{(1)}(m)d$ mean select m from 1 to n in turn. After comparing we can choose m, which makes the response function the least average error, and establish the best prediction model. When $m = 1$, it is just the general GM(1,1). In the common condition, we can get satisfactory prediction precision, when $m = n$. Then the result is retrieved to the total by means of $p^{(0)}(t+1) = p^{(0)}(t) + x^{(0)}(t)$. We call it the grey increment model with new initial value (NGIM) as we adopt $x^{(1)}(n)$ to be the new initial value. The initial value $x^{(0)}(1)$ of the general grey model is not related to its prediction of it, which does not make good use of the original sequence's information, so it doesn't fit for the least information principle of the gray system theory. Thus, it also produces some errors in the prediction. According to the theory of new information first, we can improve the prediction precision of grey model by putting large weight on new information. Meanwhile, we can make full use of the "least information", optimize and improve the model by means of the initial value $x^{(1)}(n)$ replace the original value $x^{(0)}(1)$. Thus, we can improve the prediction precision effectively. We adopt the above two new gray increment models in the following passage, to make demonstration research on the short-term, medium-term and long-term prediction of China's population (Zhang, 2002, Dang, 2005).

3. Pediction and analysis of the future population of China

3. 1 Testing Prediction of the Population of China from 2005 to 2007

To select a suitable model, we single out 5~9 dimensions short series to construct general-type GM (1, 1) model, DGIM model and NGIM model for experimental prediction of the total population of China from 2005 to 2007. Test shows that the 6-dimension model gives the closest result, which is thus taken for use, with the values from all the gray prediction models summarized in Table 2, 3 and 4.

Comparison of tests of table 2 to 4 indicates that models of DGIM and NGIM have higher prediction accuracy and better effect than other models. In 2007, the accuracy of two models reached 99.997% and 99.990% separately.

To sum up, it is superior to other models in some respects: a) High precision accuracy and stability are maintained in extended and long-range predictions (far exceeding other ordinary models); b) No large quantities of data are demanded in collection [Five to eight samples can be chosen for model establishing, which is especially fit for the occasion that data are difficult to get]; c) It is flexibility and handy in model operation [with small calculation]. Consequently, models of DGIM and NGIM are ideal and economic new tools for population prediction.

3. 2 Population prediction and demonstration analysis of China in the future

From the above comparison, we select a DGIM model and a NGIM model on a 6-dimension basis by data from 2002 to 2007 separately,

$$\hat{x}^{(1)}(k+1) = -23234.25 \times 0.96614^k + 24060.25 \qquad (1)$$

$$\hat{x}^{(1)}(k+1) = -19541.92 e^{-0.0357143(k-5)} + 24246.92 \qquad (2)$$

Tests show that the mean fitting precision of Model (1) is 98.45% and Model (2) is 98.21%. The two new models satisfy first-grade accuracy requirement for the use of the extended and long-range prediction of the total population of the country, with the predictions shown in Table 5.

Compared with table 5, the results of two new model-based predictions are much close. It indicates the feasibility of two new models used. To reduce the relative error, we can utilize the combination of the two new grey models to indicate the total population in the relevant years by putting the values of NGIM as the upper limit, that of DGIM as the lower limit and the mean of them as the prediction.

It needs to state that the natural growth rate in PRC National Statistics Bureau equals the annual net-increase individuals divided by yearly averaged total population (the births minus deaths in the involved year), and the increase rates in Tables 6 are acquired approximately by the prediction of net growth in a year divided by the total number of the preceding year.

4. Conclusions and discussions

From the above, we see that utilization of DGIM and NGIM model is able to make the effect on increment information prominent and weaken effect of disturbing factors, thus revealing the operational law of the system used for higher precision of the prediction. At the same time, the two new models are new ideal tools in population predictions for their absoluteness, facility and easy control. Not all raw data are used for establishing a grey model and different dimensions (or lengths) produce different values of a and b, leading to different predictions that constitute a prognostic grey interval. According to grey modeling theory, the established grey model is significative when $a \in (-2, 1)$. One-step forecast precision is above 98% and two to five step forecast precisions are above 97% as $|a| \leq 0.3$, while one to two step forecast precisions are above 90% and ten-step forecast precision is above 80% as $0.3 < -a \leq 0.5$ (Liu, 2004). In a word, the established GM (1,1) can be used in the extended and long-range prediction while $a \in (-2, 1)$ and $a \geq -0.3$. Thus, choosing the grey model with appropriate dimensions is the key to improve experimental prediction and actual effect. At the end of 2007, the actual population of China is 1.32129 billion, and the first step prediction precision is as high as 99.997% in this paper by testing. Therefore, the effect of prediction is quite satisfactory.

In keeping the normal operation of the present population system, the following conclusions are available:

(1) The natural growth rate of the population on a yearly basis is expected to reduce to 4.97‰ in 2006-2010 compared to 11.60‰ in 1990-1995, 9.12‰ in 1996-2000 and 6.25‰ in 2000-2005, respectively. And the rate would be lowered to about 4.6‰ in 2010 and 2.5‰ in 2025 that is equivalent to the figure reached in developed countries.

(2) The annual net increase in population in China is expected to decline from 6.60 to 6.16 million in 2008-2010, about 3.10 million persons in 2030, no more than 1.60 million persons in 2050.

(3) The population is about 1.32789 billion at the end of 2008 and no more than1.3405 billion at the end of 2010. So we can completely accomplish the restrictive target of the total to be kept inside 1.36 billion at the end of 2010 and annual natural growth rate of 8‰ during 2006-2010. At the end of 2020, the total would be 1.3917 billion, while it would exceed 1.4 billion at the end of 2023. India will become the largest population country instead of China as reported. At

the end of 2030, 2040 and 2050 the total would be 1.428, 1.454 and 1.473 billion, respectively. It can be expected that the total would not exceed 1.48 billion persons with the persistent and efficient implementation the policy family planning, on the basis of markedly prosperous socio-economic situation, pronouncedly raised spiritual civilization and significantly improved qualification of national citizenship in the future.

As shown by the thematic slogan for World's 6 Billion Population Day in 1999, the selection of mankind's birth policies affects the choice of their future in the end. And the essence of the population problem is the development. But the drop in birth rate and stability depend eventually on socio-economic development. We come to the conclusion that the present stage for the population development is in the third interval of the second period (1970 to present). The characteristic of the period is slowly declining at lower birth rate into a stabilized low-rate stage. With fast advance in economy, improved living standard and health care, the crude death rate in China would be slowly declining to the bottom limit of 6.2‰ and maintained at 6.2~6.3‰ in a long time. A chief factor that determines the growth in the future 40~50 years is birth rate. Consequently, the only strategic decision-making is to strictly control the birth rate for keeping lower rate as our serious target on a long-term basis. Although the mission is prolonged and arduous, we should not be lax.

Currently, the structure of the population is becoming increasingly prominent in the process of solving the issue, as follows:

(1) Baby sex pro rata is serious lopsided and goes beyond the range 103~107, high to 119:100. Now male is 18 million more than female in the nubile period and we can forecast that in 2020, the male will be 20 million more than the female at the age of 20~45. China goes through a longest duration with the highest baby sex pro rata. It will induce adverse effect to social stability and harmony (Xin,2007) .

(2) There are 0.8~1.2 million invalids every year, 30% dead, 40% lifelong defective, and only 30% can be cured or corrected, so we loss about 1 billion every year. Proportion of invalids is higher and the total population of invalids has exceeded 60 million as reported, amount to the population of France.

(3) Data provided by National Elder Committee indicates that the population of people older than 60 is 143 million, about 11% of total population. As the Ministry of Affairs reported, the population of the people over the 65 years old is 104.19 million at the end of 2006. It is 7.9% of the total population and raises 0.2% compared with last year. The population of the old people will be 240 million at 2020. It indicates the society of aging is coming ahead, but the whole society has not prepared completely (Xin, 2007).

Besides that, we are facing such problems as qualities of the population out of phase with development, social consequences from population fluidness and ex- and immigration for development, employment, spreading of diseases as AIDS endangering the population's security, etc. Although the increasing quantities of the population have effect on the economic increase, the population's structure and qualities are also the keys. We shall continue to put into strict control the population augmentation and stabilization of birth rate at lower level and place the focus on bettering the population's structure, establishing systems of sound child rearing and social security in an attempt to overall raise the qualities of population, mobilize all departments and the whole society for integrative management of the problem to stepwise realize a long-term harmonic development of population, resources and society. As noted by Mr. Zhao Baige at Oct 9th, 2006, Assistant Director of the National Committee of Population and Planned Birth, China will meet the three population peaks (Xin, 2006): laboring age, aging and total of the population one after another next half century to follow and we should be ready for the challenge.

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Table 1. Statistics of China's population from 1949 to 2007

year	total pop(10^4)	birth rate (‰)	mortality (‰)	natural growth (‰)	net increase(10^4)	increase rate (‰)
1949	54,167	36.00	20.00	16.00	----	----
1950	55,196	37.00	18.00	19.00	1,029	19.00
1951	56,300	37.80	17.80	20.00	1,104	20.00
1952	57,482	37.00	17.00	20.00	1,182	20.99
1953	58,796	37.00	14.00	23.00	1,314	22.86
1954	60,266	37.97	13.18	24.79	1,470	25.00
1955	61,456	32.60	12.28	20.32	1,190	19.75
1956	62,828	31.90	11.40	20.50	1,372	22.32
1957	64,653	34.03	10.80	23.23	1,825	29.05
1958	65,994	29.22	11.98	17.24	1,341	20.74
1959	67,207	24.78	14.59	10.19	1,213	18.38
1960	66,207	20.86	25.43	-4.57	-1,000	-14.88
1961	65,859	18.02	14.24	3.78	-348	-5.26
1962	67,295	37.01	10.02	26.99	1,436	21.80
1963	69,172	43.37	10.04	33.33	1,877	27.89
1964	70,499	39.14	11.50	27.64	1,327	19.18
1965	72,538	37.88	9.50	28.38	2,039	28.92
1966	74,542	35.05	8.83	26.22	2,004	27.63
1967	76,368	33.96	8.43	25.53	1,826	24.50
1968	78,534	35.59	8.21	27.38	2,166	28.36
1969	80,671	34.11	8.03	26.08	2,137	27.21
1970	82,992	33.43	7.60	25.83	2,321	28.77
1971	85,229	30.65	7.32	23.33	2,237	26.95
1972	87,177	29.77	7.61	22.16	1,948	22.86
1973	89,211	27.93	7.04	20.89	2,034	23.33
1974	90,859	24.82	7.34	17.48	1,648	18.47
1975	92,420	23.01	7.32	15.69	1,561	17.18
1976	93,717	19.91	7.25	12.66	1,297	14.03
1977	94,974	18.93	6.87	12.06	1,257	13.41
1978	96,259	18.25	6.25	12.00	1,285	13.53
1979	97,542	17.82	6.21	11.61	1,283	13.33
1980	98,705	18.21	6.34	11.87	1,163	11.92
1981	100,072	20.91	6.36	14.55	1,367	13.85
1982	101,654	22.28	6.60	15.68	1,582	15.81
1983	103,008	20.19	6.90	13.29	1,354	13.32
1984	104,357	19.90	6.82	13.08	1,349	13.10
1985	105,851	21.04	6.78	14.26	1,494	14.32
1986	107,507	22.43	6.86	15.57	1,656	15.64
1987	109,300	23.33	6.72	16.61	1,793	16.68
1988	111,026	22.37	6.64	15.73	1,726	15.79
1989	112,704	21.58	6.54	15.04	1,678	15.11
1990	114,333	21.06	6.67	14.39	1,629	14.45
1991	115,823	19.68	6.70	12.98	1,490	13.03
1992	117,171	18.24	6.64	11.60	1,348	11.64
1993	118,517	18.09	6.64	11.45	1,346	11.49
1994	119,850	17.70	6.49	11.21	1,333	11.25
1995	121,121	17.12	6.57	10.55	1,271	10.60
1996	122,389	16.98	6.56	10.42	1,268	10.47
1997	123,626	16.57	6.51	10.06	1,237	10.11
1998	124,761	15.64	6.50	9.14	1,135	9.18
1999	125,786	14.64	6.46	8.18	1,025	8.22
2000	126,743	14.03	6.45	7.58	957	7.61
2001	127,627	13.38	6.43	6.95	884	6.97
2002	128,453	12.86	6.41	6.45	826	6.47
2003	129,227	12.41	6.40	6.01	774	6.03
2004	129,988	12.29	6.42	5.87	761	5.89
2005	130,756	12.40	6.51	5.89	768	5.91
2006	131,448	12.09	6.81	5.28	692	5.29
2007	132,129	12.10	6.93	5.17	681	5.18

Note: The data are taken from the "China Statistical Yearbook"(2000-2007). The right-hand-side net increase of population and increase rate are based on integrative treatment by the writers.

Table 2. Comparison of various grey models-based predictions for China's total population for 2005(Units: 10^4 persons)

model	statistics	prediction	residual difference	relative error (‰)
GM (1, 1)	130756	130851.70	95.70	0.73
DGIM	130756	130685.99	-70.01	0.53
NGIM	130756	130704.28	-51.72	0.39

Table 3. Comparison of various grey models-based predictions for China's total population for 2006 (Units: 10^4 persons)

model	statistics	prediction	residual difference	relative error (‰)
GM (1, 1)	131448	131563.92	115.92	0.88
DGIM	131448	131471.21	23.21	0.18
NGIM	131448	131495.53	47.53	0.36

Table 4. Comparison of various grey models-based predictions for China's total population for 2007 (Units: 10^4 persons)

model	statistics	prediction	residual difference	relative error (‰)
GM (1, 1)	132129	132244.7	115.7	0.876
DGIM	132129	132133.4	4.38	0.033
NGIM	132129	132115.7	-13.28	0.101

Table 5. Two new grey models-based predictions of China population for 2008-2050 (Units: 10^4 persons)

year	total			net increase			growth rate (‰)		
	DGIM	NGIM	AVE	DGIM	NGIM	AVE	DGIM	NGIM	AVE
2008	132791	132787	132789.0	662	658	660.0	4.97	4.96	4.965
2009	133431	133423	133427.0	639	636	637.5	4.79	4.77	4.780
2010	134049	134037	134043.0	618	614	616.0	4.61	4.58	4.595
2011	134646	134631	134638.5	597	594	595.5	4.43	4.41	4.420
2015	136840	136812	136826.0	520	518	519.0	3.80	3.79	3.795
2020	139189	139150	139169.5	438	436	437.0	3.15	3.13	3.140
2025	141167	141119	141143.0	369	367	368.0	2.61	2.60	2.605
2030	142831	142778	142804.5	310	309	309.5	2.17	2.16	2.165
2035	144232	144177	144204.5	261	260	260.5	1.81	1.80	1.800
2040	145412	145354	145383.0	220	220	220.0	1.51	1.51	1.510
2045	146405	146345	146375.0	185	185	185.0	1.26	1.26	1.260
2050	147241	147181	147211.0	159	156	157.5	1.08	1.06	1.070

Note: DGIM denotes the discrete grey increment model and NGIM denotes the grey increment with new initial value model.
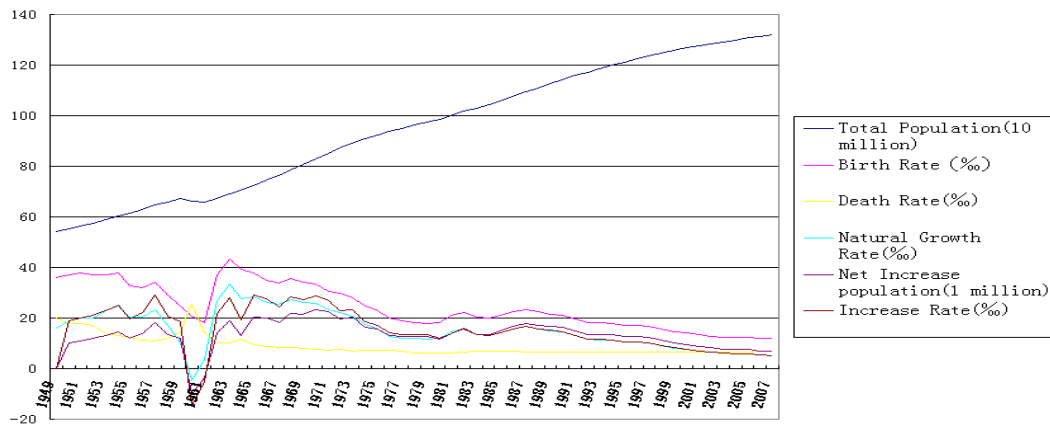

Figure 1. Natural change of China's population from 1949 to 2007

Efficiency of Fixed-Width Transect and Line-Transect-based Distance Sampling to Survey Red Junglefowl

(*Gallus gallus spadiceus*) in Peninsular Malaysia

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Abstract

Reliable survey method is very important to estimate wildlife population. In this study, fixed-width strip- and line-transect samplings were simultaneously used to yield population estimates on oil palm plantation. The latter was found to be more accurate but less precise than the former based on the Per cent Relative Bias (hereafter PRB). Using the strip-transect, an overall density and abundance were estimated at 0.3237 birds/ha and 3 018 ± 273 birds (CV = 9.05%), respectively. An unbiased overall density generated by line-transect, D ± S.E. = 0.500 ± 0.069 birds/ha (95% CI: 0.38137 - 0.65521) and estimated total abundance, N ± S.E. was 4 661 ± 644 birds (95% CI: 3 556 - 6 109; CV = 13.81%) for the entire 9 323.53 ha study area. The former and latter method gave relative and absolute estimates, respectively.

Keywords: Density, Abundance, Fixed-width strip-, Line-transect, Per cent Relative Bias

1. Introduction

Density and abundance are the essential ecological information required for population ecology. The scope of ecology covers distribution of organism and its abundance (Buckland, 1993; 2001). And estimating the abundance has been a challenge in wildlife science because many previous surveys used indices to estimate relative abundance (Rusk, 2007). The managers and biologists have to consider the most cost-effective way to survey a population and later come out with very reliable estimates in order to apply them in the management. New survey techniques are well developed today and some are inexpensive and without physical contact with study animal. One of them is Distance Sampling which was introduced and refined by several statisticians (Buckland, 1993, 2001; Burnham, 1980). Unlike all the simple indices, Distance Sampling fits a detection function to the observed distances in order to estimate the proportion of objects missed by the survey (Thomas, 2002). In the absence of complete census, Distance Sampling is a reliable survey method available to produce useful information.

Wildlife resource management in Peninsular Malaysia is improving through active law enforcement and engagement with stakeholders but still lacks the science. Poaching was encountered seriously and prosecuted illegal hunters were fined for the wildlife crime they committed (DWNP 2006). One good example is in term of gamebird management which still needs better scientific based management. Not only the gamebirds are exploited with liberal hunting quota but the population size has never been surveyed to determine its status. Red junglefowl (hereafter RJF) or *Gallus gallus spadiceus*, is evaluated as being of Least Concern in the IUCN Red List. In Peninsular Malaysia, it is a game-bird species protected under the Wildlife Protection Act 76 (1972). Previous studies on the species in Malaysia was pioneered by Abdullah and Babjee (1982) and later followed by Arshad (1999) through several publications (Arshad & Zakaria, 1999; Arshad, 2000a, 2000b; Zakaria, 2003). Population density of RJF in Malaysia is poorly studied and not available in publication, especially before 1999. Globally, a paucity of survey efforts deters any management

development of population levels to harvest the species in sustainable way. Main literature written by naturalists such as Delacour (1977) and Johngards (1999) never addressed the significance of oil palm plantation as the main habitat for RJF in Southeast Asia.

The main objective of this study was to determine the efficiency of fixed-width transect and line-transect-based Distance Sampling in estimating the density and abundance of RJF on palm oil plantation. This study also evaluated the precisions offered by coefficient of variation (CV) in estimates of density generated by fixed-width strip and line transects sampling.

2. Methods

2.1 Study Area

This study was conducted in Carey Island, located on the west coast of Peninsular Malaysia, in the state of Selangor (Latitude: 101º 16'E - 101º 27' E, Longitude: 2º 48'N - 2º 59'N). Mean daily air temperature was 29.08 ± 0.07 º Celsius from 1st of May to 31st of August 2006 (Subang Weather Station of Malaysia Meteorological Department). Surveys were carried out for four months consecutively (May - August 2006) at different dates (2nd - 6th May; 12th - 16th June; 24th - 27th July; 28th - 31st August). Geographically, the island is separated from the mainland by the Langat River, and the landscape was predominantly cultivated with oil palm. The island is a completely low lying area and defended from the intrusion of seawater by artificial barriers. The major landowner was Sime Darby Plantation, a government-linked investment company. The plantation of 11 509.36 ha has been divided into management divisional areas, namely, West estate and East estate with 5 199.53 ha and 5 229.59 ha, respectively. The plantations covered more than 77% of the whole land area (approximately 15 000 ha). The plantations can further be divided into mature (> 4 years old oil palm) and immature, accounting for 9 323.53 ha and 1 105.59 ha, respectively.

2.2 Survey Design and Implementation

Twenty-one transect lines, or tracklines, ranging from 0.5 to 2 km in length were covered on foot in the study. The tracklines were located separately at > 200 m to avoid double counting of individuals. Our survey work was limited to four to five days in each month, as permitted by the plantation management - which provided logistic assistance. The tracklines were set up randomly in straight lines on the loading road, and marked using a Global Positioning System. These tracklines were considered spatial replicates and repeated every month. The loading road are the road within every plantation block, they are generally in straight lines either oriented in a north-south or east-west direction.

Two observers traversed the tracklines on foot. Each observer was assigned to the left or right side of the transect line. Daily data collection of approximately four hours started from 0730 to 1230 hrs – with work suspended through the early afternoon. The surveys resumed for another four hours from 1500 to 1900 hrs. In this study, we assumed that an aural detection represented 4 birds/flock as every crowing sound from an unseen male signifies its territoriality and controlled harem.

The perpendicular distances between the transect line and the initial location of RJF were measured directly with a digital rangefinder. The geometric centre of a cluster was determined to be the centre point of the flock from the trackline (Buckland, 1993, 2001). The observers marked the nearest oil palm tree to the RJF and walked until to a point which paralleled the point where the RJF was first spotted. This method seemed to be more practical, instead of using the triangulation method.

2.3 Fixed-width Strip Transect

For strip transect surveys, data were analyzed by month and over the whole hunting season. The total numbers were estimated using the equation suggested by Greenwood and Robinson (2006), specifically designed for unequal sample areas. The formulae incorporated the relationship between the samples and the whole study area from which they were drawn. In a finite number (M) of potential sampling units, the sampling fraction (m/M) was used to calculate the standard error and the confidence limits of the mean. In this case, m is considered the actual sample. The sampling unit or site is defined as a standard grid of one km^2 on a topographic map. The calculation used to estimate population size for the fixed-width strip transects sampling is outlined as below:

D = estimated density of RJFs per unit area (ha) = $\sum_i n_i / \sum_i a_i = n_i/A = n_i/2WL$,

N = estimated total number in the N sites = A x D,

var (N) = $[var(n) + (D)^2 var(a) - 2(D)cov(an)]M^2(1- m/M)/m$,

Standard error of estimated N = $\sqrt{var(N)}$,

where M = total number of sites comprising the study area, A = total area of these sites, m = number of sites sampled, a_i = area of the i th site, n_i = numbers of RJF on the i th site, W = half-width of the strip transects, and L = length of the transect.

In this case, m was calculated as m = $\sum$(Strip Area) ha x 1 km^2/100 ha = 4.256 km^2

The sampling fraction was computed as m/M = 4.256 km^2/93.235 km^2 = 0.0456.

2.4 Line-Transect-based Distance Sampling

The RJF densities and abundances were estimated using the Conventional Distance Sampling engine of DISTANCE 4.1, Release 2 (Thomas, 2003), where each line was used as sampling unit and by selecting the model that best fits the data (Burnham, 1980). A scatter graph of the cluster size s_i against the x_i distance was plotted to check any size-biased problem. Pearson correlation was used to determine any relationship between cluster size and distance.

Five models were selected as key functions, together with its series expansion (Half-normal + Cosine; Half-normal + Hermite; Uniform + Cosine; Uniform + Polynomial; Hazard-rate + Cosine). Final model was selected on the lowest value of the Akaike's Information Criterion (hereafter AIC). The AIC identified the best model that fits the data well, and does not have too many parameters (Buckland, 1993, 2001). Ungrouped data in the form of measured perpendicular distances were analyzed. The perpendicular distances of each RJF from the transect line were recorded. All the RJFs located on the line were detected with certainty, the densities of RJF clusters in the area surveyed (D) were estimated. The parameter f(0), corresponds to the probability density function of the perpendicular distances, evaluated at zero. The parameter f(0) is also interpreted as 1/µ, where µ is termed the effective strip half-width and, when multiplied by 2L, gives the effective area surveyed. If one animal was detected then it was assumed that the whole flock was detected (Thomas, 2002). To obtain the estimated density of individuals, the previous equation was multiplied by an estimate of mean cluster size in the population, E(s):

D = n x f (0) x Ê(s))/2L

The variance of estimated density which comprised three components was calculated as outlined by Buckland et al. (1993, 2001):

Variance (D) = D^2 x {[cv(n)]^2 + [cv(f(0)}]^2 + [cv(s)]^2}

2.5 Comparison between Fixed-width Strip and Distance Sampling-Line-Transect Estimates

In order to compare the estimates between fixed-width strip and line transect, per cent relative bias (PRB) was applied in the study. However, only truncated results of line transects were used in the calculation. Following the same example used by Ogutu (2006), the estimates produced by the line transects are taken to be unbiased, and the strip-transects are taken to be biased because visibility decreases with distance. The PRB is therefore calculated as:

PRB = 100(Estimated N$_{Strip}$ – Estimated N$_{Line}$)/Estimated N$_{Line}$

3. Results

3.1 Relative Estimates by Fixed-width Strip Transect

The fixed-width was defined by the maximum perpendicular distance of detection multiplied by two (strip width = 2W = 2(d$_{max}$) = 2 x 80 m = 160 m). The maximum distance was based on the aural detections and applied to density calculations. The highest density computed was in July for actual and adjusted count (sample size for bird counted, n$_i$ = 101; density, D$_{Actual}$ = 0.237 and n$_i$ = 146; density, D$_{Adjusted}$ = 0.343, respectively) and the lowest was in August (n$_i$ = 77; D$_{Actual}$ = 0.181 and n$_i$ = 122; D$_{Adjusted}$ = 0.287, respectively) (Table 1). The CVs were calculated around 8-12%. The estimated densities and abundances for adjusted detection were higher than actual detection. The CVs also increased in the adjusted detection due to increase in sample size. Total actual count of RJF for four months was not significantly correlated with sampling area (Pearson correlation = 0.367; P = 0.102) (Figure 1).

3.2 Absolute Estimates by Line-Transect-based Distance Sampling

Over the four months, 170 detections were recorded. Goodness-of-fit test was not significant for spatial and temporal replicates (Table 2), and indicates a good fit of detection function models to the corresponding frequency of histograms of distance data. Population estimates for July in adjusted detection dropped less than estimates in actual detection. Population estimates were all similar (Table 2). Precision (measured in coefficient of precision, CV) were around 22-27%. July was the month with the highest density for actual and adjusted count (sample size for number of detection, n$_l$ = 46; D$_{Actual}$ ± S.E. = 0.555 ± 0.125 birds/ha and n$_l$ = 46; D$_{Adjusted}$ ± S.E. = 0.536 ± 0.121 birds/ha, respectively) and August was the lowest (n$_l$ = 40; D$_{Actual}$ ± S.E. = 0.453 ± 0.112 birds/ha and n$_l$ = 46; D$_{Adjusted}$ ± S.E. = 0.494 ± 0.120 birds/ha, respectively) (Table 2). These results were consistent with the strip transect estimates. Two models appeared to provide the same minimum AIC value for August, and program DISTANCE 4.1 selected one of them at random (Half-normal + Hermite). In contrast, other months used Uniform + Cosine model. The scatter plot shows that many clusters were detected near the line, and visibility diminished further from the line (Figure 2). This was a negative dependence on the distance as the observers successfully spotted larger flocks close to them.

The uniform cosine provided a good fit with the distance data (AIC = 1 397.8; Chi-square, χ^2 = 11.406; d.f. = 11; P = 0.410) for the actual count results. RJF density was estimated at 0.503 ± 0.056 birds/ha (CV of 11.19%). But, for the non-adjusted aural detections the precision was almost similar. Truncation of 10 % data was applied to remove the

outliers in order to improve data for modeling. This consequently reduced observations from 170 to 159. This procedure decreased the precision for actual (0.513 ± 0.071 birds/ha; 4 783 ± 657 birds) and adjusted estimations (0.500 ± 0.069 birds/ha; 4 661 ± 644 birds) to 13.74% and 13.81% respectively. Repeated sampling is not a problem in distance sampling method as long as the same individual is not double counted in a given survey (Buckland, 1993, 2001). Temporal replicate is an example way to increase precision. The CVs for overall surveys increased by around 11% compared to monthly estimates.

3.3 Comparison between Fixed-width Strip and Line-Transect Estimates

Strip-transect sampling resulted in lower estimates of RJF abundance than the line-transect sampling based on the negative value of PRB (Table 3). However, the former produced more precise estimation than the latter, both in spatial and temporal replicates. This was consistent with our finding that the strip-transect estimates tends also to be severely biased low relative to line-transect estimates. This result is similar to that of Ogutu (2006). The results showed the distinction between two sampling methods in which fixed width of strip transects yielded higher precision in terms of visibility than variable strip half width of line transect. Noting that the former used a straightforward computation of animal encountered and the latter used detection function of animals encountered and missed during the surveys. The assumption that every animal was counted in the strip plot was defined to be every RJF encountered visually and aurally during the survey, which gave complete counts.

4. Discussions

The cluster or flock density obtained was higher than that of Zakaria (2003). He estimated 0.449 ± 0.026 flocks/ha in the four year old plantation. In contrast, we estimated 0.202 ± 0.025 flocks/ha. For estimated average size of flock, Zakaria (2003) reported that the largest size was 3.06 ± 0.35 birds and 1.88 ± 0.06 birds for four year old and 22 year old plantation respectively. Our result yielded 2.471 ± 0.144 birds/flock. On the other hand, Collias and Collias (1996) reported the average flock size as 11 birds for an introduced free-ranging population in San Diego Zoo, which is about twice the average of five birds per flock they found in India (Collias & Collias, 1967). We disagree with any suggestion that cluster size is limited to less than a dozen per flock in the wild, since we observed as many as 18 birds per flock (male : female = 4:14) in May. Other results by Javed and Rahmani (2000) estimated 1.60 ± 0.11 to 5.70 ± 0.62 birds/flock, but varied according to winter and summer season. The surveys were limited to plantation blocks more than four years old because it was found difficult to walk through plantations of young, thick, and short palms when we tested it during the pilot study. It might be possible to use point transect sampling to survey such thickly vegetated habitat and analyze the data separately. Estimates of point transect and line transect sampling might be combined to provide overall population size. The estimates from line-transect survey produced almost similar abundance and CV. This reflects that a good level of accuracy was achieved in this survey, as suggested by Buckland (1993, 2001).

The line-transect estimates were twice those of the strip transect estimates. Both strip and line transect sampling improved their precision for overall estimates. The overall CVs from both samplings are between 9% and 11%. Aural detections were adjusted to rectify the size bias, which is more important than precision optimization in distance sampling analysis (Buckland, 1993, 2001). Without the adjustment, the estimates are underestimated. One common practice in avian studies using distance sampling to increase n, is repeated sampling (Rosenstock, 2002). Buckland (1993, 2001) suggest that double-counting generally is of little consequence in practice, particularly if such events are relatively infrequent. The distribution of both counts and densities were not normal for certain months (June and July). Greenwood and Robinson (2002) suggested that departure from normality has no effect on the estimations of the means and variances, with an exception for the standard error and confidence limits. The analysis of variance to compare the monthly means of density is fairly robust with respect to the violation of normal distribution assumption.

For PRB, the fixed-width strip-transect estimates showed negative bias in all cases. Therefore, this method underestimated the population densities and abundances. Generally, biases and limitations of index counting procedures have been highlighted (Burnham, 1981; Verner, 1985) and are a matter of great concern, because they are then unable to provide reliable information (Rosenstock, 2002). The point estimate (overall) of RJF density in the Carey Island (0.500 ± 0.069 birds/ha) was lower than the highest density of 0.842 ± 0.055 birds/ha as obtained by Zakaria (2003) in four-year old oil palm plantation, although the CV was not given. The estimates from this study were higher than the estimates for other plantation habitats found by Zakaria (2003). This specific result was obtained from one of his study sites (Sungai Sedu GHP Plantation) less than 15 km from the Carey Island site. This particular plantation was 709.06 ha, which made it only a fraction of 8% of the surveyed area of Carey Island. The estimates from Zakaria (2003) used two tracklines and were repeated twice every month for a year. No monthly estimates were given in that study. Treating each walk as a sample tends to underestimate the variance, rather than pooling data for all walks for a given transect and treating each as true spatial replicate (Jathanna, 2003).

The estimates from Carey Island were more representative for oil palm plantation in Peninsular Malaysia. If stratification was used to analyze the data, it is possible that a higher density can be obtained in certain habitat or area, as demonstrated by Arshad (1999). However, overall estimates were more useful rather than stratification estimates for

wildlife managers as they normally did not know much about plantation conditions, especially if it is privately owned. The results of this study reestablished that the density of RJF in oil palm plantation is higher than in primary forest. O'Brien (2000) found the density in heavily and lightly hunted areas were 2.32 and 1.32 birds per 100 ha, respectively in lowland rainforest of Sulawesi, Indonesia. Other early estimations were conservative because of a lack of rigorous statistical analysis and used merely naive estimate calculations. Studies conducted in India provided an estimate of 1.00 birds/ha (Collias & Collias, 1967) and 0.25-0.50 birds/ha (Bump & Bohl, 1961) respectively. These estimates resulted from surveys conducted in semi-natural habitat, but lacked rigorously statistical analysis. Point estimates derived from bird count should have suitable measures of precision (standard error, coefficient of variation, or confidence interval) since otherwise they are of little value (Rosenstock, 2002) and make comparisons difficult (Reading, 1998).

During the four months surveys, only 66 detections were registered as aural. Separate analysis for monthly aural detection would produce imprecise estimates due to small sample size. Therefore it is good practice to combine both visual and aural counts in order to reliably estimate population abundance. Bibby (1992) and Buckland (1993, 2001) suggested a minimum of 40-80 sightings per survey for a precise estimate of density. Based on the field observations, the crowing males of RJF only moved a little. This situation made it possible for the observers to approach close to the birds even without any sighting. Jiménez (2003) suggested that movement of singing birds seems unlikely to cause significant error in detection distance measures.

5. Conclusion

From this study, the line-transect-based Distance Sampling provided unbiased density and abundance of RJF but less precise than the fixed-width strip transect. The results of the former survey method were more reliable to be applied for decision making process in wildlife management and conservation.

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Table 1. Fixed-width strip transect counts. Monthly count (ni), variance of count, covariance of area multiplied by count, estimates of density, population abundance, variance of abundance, standard error of abundance, and per cent of coefficients of variation (% CV), by month (May, June, July, August), and over the whole open hunting season.

Replicates	Month	Detections	Sample size, n_i	var(n)	cov(an)	Density [A] (birds/ha)	Abundance [B] (N ± S.E.) (no. of bird)	Var(N)	% CV [C]
By month (21 lines/month) [D]	May	Actual	87	34.83	22.240	0.2044	1 906 ± 235	55 437	12.33
		Adjusted	138	56.56	26.480	0.3242	3 023 ± 300	90 016	9.92
	June	Actual	88	19.16	12.667	0.2068	1 928 ± 180	32 513	9.34
		Adjusted	145	43.79	14.907	0.3407	3 177 ± 283	80 173	8.91
	July	Actual	101	22.26	0.213	0.2373	2 212 ± 224	50 291	10.13
		Adjusted	146	30.75	2.853	0.3430	3 198 ± 266	70 933	8.32
	August	Actual	77	20.03	10.213	0.1809	1 687 ± 190	35 944	11.26
		Adjusted	122	35.16	11.173	0.2867	2 673 ± 258	66 411	9.65
Combined (84 lines) [E]	Overall	Actual	353	23.37	10.924	0.2074	1 934 ± 205	41 948	10.60
		Adjusted	551	40.27	13.353	0.3237	3 018 ± 273	74 364	9.05

[A] Naive density = no. of bird detected/area

[B] S.E. (N) = $\sqrt{Var(N)}$

[C] %CV = 100% x [(S.E. of Density)/Density]

[D] var(a) = 64.60

[E] var(a) = 62.26

Table 2. Sample size of combined detections (visual and aural) (n₁), number of RJF sighted per km (n/L), expected cluster (or flock) size [E(S)], cluster (DS) and individual density (D), population abundance (N), and its per cent of coefficients of variation (%CV) for Carey Island based on program DISTANCE 4.1, release 2 software.

Month	Sample size, n₁	Detections[A]	(n/L)	E(S) (no. of bird)	DS ± S.E. (flocks/ha)	D ± S.E. (birds/ha)	N ± S.E. (no. of bird)	%CV [B]
May	36	Actual	1.3534	2.7996	0.1636 ± 0.0370	0.4581 ± 0.1226	4 271 ± 1 143	26.76
		Adjusted	1.3235	3.2603	0.1600 ± 0.0369	0.4950 ± 0.1359	4 864 ± 1 360	27.96
June	48	Actual	1.8045	2.2124	0.2315 ± 0.0514	0.5121 ± 0.1229	4 775 ± 1 146	24.00
		Adjusted	1.8045	2.3453	0.2315 ± 0.0514	0.5429 ± 0.1339	5 062 ± 1 249	24.67
July	46	Actual	1.7293	2.6177	0.2120 ± 0.0423	0.5549 ± 0.1249	5 174 ± 1 165	22.51
		Adjusted	1.7358	2.5209	0.2128 ± 0.0423	0.5364 ± 0.1209	5 001 ± 1 127	22.54
August	40	Actual	1.5038	2.1903	0.2069 ± 0.0465	0.4532 ± 0.1122	4 226 ± 1 046	24.76
		Adjusted	1.5038	2.3862	0.2069 ± 0.0465	0.4938 ± 0.1196	4 603 ± 1 115	24.22
Overall	170	Actual	1.5977	2.3081	0.1933 ± 0.0188	0.4461 ± 0.0495	4 159 ± 462	11.11
		Adjusted	1.5977	2.6009	0.1933 ± 0.0188	0.5027 ± 0.0562	4 687 ± 524	11.19

[A] Results from actual count were warned because of size bias adjustment has increased expected cluster size.

[B] %CV = 100% x [(S.E. of Density)/Density] = 100% x [(S.E. of Abundance)/Abundance]

Table 3. Summary of the coefficients of variation (CV) of line and strip transect estimates of population abundance, and the per cent relative bias (PRB) of the strip transect estimates of abundance relative to the corresponding line transect estimates.

Replicates	Month	Detections	% CV(Strip)	% CV(Line)	PRB
Spatial	May	Actual	12.33	26.76	-55.37
(21 tracklines)		Adjusted	9.92	27.96	-37.85
	June	Actual	9.34	24.00	-59.62
		Adjusted	8.91	24.67	-34.68
	July	Actual	10.13	22.51	-57.24
		Adjusted	8.32	22.54	-36.05
	August	Actual	11.26	24.76	-60.09
		Adjusted	9.65	24.22	-41.93
Temporal	Overall	Actual	10.60	11.11	-53.50
(21 tracklines x 4 times)		Adjusted	9.05	11.19	-35.61

Table 4. Estimates of density and abundance of RJF produced by previous studies and this study.

Study/Area	Sampling method	Habitat	Individual density (birds/ha)	Flock density (flocks/ha)	Flock size (birds/flock)
Bump & Bohl (1961), India	Naïve estimate	Mixed evergreen forest	0.25 to 0.50	n.a.	n.a.
Collias & Collias (1967), India	Naïve estimate	Sal forest	1	n.a.	5
Collias & Collias (1996), San Diego Zoo, USA	Naïve estimate	Semi-feral population	13.4	n.a.	11
O'Brien et al. (2000), Sulawesi	Line transect (4 tracklines)	Lowland rainforest	0.015	n.a.	n.a.
Javed & Rahmani (2000), India	Line transect (6 tracklines)	Sal forest	n.a.	n.a.	2.40 ± 0.11 [A]
		Mixed forest			2.50 ± 0.10 [A]
		Riparian forest			1.80 ± 0.36 [A]
		Teak forest			2.50 ± 0.26 [A]
		Grassland			1.60 ± 0.11 [A]
		Forest-grassland			2.50 ± 0.17 [A]
Arshad (1999), Zakaria et al. (2003), Malaysia	Line transect (2 tracklines in each habitat except for fruit orchard)	Oil palm plantation [B]	0.842 ± 0.055	0.449 ± 0.026	1.88 ± 0.06
		Rubber plantation	0.061 ± 0.087	0.043 ± 0.062	1.40 ± 0.24
		Fruit orchard	0.157 ± 0.036	0.083 ± 0.015	1.89 ± 0.26
This study	Strip transect Line transect (21 tracklines)	Oil palm plantation [C]	0.324 0.500 ± 0.069 [D]	- 0.202 ± 0.025	- 2.471 ± 0.144

n.a. = information not available

[A] Mean flock size (± S.E.) from summer observation.

[B] Plantations of 4-year old growth.

[C] Overall estimates.
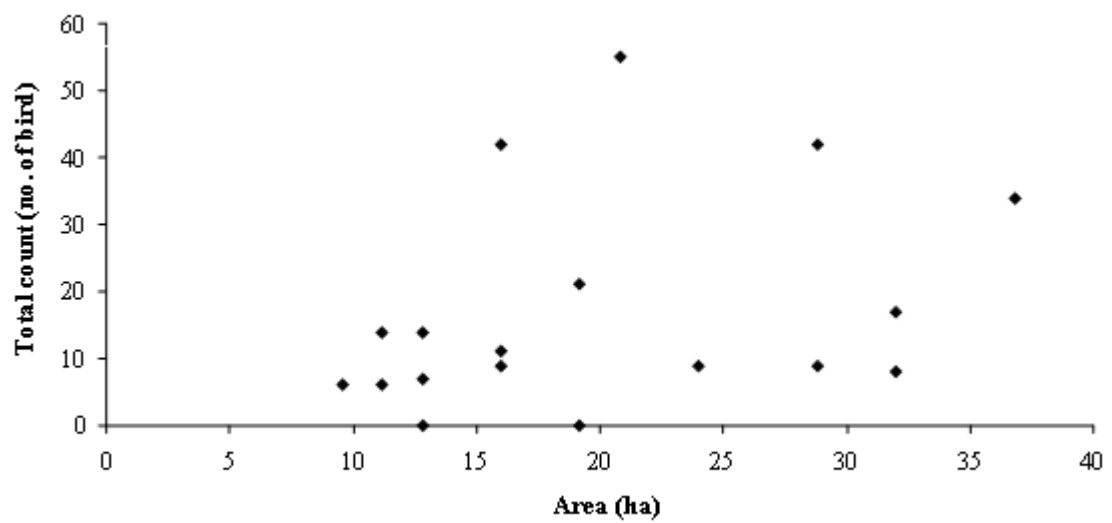
[D] 10% truncation.

Figure 1. Total actual count of RJF for four months detected on 21 fixed-width strip transects of various sizes. More birds were detected in strip areas between 16 and 36.8 ha than strip areas between 9.6 and 16 ha.

Study on the Five-color Harmony and Resonance

Theory of Livable Ecosystem Construction

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Abstract

Ecological industry, resource guarantee, environment ecological safety and ecological control are key parts which should be emphasized in the construction of livable eco-city. To more visual and lively express this idea, we endow every key part bright color and put forward the five-color harmony and resonance theory of livable ecosystem construction based on that.

Keywords: Eco-city, Livable ecosystem, Harmony and resonance theory

1. Introduction

In the 21'st century, human society is facing increasingly serious problems such as global population quick increase, resource deficiency, climate depravation and eco-environment crisis, and "environment and development" has further become into the time topic that all human beings notice. As the main type of living environment, city has been developed fully, and the urban population has occupied 50% of total world population, and the GNP created by the urban population has achieved 90%, and the consumed assistant energy by the urban population has also achieved 90%. When city brings human society civilization and advancement, it also brings a series of urban problems because of highly concentration of matter and energy, dense human activities, large environment change and brittle zoology. Therefore, the ecological construction and livable inhabitancy of city has become very urgent. In this article, we endow the key parts of the livable ecosystem construction bright colors and put forward the five-color harmony and resonance theory of livable ecosystem construction based on that.

2. Connotations of "five-color"

Ecological industry, resource guarantee, environment ecological safety and ecological control are key parts which should be emphasized in the construction of livable eco-city. To more visual and lively express this idea we endow every key part bright color, i.e. golden, yellow, blue, green and red.

2.1 Golden ecological industrial development

The development of ecological industry makes for the maturity of economical conditions for eco-city, in other words, to develop ecological industry is to strengthen the economic power of livable eco-city construction and tamp the base of livable eco-city construction. Because the gold is always the symbol of money and value, so we adopt golden color to represent the display of economic strength for livable eco-city.

2.2 Yellow resource macroscopical guarantee

The success of livable eco-city construction is decided by whether the natural resource that people depend on can be guaranteed continually. At present, when China economy is developing very quickly, because the mode of economic development is extensive, water, earth, biology, mine and many natural resources are largely wasted, and the natural resources in some places are close to dry up. The yellow color is the alarm color, and here it represents natural guarantee to awake people's alert to resource deficiency and excessive consumption and promote the sustainable utilization of resources.

2.3 Blue environment support

The environment system composed by water, atmosphere, voice and solid waste is one important subsystem that livable

eco-city involves ecosystem, which has important support function for the construction of livable eco-city. The water environment and the atmosphere environment are important contents of the environment system, and people always use the blue color to describe the qualities of atmosphere and water. The blue color can represent the environment support, which can better denote the good function of environment support in the construction of livable eco-city.

2.4 Green natural ecological safety

The dynamic balance of natural ecosystem is the important base of livable eco-city. Whether the structure of ecosystem is reasonable, and whether the function of ecosystem can be normally exert, are one of main indexes to measure whether the construction of livable eco-city is successful. The vegetation is one important composing in the natural ecosystem, and its most colors are green, so we use the green color to represent the natural ecological safety.

2.5 Red ecological control

The ecosystem has the function of self-adjustment, and when it is disturbed by the exterior of the system in certain range, it can implement some adjustments of part structures and functions to sustain the balance of whole system. When the interference from exterior is over large and exceeds the ability of self-adjustment, the system will lose balance and blow up finally. In the process of livable eco-city construction, the proper artificial control to regional society, economy and environment according to natural rule, economic rule and social rule can better sustain the whole balance of ecosystem. Because this control process has certain compulsion to some extent, so we choose the red color to represent the ecological control.

3. The theory of harmony and resonance

Five colors are the core and key of livable eco-city construction, and because five colors are not isolated, so various colors have direct or indirect associations, which are shown in Figure 1. Only exactly grasping the strengths of five colors and harmonizing the relationships among five colors, can exert the functions of five colors to the largest extents and make them form resultant force, i.e. realize the resonance of five colors and achieve the highest ambit of the livable eco-city construction.

3.1 Cultivating green natural ecological safety

The core content of natural ecological safety construction for livable eco-city is to establish regional ecological safety system frame, recover the continuality of regional ecological process, construct the sight situation of regional ecological safety and promote the sustainable development of social, economic and natural compound ecosystem for the whole city through the identification to the regional sight ecological unit, the maintenance and construction of structure and function, and the protection and construction to the structured ecological control region, ecological channel and ecological nodes. The concrete construction contents generally include following aspects.

(1) The construction of structured ecological control region. The structured ecological control region is the reservation of regional natural ecosystem and the harbor of species, and it has the functions of source and collection for regional ecological circulation. The recognition, identification, protection and construction of structured ecological control region are the base of regional ecosystem construction. According to the area principle, the shape principle, the position principle, the amount principle, the species localization principle and other construction principles, and the structured analysis results of sight space structure source, collection and strategic points for livable eco-city, the layout will combine the actual regional situation and make the structured ecological control region construction project which can accord with the characters of livable eco-city and can be implemented easily.

(2) The construction of ecological channel and nodes. To maintain the stability and healthy of regional ecosystem, we should strengthen ecological associations among various regions, regions and source and collection according to regional natural situation, and this sorts of associated function is accomplished by the ecological channel. According to the area principle, the shape principle, the position principle, the amount principle, the species localization principle and other construction principles, the layout will combine the analysis results of source, collection and strategic points according with the actual regional situation of livable eco-city and make the feasible project of natural ecological channel system construction.

3.2 Constructing yellow resource guarantee

The natural resources are the base to develop social economy, and their using modes and using efficiencies are directly or indirectly associated with the ecological environment. In the process of economic development, the traditional development mode with high investment, high consumption, low benefits and high pollution occupies considerable proportion for a long time, which certainly will induce large numbers of resource waste. To construct livable eco-city, we should systematically analyze the utilization actuality and problems of regional water resource, infield resource, mine resource and other main natural resources to enhance the protective consciousness for important natural resources, advocate the science, economization, high efficiency, circulation and continuance of resource development and utilization, and carefully construct the resource guarantee system. The concrete content generally includes the demand

balance guarantee of water resource, the demand balance guarantee of infield resource, and the reasonable development and protection of mine resource, biology diversity resource.

3.3 Tamping blue environment support

The construction system of livable eco-city is a harmonious, balanced system full of energy, which includes the environmental subsystem, the social subsystem and the economic subsystem. The qualities of atmosphere and water and the disposal of solid waste are basic support conditions to decide whether the urban social economy can quickly and continually develop. In the construction process of livable eco-city, we should strengthen the existing results of environment construction, solve existing environmental problems and eliminate environmental hidden troubles. The concrete construction content includes following aspects.

(1) Improving the environment of atmosphere.

Because of the reasons of history, before the livable eco-city is constructed, the regional function division, industrial distribution, industrial structure and energy structure had many aspects with unreason, and the contribution proportions of the numerous coal-burn equipments, the high letting density, the dust pollution and the automobile-exhaust pollution are continually ascending, the quality of atmosphere environment always doesn't allow optimism, and dust-drop, sulfur dioxide and inhalant grains and other pollution indexes always exceed the standard. To construct livable eco-city, based on analysis of abundant investigation and research, we should implement term-division and region-division control project to every contribution source aiming at main contribution sources of atmosphere pollution and combining the actual situations of regional development. For example, we should fully push the energy structure adjustment and implement clean energy plan, and we should establish centralized heat power supply source with large capacity and high efficiency, and we should expedite the step of desulphurization and dust-ridding and quicken the desulphurization and dust-ridding schedule for the electric plant, and we should fully implement the governance of automobile-exhaust pollution and enhance the automobile-exhaust standard and strict new car admittance system, and we should fully comprehensively govern the construction and ground dust, and the city roads should be washed periodically, and the construction should adopt the wet working mode, and the region and the soft cover and hard cover of the urban and village combined areas should be realized.

(2) Enhancing the quality of water environment.

The water environment quality is always the hotspot that people pay attention to. The construction of livable eco-city should analyze the distribution, pollution species and quality, exhaust direction, exhaust mode and exhaust intensity of industrial, agricultural and living pollution sources influencing regional water environment quality, establish corresponding measures aiming at the control of main pollutions, and put forward comprehensive governance measures with region-division and stage-division to various pollution sources which may induce the pollution of water environment (including surface water and groundwater). In the construction process of livable eco-city, the sewage centralized governance is the effective measure to enhance the quality of water environment. For example, we should expedite the construction of pipe network, and we should strengthen the governance power to living sewage, and the city should strengthen the living sewage pipe network construction and perforation and the villages and towns should expand the cover area of centralized disposal to living sewage, and we should continue to implement dredging project and improve the water flow, increase the capability of river water environment and improve the quality of regional water environment.

(3) Controlling the pollution of voice.

At present, because the situation that the catering industry is mixed with residential areas is at large, so the voice pollution of service industry exists. At the same time, the urban construction needs large numbers of construction, and the yawp of construction is still one pollution source in a long term. With the development of urban road and the increase of vehicle quality, the traffic yawp pollution is ascending, and we must adopt measures to strictly control it. The construction of livable eco-city should combine with the regional road layout and reconstruction, and control the traffic yawp pollution through strengthening traffic management and establishing forest sound insulation belt. We should seriously strengthen the environmental management to industry, commerce and recreation grounds, control the industrial and social yawps and protect residential area, school and hospital.

(4) Preventing the pollution of solid waste.

The construction of livable eco-city should enhance the using efficiency of energy sources through clean production, reduce the production of solid waste, establish the comprehensive using and development system of solid waste, enhance the comprehensive using rate of solid waste and make the comprehensive utilization of solid waste develop better, implement the using and safe disposal to past years' industrial storage solid wastes, further enhance the level of resource and harmless of solid waste, realize the order development of solid waste industrialization through whole process control management, avoid and reduce the environmental pollution and destroying to regional ecosystem because of the imperfect exhaust, utilization and disposal of solid waste, and establish the solid waste disposal system

which harmonizes with the regional economic and social development.

3.4 Developing golden ecological industry

The ecological industry is the stay point to implement the strategy of circular economy, and whether the ecological industry can be established and whether the structure is reasonable will largely influence the healthy development of social economy. The construction of livable eco-city should advocate developing circular economy, social development and ecological environment protection to achieve the harmonious ambit that develops in the protection and protects in the development, and fully develop the ecological industry. The concrete content should include following aspects.

(1) Developing ecological agriculture.

The development of ecological agriculture is to realize ecological agricultural production. In the construction process of livable eco-city, we should mainly consider the prevention of fertilizer pollution, pesticide pollution and farming film pollution and the breeding pollution of domestic animals and birds. To prevent the pollution of fertilizer, we should reasonably, properly use fertilizer, reasonably use microelement fertilizer and broadly extend the use of organic fertilizer and the application of ground-measured fertilization technology. To prevent the pesticide pollution, we should reasonably use existing pesticides, actively develop environmental protection pesticide such as biology pesticide, actively develop the comprehensive prevention to farming plant diseases and insect pests, and implement the safe use of pesticide. To prevent the farming film pollution, we should expedite the recycle of farming films and extend the application of dissolvable farming films. To prevent the breeding pollution of domestic animals and birds, we should actively push the scale breeding, reasonably divide breeding forbidden area, carry out the animals and birds dejection resource project and control the breeding pollution of domestic animals and birds. The prevent the pollution of pesticide, we should adjust measures to local conditions to develop green agriculture and organic agriculture which take the green foodstuff, organic foodstuff and other agricultural products with high additive values as the aim, and improve reducing pollution and increasing efficiency for the agriculture.

(2) Developing ecological industry.

The construction of livable eco-city should expedite the step of industrial ecological alteration, take the industrial structure adjustment and the enhancement of project environmental protection threshold as the headstream to govern industrial pollution according to the ideas of industry high-degree and resource intensification, take the development of circular economy as the important measure to improve new industrialization, change the mode of economic increase and enhance the quality of economic development. The construction of livable eco-city should actively adjust the industrial structure, make out, indirect and push the industrial structure of the whole city by the concept of circular economy, fully push the regional industrial structure strategic adjustment, optimize the industrial distribution, and enhance the development centralization degree and unit area investment degree according to the industrial centralization and distribution rationalization. The construction of livable eco-city should strictly implement the evaluation system of construction project environmental influence, take the enhancement of industrial layer as the guidance, enhance the admittance doorsill of pollution enterprises, take the industrial development tendency as the rule, strengthen the selection strength for the projects, implement selecting investments and strictly control the settlement of new pollution resources. The construction of livable eco-city should fully develop circular economy, try to utilize the resources highly effectively and realize the recycle of wastes. Taking the industries such as the electrical power plant, printing and dyeing, paper making and steel as the emphasizes, and fully developing the demonstration of circular economy experimental unit, and depending on the innovation of science and technology and policy guidance, the cycle production of enterprise should be pushed according to the principle of "decrement, recycle, resource". We should fully develop the construction of ecological industrial parks, reasonably match the products and industries in the park, extend the industrial chains, and try to realize the maximization of comprehensive benefits in the park and the minimum of waste exhaust environmental influence. We should drive the big social cycle, and gradually establish the economic systems such as resource economization type, environmental friendly type, and cycle and utilization type.

(3) Developing ecological tourism.

In the construction of livable eco-city, the ecological tourism should be developed fully to minimize the influence of the tourism industry to the ecological environment to the largest extent. The managements to tourism enterprises, tourism sights and tourism routes should be strengthened. For the tourism enterprises, the environmental management system construction to tourism sights and tourism enterprises should be strengthened. For the layer of sights, the construction of various ecological tourism sights should deeply develop and protect existing tourism sights, which can not only fully utilize the resources of ecological tourism, but maintain the sustainable utilization. For the layer of route design, the independent ecological tourism route construction and the combined ecological tourism route construction should be included. The attraction of tourism route can be increased and the repeat influence of unreasonable route to certain area can be reduced by the optimized combination of tourism resource and the reasonable journey arrangement.

3.5 Red ecological control system

Whether the ecosystem structure of livable eco-city is reasonable and whether its functions can be perfected and exerted normally is decided by the special natural ecological factor, i.e. human being. The construction of livable eco-city should base on a series of factors which have important influences to the ecological environment such as human living demands, survival demand, culture and management, and one truly feasible ecological adjustment system should be constructed on the systematical layer. The concrete contents should include the ecological information adjustment, the establishment of circular society, the construction of ecological residence, the construction of ecological culture, the policy of eco-city construction, the construction of management system and the construction of science and technology support system.

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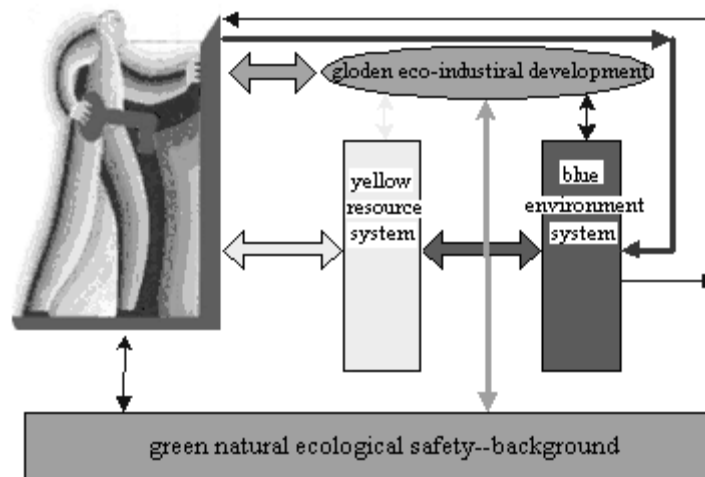

Figure 1. The Sketch Map of Five-color Harmony and Resonance

Facility Management Challenges and Opportunities

in the Malaysian Property Sector

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Abstract

Facilities Management (FM) is becoming an increasingly important factor in the built environment. In Malaysia, the field is still in its infancy. This paperwork aims to determine the extent of FM in Malaysia and reviews the changes in the property sector that may positively contribute to opportunities in FM and the challenges that need to be taken into account. In particular, this paper focuses on the changes that are taking place, both at the corporate and at government level. The paper considers issues arising in the local market based on personal observation and discussions with professionals in the property management sector in Malaysia. This review focuses on areas where FM is being actively implemented. This includes discussion on the types of property FM, the management method used and the extent of FM being adopted. The challenges and the opportunities in the local property and construction market are also discussed, specifically to understand the limits of growth for FM. FM is relatively new in Malaysia and much it's the wider concept of FM of building management is still in the process of improving its maintenance management structure. Generally, Integrated Building Management Systems which require an integrated IT advancement and strategic management approach is widely being seen as the improvement of FM in Malaysia. This in fact is the closest definition for FM that is being understood in Malaysia. It may be concluded that until the property management industry fully matures it is unlikely that facility management will be widely practiced for some time in the Malaysian property sector.

Keywords: Facilities management, Challenges, Opportunities, Property management, Extent

1. Introduction

Facilities management (FM) is now seen in some Asian countries, such as Japan, as an important area in business, and the techniques of FM are increasingly used. As the field of facility management assumes greater importance and as more individuals and organizations become involved, its attendant definitions and descriptions continue to increase. One of the more straightforward of these comes from the international Facility Management Association (IFMA), which defines facility management as "the practice of coordinating the people and the work of an organization into the physical workplace." A more detailed definition is offered by Engineering News-Record:" the discipline of planning, designing, constructing, and managing space-in every type of structure from office buildings to process plants. It involves developing corporate facilities policy, long-range forecasts, real estate, space inventories, projects (through design, construction, and renovation), building operation and maintenance plans, and furniture and equipment inventories."

The Library of Congress seeks to encompass the field's evolution and change by defining facility management as "the

practice of coordinating the physical workplace with the people and the work of the organization, integrating the principles of business administration, architecture and behavioral and engineering sciences." The International Facilities Management Association (IFMA) gives the following definition: "The practice of coordinating the people and the work of an organization into the physical workplace". A more explicit definition is: An integrated approach to operating, maintaining, improving and adapting the buildings and infrastructure of an organization in order to create an environment that supports the primary objectives of the organization.

The functions of facility management are wide and include the management of real estate, of finance, of change, and of human resources, in addition to services maintenance, domestic services, utilities supplies, security, safety and health and contract management - all of the non-core activities of the organization. Hammer J.M. (1998) has included the following functions; inventory management, programming, master and layout planning, project administration and implementation, purchasing co-ordination, maintenance planning, site management, overall systems coordination. It is a multi-disciplinary function that involves many professionals in the decision-making processes, but to date in Malaysia few are designated 'facility managers'.

2. What is facility management (FM)?

FM carries out many definitions but these can be summarized as "the integral managing and execution of housing, services and other means, which contribute to a better performance of the primary process (in relation to effectiveness flexibility efficiency and creativity) in changing surrounding (primary process, market, social and technological) (2). This definition has some practical implications such as an integral management (with an equal accent on both words), a contribution to the core business, a limitation to building occupants, services and other means (equipment) for the workplace and its surroundings, and an ability to cope with changes

Although FM is limited to building occupants, services and other means, the field of activities is very large. In relation to the requirements of the occupancy and the kind of occupants to whom means and services must be delivered, a detailed, tailor made package must be created up. Alternatively, diversity can be constrained by overlapping the packages: certain services are needed everywhere, the way of organizing the services requests a similar approach in attitude to client and to business. The facility management therefore will alternatively operate on three levels – strategic, tactical and operational – and the activities can vary between advising and policy making on one side and managing and executing operations on the other.

3. FM practice in Asia

When it comes to FM practice, there is a stark contrast between the Western countries and the Asian Countries. Basically, the field of FM is much more developed and widely being put into practice by property developers / companies in the West. The development of FM is only in Asian countries such as Hong Kong, Malaysia and Singapore and has been developed along three lines, namely practice, research and education. FM has not been readily adopted or encouraged by the Malaysian Government in any organized way.

In Hong Kong, FM has been practiced since 1994 by the local International Facilities Management Association (IFMA) and up to present date, the organization has gone from strength to strength, gaining more members and carrying out successful annual conferences. The whole area of FM is quite well developed with the growth in the professional FM sector being matched and complemented by research and education. The growth of FM has been encouraged by the fact that traditionally Hong Kong has been a place where East meets West and this results to more open ideas along with its multi-cultural dimension. A number of Japanese companies have established FM as part of their organizations; amongst which are the Nippon Telegraph and Telephone Corporation. This company in fact is the first to promote integrated facilities management system through the use of automated mechanization. The Taiwan chapter of IFMA is much smaller than either Hong Kong or Japan but again the overall trend is for an increasing membership. These indicate, together with the well-attended Asian FM conferences, that interest in FM is growing.

FM is described as a very new term in Korea. There the Ministry of Industry and Trade survey found that only 2.7 percent of those surveyed were familiar with the concepts of FM. Although this figure is low, a number of the multi-national companies such as Samsung, Hewlett Packard and IBM Korea had used international FM consultants. The introduction of FM has started in Korea but appears to be developing at a slower pace than some of its competitors in the region. Parallel to the establishment of appropriate Facilities Management guidelines, benchmarking to assess the required quality level is essential. Benchmarking serves both the purposes of helping companies to have an external focus and in finding the industry the best practices by constantly comparing their own performance against that of others.   It was found that more than 70 percent of *Fortune 500* companies' use benchmarking on a regular basis and benchmarking was quoted as one of the top five most popular business processes. A comprehensive and detailed list of metrics to measure the importance of elements to achieve improved performance had been carried out by precedent researchers in 2000.   The study was done on organizations located in 5 countries namely, Australia, Singapore, Hong Kong, Malaysia and Japan. Results of the analysis hinted that the categories of "ground and environment", "size and use

of facilities" and "energy consumption" were higher than any other categories as listed, indicating that opinions about the "maintenance" was considered as lower importance but energy consumption is lowest in importance compared to other categories. Table 1 as follows listed the results in tabulated form.

<Table 1>

4. Facility management practices in Malaysia

At present, there is no specific leading body for FM in Malaysia. However, the practice of FM in the property area has been widely adopted in recent years. The non-existence of a specific organization to provide guidelines and control on the quality level as well as to assess the performance of FM practice is the reason why evaluations on this field is difficult to analyze. Comparisons thus cannot be made as no specific structure can be used to benchmark the performance of FM practice. As mentioned above, the practice of FM in the Malaysian property sector is being widely adopted by hospitals. Automated computerized system as an integrated approach is the closest to define the adoption of FM. Listed in Table 2 is the type of buildings adopting and practicing FM. Examples of properties using integrated facilities management system are given in the following table.

<Table 2>

FM in Malaysia is perceived only when building is automatically controlled by computerized software. It should be noted that the uses of dedicated facilities management information technology is only to stimulate advancements in FM. The concept of this is to put forward that a synergistic interaction occurs between the process of FM and the specialist information technology (IT) used for FM. However, the cooperation of this mechanism and of this interaction between specialist FM Information Technology and the process appears to be dependent in the relative capabilities of the process and the IT. Definition of facilities management is poorly understood and thus, it is not being practiced in an appropriate way. Based on research done, the computerized systems used are not only to assist in data monitoring, maintenance tracking as well as space management but at the same time the main concern of use is more on how to ensure monitoring energy of consumption. The scope provided by the computerized systems provides integrated functions that allow the management to manage and to control the following areas only, namely property management, building operation and services management (Facility Planning), maintenance and security. Further research done on several building organizations confirms that a prototype strategic role covering the following aspects is initially adopted to implement the uses of the integrated FM, including formulating and communicating facility policy, planning and designing for continuous improvement of service quality, identifying business needs and user/customer requirements, negotiating service level agreements, establishing effective purchasing and contract strategies, creating service partnership and creating systematic service appraisal in terms of quality, value and risks.

In broad use, facilities management comprises bits and pieces of the above areas, either whole practices or covering only part of the area, i.e. maintenance scope, which are put together in hard copy format. Record or data tracking is poorly or hardly compiled, thus resulting in a poor record of data management, contributing to negative future planning of maintenance works and services management. The practice of facility management in Malaysia at present is undertaken by Real Estate firms. This is due to the fact that buildings such as high rise office towers are managed by property consultants. Property management companies typically provide property and building management services as well as simple operations and maintenance. Their work has traditionally been blue-collar intensive with limited training for operatives. In addition, most companies manage a limited range and number of properties related to their core employer. Hence, with the drive towards a more complex and sophisticated built assets and alignment within the property management sector has come about. A probe into the construction industry shows that no specific FM consultant firms have been established in Malaysia yet but it is envisaged that within these next few years, a positive call will emerge from the changes in the industry.

Recently there have been a number of important ground-breaking FM studies dealing with various topics conducted in Malaysia. This development shows some improvement in defining the importance of adopting FM in Malaysia. A number of research projects are also being carried out by academic institutions with close collaboration of academic and FM practitioners in other countries, thus demonstrating a certain degree of synergy.

The increasing awareness on the importance of a proper maintenance management system becomes the main contributing factor on the development of FM in Malaysia. Subsequent to this, the business management of various organizations has started to promote the need of facilities management as part of the business organization. However, up to the present date, no specific profession has been established in Malaysia. The responsibility of Facilities Manager is often being undertaken by various professionals, especially the Mechanical and Electrical engineers and the Civil engineers. As noted, these professions are not specifically designed to cover the required skills and knowledge of what is expected from the facility managers. In Malaysia, the course of Masters in Facility Management is offered only in University of Teknologi Malaysia(UTM) and in Universiti Teknologi MARA, Shah Alam (UiTM). These courses took students from various backgrounds, particularly those from the construction line as the pioneers for this field. Specific

subjects on Maintenance Management and FM are also designed for students in Building Surveying program in UiTM and University Malaya (UM)

5. Development of FM in Malaysia

5.1 Problems of FM Implementation

In broad term, the main problem of FM adopted and implemented in Malaysia concerns the organizational response to the needs of FM in the property industry. It should be noted that the beneficiaries of any facility provided in a property require direct response and participation of the community that the facility is provided for. Response comes in the manner where the community is allowed to have a say in the decisions concerning the facility, and where possible to take part in its development and manage it on completion. This can be achieved through community participation, which according to Cernea (1985) is defined as "an active process by which beneficiary client groups influence the direction and execution of a development project with a view to enhancing their well-being in terms of income, personal growth, self-reliance or other values they cherish". Joint or collaborative involvement of the government appears through the imposition of guidelines and research works as well as assistance in complying to the requirements.

In short, the problems of FM implementation in Malaysia, based on the observation are summarized as follows, namely (a) Lack of participation from the whole organization due to lack of understanding on the importance of providing a comprehensive FM in order to achieve the objectives of this concept, (b) Lack of technical knowledge and expertise on handling the problems often occur, thus the need to design a flexible FM planning, the need to manipulate the advantages and benefits of using FM and the need to provide immediate responses for arising problems, (c) The lack of proper FM guidelines and requirements in Malaysia that can be used to measure the quality and performance of FM practices by company as well as to standardize the practice and implementation., and (d) Non-existence of specific FM association to monitor the progress of FM being practiced by property management or consultants in Malaysia.

The failures found in the adoption and implementation of FM in Malaysia can be categorized into four factors as described in Table 3.

<Table 3>

5.2 Changes

Malaysia's economic growth is driven by four factors, including (a) A high savings rate, which supports vigorous rates of investment and capital accumulation, (b) Structural change, which has been both the cause and effect for growth, e.g. the shift in economic and industrial sectors, (c) Pragmatic and incremental reforms resulting in a move from a planned economy to achieve Vision 2020, (d) Economic conditions, e.g. the "advantages of backwardness" whereby growth is related, and   (e) to the changes in the global economy.

Looking at a minor context, the changes that may boost the implementation of the FM can be summarized as follows: (a) The changes in the social perception in which a well-maintained building is much more sought after by potential tenants or buyers. This has resulted in a need to plan and to design suitable management approach that may suit the needs of the buyers/tenants, (b) The changes in the services offered for new development where integrated system (computerized system) is much preferred by potential tenants/buyers. As mentioned earlier, automated building services required computerized automation and this supports the development of FM in building management, and (c)There has been constant improvement in the technology sector. The progressive changes in technology has seen more and more new technologies being made available in Malaysia and the implementation or adoption of these new technologies often require advancement in management system and IT system. It is noted that most of the modern technologies are of integrated system, requiring IT technology in order to operate them.

5.3 Opportunities

The subject of FM is still new in Malaysia and this provides greater opportunities as these have not been established and therefore many areas of FM are more flexible for different techniques and approach practices than in other countries. The opportunities for FM development in Malaysia arise from the following issues, namely (a) the slow economic pace in Malaysia has resulted in slow construction development. Acknowledging the need to increase the construction sector, the government has encouraged consultants and contractors to get involved in more specialized areas, especially in maintenance works and management of services, facades as well as conservation works in order to ensure that this sector becomes much more competitive in the global world, and (b) the maintenance and services rates are becoming high in Malaysia and FM is seen as a substitute for strategic and proper management that can control and manage overall building costs. In addition to this, FM also provides strategic planning that records all relevant data specific to FM area, (c) for many leading participants in the outsourcing industry today, the well understood tools of performance based or incentive contracting and improved techniques for operational management are now taken for granted as the starting point for services delivered. The top players on both the in-house and industry supply side are now increasingly responding to core business needs. They are doing this by addressing a more strategic challenge using the concepts

within the construction industry to construct service agreements that free core business capital tied up in facilities at the same time reducing costs and increasing quality, (d) In several city centres, such as Kuala Lumpur and Johor Bahru, the city areas are considered dense and compact, disallowing any future construction development to take place. Thus the buildings located within the city centres are forced to be maintained as the cost of demolition is very high. In addition to this, the cost of services and maintenance is also high and therefore FM is seen as an approach to minimize high maintenance cost that may occur due to poor maintenance in the past., (e) Another arising issue is the inability of property or building management to collect the rental rate for space rented, services and bills from the tenants, contributing to insufficient funds to pay for necessary bills. FM is practiced as this can ensure that rental can be collected as a stipulated date, as the failure to provide the rental fee may result in disconnection of services, such as Mechanical and Electrical provided to the tenants.

6. Challenges

The real challenges for FM to be thoroughly implemented in buildings lies in the following areas:

(a) The non-existence of standards that can be used to measure the quality level and performance of both traditional and integrated FM applied by the building/property management. The current situation in Malaysia confirms that practices vary from one organization to another, depending on the services provided or applied for the buildings. The slow pace of regulating appropriate FM standard or regulation is another factor that requires immediate response and action.

(b) Lack of local expertise to provide immediate response to failure of service as well as lack of FM practitioners in the local market that can provide advice or assistance in the implementation of FM. Property skills are vital, but the local industry remains conservative and protective. A change in the mindset is needed and therefore more proactive campaigns are needed to change the perception of the professionals involved in the construction and property markets.

(c) The implementation of FM is considered late for some properties as at present, there are many aging buildings with high deterioration level. FM may help in standardizing future maintenance allocation required but this, however, may not contribute to minimization of maintenance cost if the building services are in poor condition due to improper maintenance carried out in the past.

(d) Malaysia is still lagging behind in the aspect of software development specific to FM and adoption of integrated FM may require high initial cost, unless the computerized programmes can be found locally in the market. Most building management claim that their profits are not as much as expected and in order to adopt this integrated system, funding support is required.

The adoption of an integrated FM requires space allocation in order to store the automation mechanism to operate the integrated services system. This may not be a problem for new developments but as earlier mentioned there are lots of aging buildings and densely populated buildings. Allocation of the monitoring units may need some adjustments and reshuffling of the existing services, furthermore costly renovation works might have to take place.

7. Conclusion and Recommendations

The formal practice of facility management as a recognized discipline is a new phenomenon and as such is vulnerable. This area is hardly recognized in Malaysia even among the building administrative professions. However, FM as a discipline merged out of practice due to the need to focus on the elaborate and expensive facilities which crucially support the activities of most of today's organizations. It is a distinctive part of the overall management function and borrowing from the concept of business process analysis as is the process that provides the working environment in which an organization functions.

Offices and hospitals appear to have dominated the attention of the facility management profession in Malaysia. Other facilities are seldom seriously considered. Traditional management methods are dominantly applied compared to integrated FM system although the new approach proves positive strategic operations. Again, the common factor in all of this lies in the integration by the facility manager of all of the support roles which provides a working environment for an organization. The lack of local expertise as well as the disaggregated deployment of specialists cannot meet the challenges in Malaysia at present time. More efforts are required to open the eyes of the industry as well as the public and professional bodies. To be more flexible or less protective, this requires participation from all sectors and positive responses from the government

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Table 1.Analysis of results

	Name of metric	Average Importance Rating	Mean Standard Deviation
1	Cleaning	3.78	1.06
2	Refurbishment	3.78	1.09
3	Parking	3.76	1.06
4	Ground and environment	3.66	1.14
5	Size and use of facilities	3.64	1.28
6	Safety and security	3.59	0.99
7	Maintenance	3.54	0.89
8	Energy consumption	3.49	1.23

Table 2. List of properties adopting integrated FM (computerized system).

	Category	Property	Facilities System Used	Examples
1	Service / Amenities	Hospital	THIS (Total Hospital Integrated System	Selayang Hospital, Putrajaya Hospital
		Warehouse	CAFM (Computerized Aided Facilities Management	KLIA Cargo, MIMOS
		Hotels	BUS (Building Automation System)	Pan Pacific KLIA, Le Meridian
2	Business	High-Rise Office Tower	BUS (Building Automation System)	Petronas Twin Tower , Central Plaza, Telekom Tower
3.	Commercial	Shopping Complex	BUS (Building Automation System)	KLCC, KL Sentral
4.	Residential	Condominium	Smart Home System	KL Sentral, Cyberjaya

Table 3. Facilities management failures on managing building features

	Failing Factors	**Description**
1.	Tactical Failings	Inadequate performance standards
		Low maintenance of cleaning standards
2.	Strategic Environmental Failings	Lack of building performance monitoring data
		Failure to anticipate the consequences of change
		Failure to understand the non-linear nature of building complexity
		Slow response of systems used
3.	Tactical Cultural Failings	Responding slowly to complaints
		Ignorance job stress
		Failure to provide appropriate advise on design and planning based on overall performance
4.	Strategic Cultural Failings	Facilities management issues not prioritized
		Over reliance on automated systems used
		Flagging improvement due to lack in technical knowledge and background

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Study on the Shortage and Reconstruction of Chinese

Ecological Tax System

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Abstract

Guiding by the view of science-based development, the ecological tax system which also possesses the benefits of encouragement and financing capital should be gradually established, so the material benefits can stimulate and drive that the social pollution costs are translated into production costs and market price, and the policy and law objectives to control ecological pollution and improve ecological quality can be realized. According to the requirements of sustainable development, China present tax system should be adjusted, and the relatively perfect ecological tax system should be gradually established. In this article, we put forward main countermeasures including the taxation to ecological pollution tax, the reform to resource tax system, and the adjustments to corresponding articles of other tax types about environmental protection.

Keywords: Ecological tax, Ecological pollution tax, Ecological resource tax

1. The basic frame and functions of the ecological tax system

The ecological tax means many tax types and special taxation system composed by a series of taxation measures that are imposed by the country for realizing special ecological objective, raising environmental capital and strengthening taxpayers' environmental activities, and it includes special tax types and relative regulations aiming at pollution ecology, the behaviors or products destroying the ecological balance, various tax adjustment measures to protect the ecology and relative contents about environmental protection contained in other tax types.

The special ecological protection tax includes the ecological pollution tax imposed to contaminations or pollution behaviors and the ecological resource tax imposed to rare resources or the behaviors utilizing or destroying natural resources (Xu, 2001, p.22). The existing ecological tax types imposed by various countries include (1) the pollution tax, i.e. the direct tax which is directly associated with actual pollution values (or evaluation values) and computed by the pollution amount, (2) the product tax or material tax, i.e. the indirect tax to commodity or service which mainly aims at the products which produce pollutions in the production process or in the consumption and disposal process, (3) the special tax to finance capital for the environmental protection. The relative ecological tax measures include (1) the tax payout, i.e. derating the behaviors or establishments that are propitious to the environmental protection, for example, implementing derating or drawback to the investments of energy-saving or low pollution equipments for encouraging environmental investments, and implementing tax derating to some technology transfer fees for encouraging environmental technology research, and implementing tax-free to the recycle of old and waste goods for encouraging the recycle of the equipments, (2) tax difference, i.e. implementing low tax rate for the beneficial ecological products and imposing high tax rate for the products harming the ecology, (3) other relative environmental protection regulations contained in other tax types.

The ecological tax can make a price for the ecological resources and number the price into the cost that enterprise or personnel utilized the ecological resource, realize interior translation of the exterior cost, change the market price signals to rectify the consumption and production behaviors which harm the ecology. The income of ecological tax can establish the special sustainable develop fund that the government fathers and guarantee the ecological resources except for paying relative costs about management, supervision and compulsive implementation.

The ecological tax is the important encouragement tool exerted in the ecological management by the country, which objective is to exert the double functions of taxation, i.e. the encouragement and capital financing through the

establishment of ecological economic benefit stimulation mechanism, translate the social costs of ecological pollution and destruction into the production costs and market prices, and finally realize controlling ecological pollution and improving ecological quality in policies and laws through the resource distribution of the market.

2. The actuality and shortage of China ecological tax system

2.1 The pollution charge system

The adjustment to pollution behavior, the compensation to ecological infraction and the financing to prevention capital in the present stage in China are mainly realized by the pollution charge system, and the special tax type aiming at the pollution behaviors or products is lacked, and the system in the Regulation of Effluent Fees Collection, Usage and Management which has the character of quasi-tax has many shortages.

(1) The charge standard is relatively low. The present charge standard of China was instituted by the environmental protection department with the price department in 1988, which is far lower than the treatment cost of pollution, and the enterprise exceeding pollution fee only corresponds with 10%-15% of the treatments cost of pollution, and it is owed charge in fact and it only induces the situation of "who causes the pollution, who benefits".

(2) The taxation range is too narrow. The pollution charge is only paid by enterprises, and many non-enterprises are foreclosed from the main bodies of pollution, and the charge doesn't bring effluvium matter, part industrial solid wastes, living garbage and electromagnetic wave radicalization into the range of taxation.

(3) The taxation evidences are not reasonable. The present pollution exceeding charge system of China doesn't impose enterprises which are on or under the pollution standard, which can not ensure and improve the ecological quality. The exceeding charge according to the pollution concentration without considering the pollution amount would prick up the pollutions to resource and ecology to large extents. The charge according to single factor goes against cutting pollution material as a whole and makes managers in the unequal competitive state.

(4) Problems exist in the taxation management. The pollution taxation lacks legal proofs and quantitative standard, and its rigidity and authority are deficient, and the resistance of taxation is large. The professional environmental departments are lacked, so the taxation efficiency is low, the costs are too high and the capital management is confused.

(5) The whole validity of capital usage is bad. The local environmental protection bureau imposes the pollution charge and hand it in to the finance of same class in the stated time, and the charge is directly translated into the special management fund which belongs to the capital out of budget and possesses characters such as independence, specially using and separation, and only is used in end pollution treatment, induces the capital separation and "hard" budget restriction to enterprises. When the region of taxation objective differs with the region of ecological influence, it also may induce some "vacuum" zones of ecological management, and in the actual operation, the proportion that is used in the self-construction and usual expenditure for the environmental protection department are too large.

(6) The legal "hard injury" of exceeding pollution charge exists. The pollution standard belongs to compulsive standard, and the doer must be punished through money even criminal responsibility, but now the present exceeding pollution behaviors only form the pollution charge condition but not the illegal behavior, so the legislation conflict would induce interior disharmony of law system and the charge should be further clarified and modified.

2.2 Golden ecological industrial development

Following abuses exist in the present resource taxation.

(1) The character orientation is unreasonable. The present resource tax of China is only the adjustment measure to adjust the income level difference among resource exploitation enterprises, and it can not embody the interior value of resource, can not realize the interior translation of social exploitation cost, and can not help enterprises change their economic increase mode, and can not become into the interior power to reduce the resource consumption and improve the production equipments and technics flow.

(2) The taxation range is too narrow. The taxation objectives are limited in mine resource, which can not effectively protect ground resource, water resource, animal and plant resource and other natural resources, induces unreasonable parity of successive products after resources and stimulates the ravening exploitation to non-tax resources.

(3) The tax computation evidences are not reasonable. In China, the sales amount of products exploited and produced by taxpayers is the taxation evidence, which makes enterprises pay no resource taxes based on exploitation and sale, directly encourage unordered exploitation and induces overstock and waste of large of resource.

(4) The unit tax amount is low. The unit tax amount of China resource tax is lower, which limits the adjustment space and weakens the functions of resource protection and using adjustment (Wu, 2008, p.44).

2.3 Other assistant tax types with ecological protection function and taxation measures

In the present tax system frame of China, the tax types involving ecological protection include consumption tax, urban maintenance and construction tax, business income tax, housing property tax, tenure tax, vehicle and vessel usage

license plate tax and so on, and the content is disperse and the regulation is not complete, which can not really affect consumption behavior or production behavior. The taxation measures mainly are the taxation favors with single content limited in direct favor or favor after the event, which can not effectively restrain the ecological pollution and reduce the energy consumption (Cao, 2006, p.93).

3. The reconstruction of China ecological tax system

3.1 The legislation system of ecological tax

The theory and practice research of ecological tax are mainly centralized in western developed countries (especially in countries of OECD) which constituted special tax laws about ecological and resource protection early or late, imposed special tax type aiming at various behaviors or products destroying ecology and developing and utilizing natural resources, clearly regulated numerous concrete tax types by the form of law, adjusted contorted direct taxes and indirect taxes that had negative effects in traditional taxes, cancelled taxation articles which didn't according with the requirement of environmental protection and sustainable development, and realized the ecology and green of tax system (The Research Group of "Environmental Tax System" of China Taxation Academy, 2000, p.42).

China only added assistant tax adjustment measures in general tax legislations such as income tax, value added tax, consumption tax and product tax, and the perfect ecological tax system has not been established. The science-based development view should be uncompromisingly carried out, and the beneficial experiences of western countries should be used for reference, and China present tax system should be adjusted according to the requirement of sustainable development and concrete national situation, and the important objective of China tax construction is to gradually establish relative perfect ecological tax system.

3.2 Establishing the ecological pollution tax system

(1) The design of tax type. According to present ecological problems and environmental protection policy, the ecological pollution tax should be imposed designedly and starting from main pollution sources and easy tax objective, and gradually transforming from pollution charge to the ecological pollution tax. In present stage, the water pollution tax, atmosphere pollution tax (carbon tax and sulfur dioxide tax), solid waste tax and other tax types should be imposed.

(2) The design of taxpayer. All ratepaying main bodies including pollution enterprises and individuals should be limitedly deleted according to taxation efficiency, control and other factors in practice. According to the minimum principal of easy taxation and taxation fee, China taxpayer of the ecological pollution tax should give priority to beneficial pollution main bodies, adopt tax transfer modes such as commodity hidden tax to realize the intention of tax, and implement deferment or conditional taxation to individual denizens.

(3) The design of tax computation evidence. There are three selections of the ecological pollution tax for the evidence computation. The first one is the contamination amount, which can directly push pollution reduced course, but the corresponding supervision cost and technical requirement are very high. The water pollution tax and the sulfur dioxide tax adopt this type of tax base. The second one is the output of pollution enterprises, which convenient for the taxation from the headspring, and enterprises only can reduce the tax through the decrease of product or service output, and the stimulation that producers develop technology development and research for pollution treatment can not be realized. The carbon tax and solid waste tax generally adopt this type of tax base. The third one is harmful matter amount in the production factors or the consumption products, which can encourage taxpayers actively search relative replacements for raw materials, but can not impel enterprises apply themselves to reduce pollutions.

(4) The design of tax rate. It includes four aspects. The first one is the form of tax rate. Based on the character of waste let and the simplified principle of tax system, the tax rate structure of the ecological pollution tax should not be complex, and the ration tax rate should be adopted. The second one is the amount of tax rate. The tax should be limited in the compensation of exterior cost and exceed the control cost that enterprises pay for cutting pollution. In practice, the treatment objective is confirmed first, and then the treatment cost is confirmed, i.e. under the established ecological quality standard, the tax rate is confirmed combining with pollution treatment marginal charge. The third one is the uniformity of tax rate. Because the situations of climate condition, economic development level, population density and the demands of ecological cleanness degree are different, difference tax rates should be implemented according to the marginal influencing degree of pollution amount. The fourth one is the fixity of tax rate. The marginal cost of ecological control is changing with the improvement of control technology, so the relative tax rate should be properly adjusted to make the pollution control costs minimized in every special term.

(5) The design of taxation and management mode. The taxation and management should be implemented by the tax department and the environmental protection department together, and the former supervises the pollution sources periodically and offers various tax computation data, and the later imposes tax taxes according to confirmed pollution amount and supervises and manages taxpayers, which can fully exert the specialties of both departments and enhance the taxation and management efficiency.

3.3 Perfecting the ecological resource tax system

(1) Establishing the resource tax system with ownership. As the representative of resource owner, the government has right to share resource benefits with resource development enterprises together, and in the setup of tax system, the intention that imposes resource tax for keeping within limits of unlimited exploitation for natural resources should be fully expressed, and the prices of the resource ownership (irreproducible resource exploitation right) and the usage right (reproducible resource periodical exploitation right) that the government transfers should be reasonably confirmed.

(2) Expanding the taxation range of resource tax. The taxation range confirmed by the resource class table should include all irreproducible resources and the resources which repertories are on the critical level and which reproducible abilities have be obviously harmed, and if present taxation and management level can not impose all resources, at least, many reproducible resources such as water resource, forest resource, grass resource and infield resource with high quality which are all destroyed and wasted seriously should be included.

(3) Adjusting the tax computation evidence of the resource tax. The resource exploitation enterprises or personnel should pay for all exploited resources, but not only for the gained resources at present and the taxation mode according to the production amount can make resource exploiters start from their own benefits, fully consider the market demand, reasonably confirm the exploitation quantity of resources, and stop the waste of resources.

(4) Reasonably confirming the unit tax amount of the resource tax. When the unit tax amount of the resource tax is confirmed, following principles should be followed. The first one is to embody the transfer prices of low-grade resource ownership and access. The second one is to adjust the difference incomes among different resource exploitation grades. The third one is to include exterior costs of resource exploitation. The fourth one is to correctly reflect the interior value of resource. The fifth one is to consider the re-cultivation fund demand amount and establish marginal compensation fund. Through reasonably confirming the tax amount and changing the situation that resource-based industry overly depend on low cost resource, the resource economization and recycle usage can be improved (Xu, 2001, p.35).

3.4 The adjustments to other tax articles with the effect of ecological tax

To improve the green course of tax system in China, corresponding articles in other tax types should be adjusted for the environmental protection.

(1) Reforming the system of consumption tax. The taxation range of the consumption tax should be expanded. The products such as battery and once catering containers that can not be recycled and utilized or can induce serious ecological pollutions and can be replaced by corresponding "green products" should be brought into the tax range, and the different tax rates should be designed according the ecologically friendly degrees of different products and the usage of clean product should be encouraged.

(2) Perfecting the favored measure of tax. Except for keeping former tax favors such as tax reduction, tax-free and zero tax rate, various tax favored measures should be adopted aiming at concrete situations, for example, imposing high customs to the imported products that seriously pollute the ecology or may seriously pollute the ecology but are difficult disposed or have high disposal costs, derating customs to the imported products such as pollution disposal equipments, ecological supervision and research apparatus and ecological harmless technologies that can not be produced in China, adopting high custom rate to exported raw materials, primary products and manufactured goods consuming a great lot of resource, adopting lower custom rate to the imported ecological protective establishments and materials, implementing tax encouragement to the high and new environmental technologies, and implementing investment supports an reinvestment drawback to the enterprises investing in ecological treatment and protection projects for encouraging pollution treatment and improving the sustainable development of national economy.

3.5 Some problems should be noticed in the reconstruction of the ecological tax system

(1) Policy harmony. If the government can not consider possible ecological influences produced when it constitutes or implements macro policies, project policies and department policies, it will always contort the encourage mechanism, prick up the ecological depravation, so the government should notice assorting and harmonizing with other relative policies to avoid mutual collisions or deviations when it strengthens the construction of tax system.

(2) Law link. Relative laws should be modified to avoid the ecological tax conflicts with present ecological basic laws, regulations and other department laws, and the whole law system should be organically uniformed and surrounded the science-based development view.

(3) International collaboration. The ecological cycle is not restrained by the national boundaries and ideologies, and all economic and social developments in various countries will produce global ecological effects. The legislation activity of domestic ecological tax law should actively participate in bilateral or multilateral ecological tax harmony and cooperation and assume corresponding international obligations based on respecting national dominion and admitting regional differences.

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Effect of Oil Heat Treatment on Chemical Constituents of Semantan Bamboo (*Gigantochloa scortechinii* Gamble)

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Abstract

Effect of oil heat treatment on chemical constituents of 3 years old *Gigantochloa scortechinii* Gamble bamboo was investigated. The bamboo splits within epidermis were heat-treated using crude palm oil at temperature 140°C, 180°C and 220°C for duration 30 and 60 min. After removed the epidermis, the samples were then grind to pass a BS 40-mesh sieve and retained on a BS 60-mesh sieve. The sawdust was air dried for several days before conducted to chemical analyses (cellulose, hemicellulose and lignin) based on TAPPI Standard Methods. The colorimetric method devised by Humprey and Kelly (1960) was adapted to analysis starch in bamboo. Reading was obtained through Baush Lomb UV Spectrophotometer at 650 μm calculated by standard reference using A.R. potato starch. Control was used as comparison for each type of test conducted. There was no significant different between control and condition at 140°C for 60 min (81.4%) of holocellulose content. The value was decreased by 2.1 to 10.7% (79.7 to 72.7%) after heating at 180 to 220°C for 30 to 60 min. The hemicellulose content of bamboo was ranged 24.1 to 27.8% after heating at 140-220°C for 30 to 60 min. The cellulose content of heat-treated bamboo was ranged 47.4 to 55.2% after reduced about 2 to 14%. Lignin content increased about 16% (26%) at 220°C/60 min after reduced approximately 1 to 5% at 140 to 180°C for 30 to 60 min. Starch content was largely reduced about 2 to 54% (4 to 1.9%) at 140 to 180°C for 30 to 60 min of treatment. The results indicated that degradation of cellulose and hemicellulose of heat-treated bamboo was attributed to plasticization of lignin during heating in the same time hydrolysed the starch content.

Keywords: Bamboo, Oil heat treatment, Chemical constituents

1. Introduction

Bamboo is regarded as eco-friendly, which grows and matures quickly has potential to be used as an alternative material for wood. The world is loosing its resource of wood due to higher demand and to recover the resources will take 15 to 20 years. Many researches agreed that the suitable age of the bamboo used is 3 to 4 years old (Thammicha, 1989; Abd. Latif *et al*., 1990; Jamaluddin, 1999).

However, bamboo is easily susceptible to fungi or insect attack during utilization. The properties will deteriorate rapidly if the material is not treated with preservatives (Liese, 1985). Low durability is a major reason for the poor acceptance of bamboo as a building material. They are often considered as a short-term material suitable only for temporary uses (Liese and Kumar, 2003). The used of preservative in bamboo has been recognized as necessary and important for utilization in furniture and construction purposes.

Recent work on the heat treatment process of timber to prepare what is currently called torrefied wood in France, plato wood in the Netherlands and retified wood in the USA has shown that such types of processes can improve the performance of timber in several aspects (Ruyter, 1989). Foremost advantages of the wood treated improve its resistance to fungal decay (Ruyter, 1989 and van Zuylen, 1995) without the need to use any chemical solutions with consequent environmental advantages, water repellency and improve dimensional stability to moisture variations.

Oil heat treatment is another alternative way in treating bamboo without use of preservatives. This process is considered as eco-friendly treatment. Leithoff and Peek, 1997 reported that only temperature above 170°C was effective to enhance durability of bamboo however, Boonstra and Tjeerdsma, 2005 indicated that chemical composition was modified at this condition.   In this study modification of the polymeric of bamboo constituents after oil heat treatment at 140 to 220°C for 30 to 60 min was investigated. The aims of this study were:-

- To analyze the chemical properties of heat-treated bamboo

- To investigate the reaction mechanism occurring during heating at each condition applied.

2. Material and methods

2.1 Preparation of Bamboo Samples

Bamboo culms of 3 years old were extracted from randomly selected clumps in Nami, Kedah in Malaysia. The culms were cut and splitted before conditioned at $20\pm$°C and 65 RH until constant weight. The sample were then subjected to heating at varies temperature and time.

2.1.1 Heat treatment Process

Palm oil which the boiling point of 320°C fulfilled 3/4 tank. Split bamboo samples were immersed in crude palm oils with original temperature in metallic cage of stainless steel tank. Temperature was rise gradually controlled by digital controller. Three electric heaters were generated heat from electricity power sources. Data logger connected to thermocouple where four and three channels placed inside and outside (oil) of the bamboo samples. Data were recorded every 5-10°C interval. In this experiment, temperature was applied at 140°C, 180°C and 220°C with duration 30 and 60 minutes. Bamboo samples were taken out at reached temperature. Residual oil on bamboo surface was removed by wiping with cloth to avoid absorbance into bamboo samples.

2.2 Chemical Analysis of Bamboo

2.2.1 Preparation of sawdust

A small of bamboo sample (20 mm x 20mm x thickness) was cut from the heat-treated bamboo. The epidermis of bamboo was removed before grind to pass a BS 40-mesh sieve and retained on a BS 60-mesh sieve. The sawdust was air dried for several days until it reached the constant weight prior to chemical analysis. The procedure was referred from TAPPI Standard.

2.2.2 Moisture Content of Sawdust

A small weighing bottle previously cleaned and dried in an oven was weighed on an analytical balance to 0.01 g. 2.0 g air dry sawdust was placed on the weighing bottle and reweigh to 0.01 g. The sample was dried in the oven at 105°C for three hours with the cover off. Then the bottle was removed and placed in the desiccator for 15 minutes to cool, (observing the proper precautions concerning the desiccators lid and the handling of the bottle by using tongs) before weighing. The moisture content on the basis of the air-dry weight was calculated by dividing the loss in weight by air-dry weight.

2.2.3 Determination of Holocellulose content

2 g of air dried extractive-free sawdust was weighed accurately. The sawdust was transferred quantitatively to a 250 ml conical flask. 100 ml water, 1.5 sodium chloride and 5 ml of 10% acetic acid were added and the flask was placed in a water bath maintained at 70°C, swirling the content of the flask at least once every five minutes. The flask was kept closed with a small, inverted Erlenmeyer flask.

5 ml of 10% acetic acid was added after 30 minutes. 1.5 sodium chloride was added after further 30 minutes. Alternative acetic acid and sodium chloride at 30 minutes were continued, after last addition of sodium chloride. The mixture was heated for 30 minutes after last addition of sodium chloride. Residue should be white and retain woody structure. The suspension was cooled in an ice bath.

Residue was filtered into a weighed fruited glass crucible (medium or coarse porosity) and washed with iced distilled water and finally washed with acetone. The residue was air-dried (allowed the residue to strand in the open laboratory for a day or two until it is free of acetone). Covered it with a perforated aluminium foil. The sample was transferred to a desiccator and weighed at daily intervals until the sample reached constant weight. The moisture content was determined on a 0.5 g sample which is afterward.

2.2.4 Determination of Cellulose content

Air-dried holocellulose was used. The experiment was carried out in a water bath at 20°C. About 2 g of sawdust were weighed out accurately and transferred into a 20 ml beaker than placed in a water bath at 20°C. 15 ml of 17.5 NaOH was added and macerated gently with a flattened glass with rod for 1 minute. 10 ml more NaOH was added and the solution was mixed for 45 seconds. Then, 10 ml more was added and mixed for 15 seconds so that at the end of 2

minutes 35 ml of the NaOH have been added. The mixture was stirred and allowed to stand for another 3 minutes. After 3 minutes, another 10 mililitre NaOH was added and mixed with stirring rod in the solution for every 2.5 minutes for 4 times.

The beaker was covered with watch glass and the mixture was left in the water bath for 30 minutes more. Then 100 ml of distilled water were added at 20°C quickly and thoroughly mixed and left the diluted mixture in the water bath for further 40 minutes. The mixture was filtered into a weighed fruited glass crucible (coarse porosity). If suspended fibers are noticed in the filtered, pass it through the cellulose mat again to clarify it. The beaker was rinsed and residue 25 ml of 8.3 NaOH solutions at 20°C and quantitatively transfer all the fiber to the crucible. During the filtration, the cellulose pad covered was always kept with solution to prevent drawing air through the pad.

The pad was washed with 650 ml distilled water at 20°C. The suction tube was disconnected, filled the crucible with 2N acetic acid at 20°C and the residue was allowed to soap for 5 minutes. Suction was reapplied to remove acetic acid. The residue was washed with the distilled water until it free of acid as indicated by the litmus paper. The bottom and side of the side of the crucible were wiped out with a dry towel and placed in the oven at 50°C, dried to constant weight, then cooled and weighed. Alpha cellulose was calculated as a percentage based on oven dry sample.

2.2.5 Determination of Lignin content

The procedure was referred from TAPPI Standard T 222 os-74. 1 g of air dried extractive free sawdust was weighed out accurately in weighing bottle and transferred in a 50 ml beaker. 10 ml of 72% sulphuric acid were added carefully with a pipetted and the mixture was stirred with a small glass rod (which is left in beaker). The mixture was left quantitatively with a wash bottle (water) to a 500 ml round-bottle flask and diluted with water until the final volume is 300 ml. While the solution was refluxing (boiled under reflex for 3 hour), a crucible was oven dried (fine or medium porosity) for 1 hour at 110°C, then allowed to cooled in a desiccator (15 minutes and accurately weighed. When the refluxing was completed, the insoluble lignin was recovered by filtration through the crucible after allowing the lignin to settle to facilitate filtration. The lignin free was washed from act with 250 ml of hot distilled water. The crucible containing the lignin was dried at 110°C for 1 hour, cooled in a desiccator (15 minutes) and weighed. Lignin content was reported as reported as percentage by weight of the dried sample.

2.2.6 Starch Content

The method devised by Humprey and Kelly (1960) was adopted to determine the starch content through the basic reaction of the amylose in bamboo starch with iodine

2.2.6.1 Preparation of powder

Bamboo samples were first ground in order to pass a 200 mesh sieved and triplicate samples of 0.4 g each were dried for 72 hours in desiccator oven containing concentrated sulphuric acid and added with 4-7 ml of 7.2 M perchloric acid in a 50 ml beaker. Reactions were allowed to continue for 10 minutes with occasional stirring. The contents were then transferred into a 50 ml volumetric flask and made up to the volume with distilled water.

After centrifuging, 10 ml aliquots were placed in a 50 ml volumetric flask together with a drop of phenolphthalein and made alkaline with 2N Sodium hydroxide. Then 2N acetic acid was added of 2.5 ml acetic acid, 1.5 ml of 10% weight over volume potassium iodine and 5 ml 0.01N Potassium iodide. Color was allowed to develop for 15 minutes before the absorption (Baush Lomb UV Spectrophotometer) at 650 µm was measured. A blank was prepared without starch aliquot. The starch content was then calculated by applying the formula:

$$\text{Starch} = \frac{0.36778 \times (E.\ reading + 0.008)}{\text{Oven-dry weight of sample (g)}} \times \frac{50}{10} \times 100$$

Where,

E reading = differences of absorption between sample and blank

2.3 Statistical Analysis

The statistical analysis was carried out using the statistical analysis software (SAS). All data were analyzed using one-way analysis of variance (ANOVA) and the mean value was separated using Least Significant Difference (LSD) to determine the differences between treatment levels.

3. Result and Discussion

3.1 Effects of heating on chemical properties of G. scortechinii

The mean contents of holocellulose, hemicellulose, cellulose, lignin and starch in the treated and untreated *Gigantochloa scortechinii* after heating treatment are exhibited in Table 3.1. The hemicellulose content was calculated based on the deducted from holocellulose to alpha-cellulose.

3.1.1 Holocellulose content

The results in Table 3.1 show that holocellulose content in the treated bamboo significantly reduced when they were treated at 220°C/60 min. The chemical reduced by 10.7% from 81.4% (untreated) to 72.7%. Even though they was slight reduction for the those treated at higher temperature, the reduction however, was not significant. The holocellulose content were in the range of 77% to 81%. The reduction of holocellulose at higher temperature (above 180°C) was due the depolymerisation of the hemicelluloses and some degradation of the cellulose during heating.

In a previous study on heat treatment of Scots pine, Boonstra and Tjeerdsma, (2005) also found the similar results where the holocellulose content of the wood decreased from 79.7% to 63.3% when it was heated at 180°C.

Bamboo holocellulose contains all carbohydrates in bamboo also the sum of the cellulose and hemicellulose. The reduction of holocellulose was possibly attributed to the degradation of hemicelluloses and cellulose.

3.1.2 Hemicellulose content

There is no specific trend of hemicellulose content of bamboo. Even though there was a reduction by 8% of the chemical when treat at 180°C/60 min and above, the reduction was not significant. The hemicellulose content for treated and untreated bamboo were in the range 24-28%.

During heating, acetic acid is formed from aceylated hemicelluloses by hydrolysis. The released acid serves as a catalyst in the hydrolysis of hemicelluloses to soluble sugars. In addition, the acetic acid that has formed depolymerises the cellulose microfibrils in the amorphous area. The acid hydrolyses the bonds joining the units of glucose, breaking cellulose into shorter chains. However, the breaking of a hemicellulose chain does not reduce as much the strength of the bamboo as breaking of cellulose chains would do.

Tjeerdsma and Militz (2005), found hemicellulose hydrolysed more easily than cellulose. Dehydration reactions occur naturally during thermal treatments of polysaccharides, causing a decomposition of hydrolysed sugars (Fengel and Wegener, 1989). Pyranosidic ring structures will be dehydrated into hydroxymethylfurfural and furanosidic ring structures in furfural (Bobleter and Binder, 1980).

According to Abatzoglou *et al.* (1990), hemicellulose are easy to hydrolysed at high temperatures between 200 to 230°C even without the presence of an acid catalyst because of its structure and characteristics for example non-crystalline, highly disordered and heteropolymers (Ishii and Shimizu, 2001).

Boonstra and Tjeerdsma (2005), stated that the heat treatment at 180°C are less effective to depolymerise of hemicellulose however depolymerisation increased after temperature was raised to 185°C consequent degraded of hemicellulose content.

According to Tjeerdsma and Militz (2005), during thermal treatment carbonic acids mainly acetic acid will be formed as a result of cleavage of the acetyl groups of particular hemicelluloses (Bourgois and Guyonnet, 1988). Depending the on acid concentration and temperature applied, hemicellulose as the most reactive wood component will be hydrolysed into oligomeric and monomeric structures (Carrasco and Roy, 1992).

According to Garrote *et al*. (1999), depending on the conditions, polysaccharides (mainly hemicelluloses) are depolymerized to oligomers and monomers and the correspondent sugars (pentoses and hexoses) can be dehydrated to furfural and hydroxymethylfurfural, respectively.

Boonstra and Tjeerdsma (2005), indicated a depolymerization of carbohydrate mainly of the hemicellulose at higher temperature during hydro-thermolysis at the same time effect on the concentration of the soluble fraction because of the formation of furfural and some degradation of the lignin wood component.

Fengel and Wegener (1989), investigated that the acidic hydrolysis of hemicellulosic polysaccharides in wood is mainly a matter of breaking the glucosidic bonds ($1 \rightarrow 4$) between monosaccharide units of the chain, the liberation of ester-bonded side groups such O-acetyl and the breaking of other ether-bonded side groups such as α-D-galactopyranose. This will lower the molecular size such as reduce the degree of polymerization for the polysaccharide and fragments of low molecular by products such as mono- and disaccharides will be solubilized.

3.1.3 Cellulose content

The cellulose content of heated and unheated bamboo is presented in Table 1. The reduction of cellulose from treatment at 140°C/60 min to 180°C/30 min was 2.9% to 3.8% respectively compared to control. This reduction further increased to 5.1% at 180°C/60 min and 14.1% at 220°C/60 min. This result shows that the degradation of bamboo cellulose increased when temperature and time of treatment increases.

Bamboo cellulose is considered to have major influence of bamboo strength. The bamboo cellulose structure is changed and that amorphous part can be degraded close to and above 220°C. The amorphous part of the bamboo cellulose possibly hydrolyzed first, leaving a residue of cellulose with reduced degree of polymerisation and increased crystallinity.

In a study of thermal treatment, degree of polymerisation of cellulose reduced and leveled of to values around 600 to 800 (Roffael and Schaller, 1971). Cellulose degradation can contribute to the loss of mechanical strength in wood under high temperature treatment (Sundqvist, 2004). Changes in the cellulose of wood during thermal have also been known as increase in crystallinity (Bhuiyan *et al*., 2000; Kubojima *et al*., 2001; Sivonen *et al*., 2002). Organic acids such as formic and acetic acid are liberated during the process which may affect the properties of wood (Risholm-Sundman *et al*., 1998; Garrote *et al*., 2001; Manninen *et al*., 2002).

Rubio *et al*. (1994), reported that cellulose degradation reactions started at an above 210-220°C and degree of degradation in the same way cellulose was significantly affected at temperature more than 270°C (Biermann *et al*., 1984). Different process conditions and treatment time applied during heat treatment may influence degradation rate of cellulose content (Boonstra and Tjeerdsma, 2005). Boonstra and Tjeerdsma, 2005 suggested that in hydrothermolysis treatment, (at 165-185°C), an effective treatment time of 30 minutes while in curing treatment, (at 170-180°C), an effective treatment time of 4 hours).

In hydrothermal at high temperatures, the heating time can be reasonably elongated in contrast with the duration of the isothermal reaction. This is important to a substantial hemicelullose alteration during heating (Carrasco & Roy, 1992).

3.1.4 Lignin content

The lignin content of bamboo that had been heat treated in a palm oil is displayed in Table 1. There is no specific trend of lignin when treated at different treatment conditions. From Table 1, it shows that lignin content decreased at treatment temperature 140°C-180°C however, it increased when the treatment temperature was raised to 220°C. At 180°C, lignin content was higher when it was heated longer. A higher lignin found in the treated bamboo compared to the control indicates that the degradation of some hemicelluloses. Furthermore, changes in structure of bamboo lignin (plasticization) at high temperature were probably attributed to the increment of lignin content.

Kamden *et al.* (2002), found that increases in lignin content can be attributed to the loss of hemicellulose or fragile pentoses and hexoses during the heat treatment. They also initiated that increase in lignin content does not involve the formation of lignin during the process but the reduction of other wood components. Boonstra and Tjeerdsma (2005), found a similar trend of lignin content during treatment process in *Picea abies*, *Pinus sylvestris* and *Pinus radiate* D. They also observed that the lignin content of heat-treated wood is increased mainly due to depolymerisation of the carbohydrates. Polycondensation reactions result in a further cross-linking of the lignin network also contributes to increase of the lignin content. The reduction of water adsorption favours the effect of increased cross-linking of the lignin network while the proportion of free hydroxyl groups still available after heat treatment.

Tjeerdsma *et al.* (1998); Boonstra and Tjeerdsma (2005), stated that the condensation reactions of lignin at 185°C, was probably contributed to higher lignin content and more hemicelluloses cleavage products.

According to Westermark *et al.* (1995), the changes in the lignin structure starts at temperature around 120°C in which the changes increased with the temperature. Kishimoto and Sano (2002), stated that lignin condensation was probably due to homolytic cleavage of ether bonds and subsequent rearrangement reactions. At temperature around 180°C, homolytic cleavage of β-ether linkages and formation of radicals condensation products and possible cross links between lignin and polysaccharides (Tjeerdsma *et al*., 1998b; Kosikova *et al.,* 1999; Sivonen *et al.,* 2002). Lai (1991), observed that mild acidic hydrolysis of lignin is proposed to be the result of the breaking of cyclic α-aryl ether bonds giving various lignin fragments such as lignols. Above 200°C the lignin degradation rate and the concentration of radicals that is formed are reported to strongly increase (Sivonen *et al.,* 2001).

Boonstra and Tjeerdsma (2005), reported a depolymerization of carbohydrate mainly of the hemicellulose at higher temperature during hydro-thermolysis at the same time effect on the concentration of the soluble fraction because of the formation of furfural and some degradation of the lignin wood component. They also reported that heat treatment at higher temperatures (185°C) result instead in a further decrease of water adsorption, in which decrease in free hydroxyl groups.

Tjeerdsma and Militz (2005), stated that lignin is the least reactive wood component, but at high temperatures, bonds within the lignin complex will be cleaved, resulting in a higher concentration of phenolic groups (Kolmann and Fengel, 1965). This state of increased reactivity of the lignin exposes the occurrence of various condensation reactions of aldehydes and autocondensation of lignin.

According to Kamdem *et al.* (2002), the chemical degradation of wood occurs in the order of hemicellulose, cellulose and lignin. A limited decomposition of lignin is observed at a temperature as low as 220°C with the presence of phenolic substances such as vanillin, coniferaldehyde and syringyl aldehyde (Sandermann and Augustin, 1964).

A partial depolymerization reported at 135°C for beech (Kosikova *et al.,* 1999) in addition, splitting of β-aryl ethers and formation of lignin condensation products at 100°-120°C was found for maple and hemolytic cleavage of phenolic β-aryl ether in wood lignin was found 130°C (Westermark *et al.,* 1995). At temperature of 150°-250°C, major changes

in the wood components occur. Both degradation and modification which thermal treatment in model systems was four times higher for hemicelulose than for cellulose and that the degradation rate for lignin was only half of that for cellulose at 150°C (Stamm, 1956).

3.1.5 Starch content

The mean starch content value in the bamboo culms is shown in Table 1. The starch content of heat-treated bamboo did not differ significantly between control and treatment conditions of 140°C/60 min. At 180°C/30 min the starch content was reduced by 22% to 3.2%, whilst at 180°C/60 min, it was reduced by 34% to 2.7%. A high reduction of starch content was demonstrated at 220°C/60 min. The value was reduced by 54% to 1.9%. The reduction of starch may probably hydrolysis of this component during heating. Removal starch from bamboo can improves the durability since fungus or pest depends on starch as a favourite food to survive.

Sundqvist, 2004 reported that pectin and starch has a similar molecular structure such as hemicellulose. He also stated that at 200°C, starch become hydrolysed under this conditions same with hemicellulose.

4. Conclusion

Holocellulose content of boil-treated bamboo did not differ to each other when it was heated at 180°C however, the content reduced significantly when treated at 220°C/60 min**.** Hemicellulose content of bamboo was not affected by the treatments. Cellulose content in bamboo was only reduced when it was treated at temperature higher than 180°C. At 140°C to 180°C, the lignin content in the treated bamboo decreased, but the chemical content value increased when the bamboo was heated at 220°C. Starch content in the bamboo was found to be inversely proportional to treatment temperatures.   At 180°C, duration of treatment did not significantly affect the starch content. The results indicated that degradation of cellulose and hemicellulose of heat-treated bamboo at higher temperature and time was attributed to plasticization of lignin during heating in the same time hydrolysed the starch content.

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Table 1. Mean chemical analyses of 3-years-old *G. scortechinii* culm after heating in palm oil at varies temperatures and times

Heating conditions	N	Holo-cellulose (%)	Hemi-cellulose (%)	Cellulose (%)	Lignin (%)	Starch (%)
Control	6	81.4 [a]	26.2 [a]	55.2 [a]	22.3 [ab]	4.1 [a]
		(3.69)	(3.58)	(1.75)	(3.31)	(0.18)
140°C/60	6	81.4 [a]	27.8 [a]	53.6 [ab]	21.1 [b]	4.0 [a]
		(4.54)	(27.8)	(2.01)	(4.09)	(0.32)
		{0}	{6.21}	{-2.9}	{-5.4}	{-2}
180°C/30	6	79.7 [a]	26.6 [a]	53.1 [ab]	21.6 [b]	3.2 [b]
		(5.15)	(4.96)	(0.71)	(2.98)	(0.35)
		{-2.1}	{1.42}	{-3.8}	{-3.1}	{-22}
180°C/60	6	76.5 [ab]	24.1 [a]	52.4 [b]	22.0 [ab]	2.8 [b]
		(3.36)	(2.14)	(3.11)	(3.01)	(0.42)
		{-6}	{-7.98}	{-5.1}	{-1.3}	{-34}
220°C/60	6	72.7 [b]	25.3 [a]	47.4 [c]	26.0 [a]	1.9 [c]
		(6.07)	(6.26)	(2.51)	(3.94)	(0.20)
		{-10.7}	{-3.63}	{-14.1}	{16.6}	{-54}

Note: Values in parentheses are standard deviations

Means with the same letter are not significantly different (p<0.05)

{   } = % change from control

N = number of sample

Brief Analysis Countryside Urbanization

Sustainable Development

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Abstract

The article studies in the predecessor in the foundation, many questions which exists in view of the current countryside urbanization advancement, uses, the small cities natural resource from the land resource to use, the small cities environmental protection sustainable management, the initiative ecology cities idea sustainable, advances small cities aspects and so on sustainable development to discuss the countryside urbanization the harmony, the sustainable development.

Keywords: Countryside, Urbanization, Countryside urbanization, Development

The countryside urbanization is a comprehensive question in our country economy and social development. Although the countryside urbanization's representation is more and more rural population housing, the work and the life in the cities, the urban population the relative share which occupies in the total population rises unceasingly, but speaking of its essence, the countryside urbanization is in the social economy system each essential factor relation and the combination unceasing optimization, is the countryside industry system optimizes and the resources deployment unceasing optimization unceasingly. Along with the urbanization advancement's acceleration, the resources consumption sharp increase, the population scale, the region scale expand suddenly, has the huge impact on the original cities function and the structure, some such as shortage of resources, the environmental pollution, the entering a city farmer lose the safeguard outside and so on question to underline. China's urbanization faced with population, resources, environment huge pressure; therefore the countryside urbanization must walk the sustainable development the path. How to use cities each resources reasonably, maintains the good ecological environment, the humanities environment, realizes the cities economy, social, the environment sustainable development finally, chats own view:

1. Small cities land resource sustainable use

The urban land by politics, the economy, the cultural center carries on the district on the whole, regarding plays the transition role the small cities land not to be able to imitate big urban the procedure, because between both has the very big difference. The urban land plan knew that from the city to the countryside shift, the small cities land must play the transition bridge on the contrary the role, such sustainable development was very important. First, does not pay great attention the sustainable development the plan, does not have plan sustainable. The small cities' origin is the agricultural village and the villages and towns; the development backing is the land resource rich countryside. The countryside cultivation way's influence, the most residents are had their courtyard, the vegetable plot, the average per person land target is oversized; the state-owned land waste is serious. Second, in region water resources, forest resources as well as mineral resource and so on, because has its spontaneous combustibility, populace's protection consciousness is bad, cuts the phenomenon to be serious excessively, and along with small urban population's increase, the industrialization level enhances unceasingly, between the economic development and the ecology contradiction is day by day incisive, if allows nature to take its course, the small cities' development will face the difficult position. These request when establishes the small town planning, must first from region resources angle embarking, pay great attention the resources the use, the protection and the government, full consideration natural condition's bearing capacity and the humanity to its transformation's possibility, study its sustainable development, determined that its development direction, reduces the plan naturally blindness, the standard development, guides the populace correct development nature and the protection nature, enables the nature both to serve for the modern age, and can satisfy the future generations need to develop.

2. Small cities natural resource sustainable use

The urbanization advancement is following without one exception to the resources consumption. The cities must use its production system consumption resources as the consumer to provide the production and the life-support services for the resident, but the present cities' resources consumption occupies the global resources consumption total quantity major part. Statistics indicated that only occupies the land area 2% cities, actually has used the world resources 75%. Cities to resources consumption, especially to non-renewable resources consumption, although has met the contemporary cities development need, but becomes after inevitably, long-term stability and sustainable development definition factor. Must establish the circulation economic type, enables the resources to obtain the circulation use. What circulation economy initiative is one kind of establishment, in the material circulates unceasingly in the use foundation economic development pattern, requests the economic activity according to the natural ecosystem pattern, organizes one "the resources - product - renewable resource" material infinite loop mobile process, thus causes from the entire economic system as well as the production and the expense process basically does not produce or only produces the very few rejects. The circulation economy request take "reduces the quantification, to use again, to circulate again" as the social economy activity standard of conduct. The decrement industrial chemicals are the request the production goal which or the expense goal achieves with the few raw materials and the energy investment decides, in economic activity source on attention nurse resources and reduced pollution. In the production, the decrement industrial chemicals frequently display to request the product volume miniaturization and the product weight light. In addition, request product packaging pursue simple, but is not the luxurious waste, thus achieves the reduced reject emissions the goal. The use principle refers to the product and the packing container again can use many times by the initial form, but is not uses one time to bring to completion, resists now world disposable thing being in flood. The circulation principle is again the goods which the request produces after completing its use function can turn may the use resources, but is not useless trash. If the Upstream Enterprise's waste material becomes the Downstream Enterprise's raw material, realizes the production cost to be lowest, the economic efficiency to be best, the ecological environment to be best, realizes the ecological environment and the economical Interco ordination development. Regarding the construction, must pay great attention the building material the recycle, like some worn out finishing materials, even some abandon the construction the column, girder all to utilize in the new construction through the original design.

3. Small cities environmental protection sustainable management

Along with our country countryside modernization process quickening with small town construction popularization, if does not take the environment question, will have the aspect which inevitably the rural environment pollution the scale and the influence expand unceasingly, this allied group 16 loudly proposed the production development, the live in plenty, the ecology good sustainable development goal does not tally. Therefore, conducts the research and the government to the countryside urbanization advancement's environment question, has the very vital practical significance and the profound historic importance. Although the countryside urbanization's advancement cannot achieve zero pollution, but causes to the environment damage to reduce the threshold, namely reduces to the natural environment system itself can withstand and the benign revolution limit, is advances in the countryside urbanization process the processing ecological environment question basic maxim. The government has three to the rural environment management's essential method: Administrative method, economic means and legal means. The administrative method is our country passes in agricultural and in the rural environment management uses many methods, but, the administrative order also has the standard in the use process to be insufficient, the binding force not strong, lacks questions and so on regularized and institution inspection and surveillance, must therefore optimize unceasingly, for instance, draws up the explicit administrative rules and regulations article, enhances the executive action the standards; The strict administrative rules and regulations article's execution, enhances the executive action the solemnity; Maintains the administrative rules and regulations the relative stability; Establishes the serious inspection control system; And so on. Economic means including charge, subsidy and pollution discharge power transaction several aspects and so on. The charge system and subsidy system our country already gained in many success experiences, but has also exposed many questions, for instance, the pollution discharge tariff manifests more and more insufficiencies: The pollution charge by the density standard charge, cannot the active control pollutant discharge amount; The tariff establishment is excessively low, the pollution enterprise is willing to pay fee the pollution discharge, but has not governed the pollution the enthusiasm; The tariff is sluggish to inflation's response, causes the actual tariff to be lower; The list pollution factor's charge system was very unfair to the pollution discharge enterprise, dampened the enterprise anti-pollution enthusiasm; And so on. At present, the economic means are not full in our country rural environment management's use, from now on, and will move along with our country market economy system's gradual establishment, the government should enlarge the economic means use dynamics, full display economic means in rural environment management function. The legal means that are through the legislation and the judicial activity carries on the control and the surveillance to the social economy activity, by the regular economy activity main body's behavior, causes it with the socio-economic development goal which decides to be consistent. Our country rural environment management's government by law construction had already made the encouraging progress, has promulgated has

implemented one batch of related resources and the environmental protection law, but the relative urban environment protection and the industrial pollution prevention says, after countryside urbanization, the cities environmental protection work was still at the start stage at present, the foundation is weaker. Generally speaking, not yet establishes adapts the small cities characteristic and the environmental protection work actual need laws and regulations system. Moreover, because the overwhelming majority small cities environmental protection organization is not perfect, the surveillance law enforcement work does not arrive, lands on feet with difficulty the small cities environmental protection work mission. Therefore, our country rural environment management's legal also means must strengthen, establishes the legal means to manage in the rural environment truly the solemnity and the authority.

4. the initiative ecology cities' idea, advances small cities the sustainable development

Along with the economical fast development, our country's urbanization advancement is speeding up. Constructs small cities what pattern according to is a very urgent question. The present pattern has the traditional city, the garden city and the ecology city; we should construct our cities take the ecology city as the goal. The ecology city emphasized the city has the good ecology function, enables the city which the people live to have the return natural quality. The ecology city emphasizes the green space area not constantly, but the emphasis biology component to the city ecological environment quality's regulative function, must jack the urban green space system to the ecological environment quality regulation system designs highly and the construction. The ecology city's construction must also carry on from the great criterion and the small criterion two aspects. The great criterion does the city is a whole carries on the plan construction, causes in urban the nature to be in the regulation environment quality the status. The small criterion must in the transportation, the housing, the rivers, the water body and so on each aspect carry on the ecology design, guarantees under the quick rhythm working conditions non-environmental damage's enjoyment. Specifically speaking, must pay special attention to the ecology model district items of basic construction prominently, pays special attention to the ecological building project, implements cities live trash burning down projects positively and so on processing project, cities industry reject handling, pays special attention to the cities industrial pollution source government, unifies the rural industry plot construction, carries out the pollutant common control, the centralism government vigorously, must limit its development regarding the scale uneconomical pollution enterprise; Is unreasonable to the industrial structure, the pollution is serious, the government is hopeless, must give to close down, carries out the clean production gradually in the rural industry enterprise, must further strengthen the Rural enterprise environmental management, enlarges closes down or the elimination to the national compulsion 15 small and the country industrial policy public proclamation elimination Rural enterprise's control inspection, prevents to resurge.

In brief, must finish the countryside urbanization the sustainable development, must really have, the reliable resources is the foundation, insisted that the region resources have the development and the use. Simultaneously both must cities oneself embark since childhood, and must set up the region and the total view; both must focus on the contemporary benefit, and must consider future need; both must have in advance consciousness, and wants not to divorced from the reality. Only then follows the objective law, realistic, can maintain countryside urbanization sustainable development

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Comparing Discriminant Analysis and Logistic Regression Model as a Statistical Assessment Tools of Arsenic and Heavy Metal Contents in Cockles

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Abstract

Two statistical techniques; discriminant analysis (DA) and logistic regression model were used to analyze the concentration of arsenic and heavy metal contents in cockles *(Anadara granosa)* from two estuaries in the state of Penang, Malaysia. This study was undertaken to understand the interrelationship between different parameters and also to identify probable source component in order to explain the pollution status. Arsenic (As), chromium (cr), cadmium (cd), zinc (zn), copper (cu) and lead (pb) were analyzed using a graphite flame atomic absorption spectrophotometer (GF-AAS) whilst mercury (Hg) was analyzed using a cold vapor atomic absorption spectrophotometer (CV-AAS). Logistic regression model showed that only two explanatory variables Zn ($p < 0.01$) and Cd ($p < 0.05$) exhibited significant effect to discriminate cockles in the two locations and responsible for large variation affording 77.5% correct assignation. On the other hand DA identified the same parameters Zn and Cd which are responsible in discriminating the two locations affording 72.5% correct assignation. Comparison between logistic regression model and DA exhibited that both techniques gave close results in discriminating the two locations.

Keywords: Heavy metals, Arsenic, Estuary, Logistic regression model, Discriminant analysis

1. Introduction

The discharge of effluents and associated toxic compounds into aquatic systems represents an ongoing environmental problem due to their possible impact on communities in the receiving aquatic water and a potential effect on human health (Canivet and Gibert, 2002). Especially in highly polluted and industrial areas, point and non-point sources of anthropogenic chemicals and metals have polluted rivers with highly complex mixtures of chemicals and other anthropogenic perturbations to degree where life in rivers is severely impacted (Smolders et al., 2004).

The application of different statistical methods has increased tremendously in recent years for analyzing environmental data (Hernandez et al., 2005; Vallvey et al., 2006). In the present study logistic regression model was used to identify the most important variables responsible in discriminating between two groups and study the relationship between one or more explanatory variables (here arsenic and heavy metals) and the dependent variable (location). In addition it can also be used for prediction (Erling, 1997; Agresti, 2002). The results of logistic regression model was compared with DA, since both techniques can be used for classification and identifying the contribution of each parameter in discriminating the two locations.

Cockles rearing in Penang that was valued at RM 8.12 million in 2001 is the third largest in Malaysia after the states of Perak and Selangor. Kuala Juru has been one of the main areas of cockle cultivation in Penang. After 1999, cockle production in Penang had undergone a declining trend with the water pollution being the primary reason. This

situation is predicted to further degenerate if Penang coastal waters are being continually polluted from effluents of local industries (Socioeconomic and Environmental Research Institute report, 2002). This study was therefore undertaken to determine whether the concentrations of arsenic and heavy metals in cockles sampled reared in Kuala Juru (Juru River) and Bukit Tambun (Jejawi River) are different based on the concentrations of arsenic (As) and six heavy metals (Cu, Pb, Cd, Cr, Zn, and Hg).   In addition it is important to identify the most important explanatory variables which help in distinguishing the cockles according to the above selected parameters.

The objective of this paper is to compare the use of logistic regression model and discriminant analysis (DA) as a statistical tools to identify the contribution of each variable in distinguishing between two groups. This study may also illustrate the usefulness of statistical analysis for evaluation and interpretation of large complex data sets to get better information about arsenic and heavy metal contents in cockles.

2. Materials and methods

2.1 Description of study area

The study site is located on the North West coast of peninsular Malaysia, in the state of Penang and within a coastal mudflat in the Juru and Bukit Tambun district. The sites are located adjacent to industrial areas which were reclaimed from mangrove. The types of industry presently in operation include: electronics; textiles; basic and fabricated metal products; food processing and canning; processing of agricultural products; feed mills; chemical plants; rubber based industry; timber based wood products; paper products and printing works; and transport equipment. Other main activities that are operating in vicinity of the cultured area are a ships' harbor with petroleum unloading and a red earth quarry which extends right up to the coastline. There are three main rivers flowing into the area, Sungai Juru, Sungai Semilang and Sungai Jejawi where some fishing villages are situated.

2.2 Analytical procedure

Samplings were carried out during a rainy season in the year 2005. 5 (five) samples of cockles (*Anadara granosa)* were collected from each of the 40 estuarine sites in Juru and Jejawi Rivers (20 sites from each location). The cockles were collected manually at low tide from the inter-tidal plats (slikkes) of the two areas. Cockles were cleaned externally by washing thoroughly through a 1-mm mesh sieve with deionized water before being transferred into a high density polyethylene (HDPE) sampling bag.   After a 36 hrs purging period, during which time sediment-bound metals were voided from the gut, the bivalves of approximately similar size (32.6 mm) were rinsed in deionized water. Soft parts (7-10 g of wet tissue) were digested in 10 mL of boiling concentrated nitric acid (Analar grade) to near dryness. Additional digestion was accomplished by the addition of 10 mL of 1:1 nitric acid/deionized water.   The resulting residue was diluted to 50 mL in deionized water.   The solution mixture was then filtered through a 0.45-µm cellulose nitrate filter prior to arsenic and heavy metals analysis.

Graphite furnace atomic absorption spectrophotometer (GF-AAS; Perkin Elmer HGA-600) was employed for the analysis of arsenic and heavy metals (Cr, Cd, Zn, Cu and Pb) and cold vapour atomic absorption spectrophotometer (CV-AAS) method was employed for Hg analysis after sample digestion in acid solution.   Calibration curves from standard mixtures of 0.05, 0.1, 0.2, 0.5 and 1.0 mgL^{-1} of Cu, Zn, Cd, Cr and Hg and 0.5, 1.0. 2.0. 5.0 and 10 mgL^{-1} of As and Pb were prepared in nitric acid solution.   The accuracy of the methods was determined by preparing digestion mixture blanks and by spiking the sample with known concentrations of As, Cu, Cd, Cr, Zn, Pb and Hg with mean recoveries of 90.5 ± 1.2 %.

2.3 Statistical methods

2.3.1 Logistic regression model

Logistic regression model or logit deals with the binary case, where the response variable consists of just two categorical values. Logistic regression model is mainly used to identify the relationship between one or more explanatory variables X_i and the dependent variable Y. Logistic regression model has been used for prediction and determining the most influential explanatory variables on the dependent variable (Cox and Snell, 1994).

The logistic regression model for the dependence of p_i (response probability) on the values of k explanatory variables x_1, x_2, ..., x_k is given in below (Collett, 2003):

$$\log it(P_i) = \log\ (\frac{p_i}{1-p_i}) = \beta_0 + \beta_1 x_{1i} + ... + \beta_k x_{ki}$$

(1)

Or

$$p_i = \exp\ (\frac{\beta_0 + \beta_1 x_{1i} + ... + \beta_{ki}}{1 + \exp\ (\beta_0 + \beta_1 x_{1i} + ... + \beta_k x_{ki}})$$

(2)

which is linear and similar to the expression for multiple linear regression.

where, $(\frac{p}{1-p})$ is the ratio of the probability of a success to the probability of a failure, and called odds,

β_0, β_i are parameters to be estimated, and p_i is the response probability.

In logistic regression model the predicted values for the response will never be ≤ 0 or ≥ 1, regardless of the values of the explanatory variables.

3. Result and discussion

The univariate statistics including maximum, minimum, median and Q_1, Q_2 quartiles for Juru and Jejawi Rivers are presented in (Fig.1 a and b) respectively. It can be seen that As and Hg exhibited higher levels in cockles, whereas Cr and Pb exhibited the lowest. The observed variability of arsenic and heavy metal contents in cockle was low and random.

Logistic regression model was applied to study the relationship between the two locations and seven explanatory variables (Arsenic and heavy metal) in order to find the most important variables that discriminate the cockles in the two locations based on selected metals.

Logistic regression was carried out using forward and backward stepwise methods for variable selection to identify the most important explanatory variables that significantly influence the response and help in distinguishing cockles obtained from the two rivers. Both methods identified the same explanatory variables and yielded the following model (Eq.3):

$$p_i = \exp \frac{52.51 - 79.86 \ Zn - 41.23 \ Cd}{1 + \exp \ (52.51 - 79.86 \ Zn - 41.23 \ Cd)}$$

(3)

Only two explanatory variables Zn ($p < 0.01$) and Cd ($p < 0.05$) exhibited significant effect to discriminate cockles in the two locations and responsible for large variation, while other parameters did not show significant effect. This model provided a good fit since the value of Cox and Snell is 0.53 and Negerlkerkr R^2 value is 0.67. The results of classification (Table 1) using logistic regression model showed that more than 77 % of the cockles obtained from different sites were correctly classified to their respective location. It can be said that the differences between cockles obtained from the two rivers belong only to Zn and Cd, while other parameters have almost the same concentration regardless of the location.

These results indicate that cockle sampled from some sites in each location have similar characteristic with cockle obtained from another location.

In summary, the two rivers studied seemed to be polluted and this is in agreement with previous studies at Juru River, Malaysia on metal accumulation on aquaculture (Yahya, 1994, DANCED, 1998). According to report by DANCED (DANCED, 1998) the electroplating, pulp and paper, textiles, food and beverages and auto-workshops industries were closely linked to industrial pollution in the Prai industrial area. This is in line with the report conducted by department of environment (DOE, 1999) that the four predominant industries of Penang are electronics/electrical, textiles, fabricated metal products, plastic and plastic products. Other industries include paper and paper products/printing works, rubber based, chemical/fertilizers and basic metal industries. Illegal mud-dumping activities of industrial waste could be another reason for the river pollution.

In general, some sites in both locations receive pollution from similar sources.

4. Comparison between Logistic regression model and discriminant analysis (DA)

The data was analyzed using discriminant analysis (DA) (Abbas, et al., 2007). The results of DA showed that 72.5% of original cases were correctly classified to their respective group (Juru river 70%, fourteen cases were correctly classified under Juru River and 75% Jejawi River, fifteen cases were correctly classified under Jejawi River). DA also showed that Zn and Cd exhibited strong evidence in discriminating the two locations and account for most of the expected variations in arsenic and heavy metal contents, while other parameters showed less contribution in explaining the variation between the two locations.

The results of logistic regression model showed that 77.5% of the cases were correctly classified to their respective groups (Juru river 75%, fifteen cases were correctly classified under Juru River and Jejawi River 80%, sixteen cases were correctly classified under Jejawi River). Logistic regression model identified only two parameters Zn and Cd responsible in discriminating the two locations. Comparing the results obtained from logistic regression model and discriminant analysis indicate that the two techniques gave almost the same percentage of correct classification and identified the same parameters responsible in discriminating the two locations.

In general, Logistic regression model and DA gave the best results in distinguishing the two locations and their results were almost similar. Both techniques also indicated that some cockles have similar characteristic regardless of the location.

5. Conclusion

Logistic regression has proved to be an efficient tool for source identification of arsenic and heavy metals in cockles. Logistic regression model showed that only two parameters Zn and Cd responsible for distinguishing the cockles affording 77.5 % correct assignation. The results of logistic regression model were close to DA results and either one can be used. This paper also presented some evidence of the bioaccumulation of As and heavy metals in cockles reared in the two rivers.

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Table 1. The result of the classification using Logistic regression model

		Predicted location		%
		Juru	Jejawi	Correct assignation
	Juru	15	5	75
Observed location	Jejawi	4	16	80
Overall percentage				77.5

a- Juru River

b- Jejawi River

Figure 1. Box-plot of arsenic and heavy metals along a- Juru River b- Jejawi River

Analysis and Research on Employment Predicament of University Students

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Abstract

The employment problem of the university students has always been one of the social focuses. The reasons of employment predicament of university students are not due to a single factor, but are results of many factors working together. The author analyzes the macroscopic and microscopic reasons of employment predicament of the university students, then putting forward measures to solve this problem from the angle of government, enterprises, universities and students respectively.

Keywords: Employment of University Students, Analysis of Reasons, Research of Countermeasures

1. Employment Predicament that University Students Are Faced with At Present

Entering into the 21st century, the students in ivory tower suddenly discover that looking for work is no longer an easy matter and employment of university students has become a focus of society. The number of national university graduates only was 1,040,000 in 2001 which, however, has reached about 5,000,000 in 2007.At the same time, the university undergraduates who wait for jobs are also on the increase year by year. The number has increased from 340,000 in 2001 to an average number of more than 1,000,000 per year starting from 2007 to now.According to Educational Department's statistics, the average employment rate of national university graduates was only around 70% since 2001 .Besides the large number of the students who graduates and seek jobs every year, there are also considerable graduates of previous years who are still unemployed, which certainly intensify the difficulty in solving the problem of university students' employment. University graduates flood into employment markets in such a large amount that every graduate has experienced the panic of employment in person.

2. Analysis to the Reasons of Employment Predicament of University Students

2.1Macroscopic Reasons that Lead to Employment Predicament of University Students

2.1.1 Social factors

2.1.1.1The total amount of labor supply overruns that of labor demand of society, which leads to gross unemployment.

According to the economic blue book recently issued by Chinese Social Science Institute in 2007, the unemployed urban population will reach more than 25,000,000 , while on the other hand employment positions has increased only by 10,000,000 in 2007 , which will leave a gap of supply over demand more than 15,000,000. At the aspect of social demand for employment position , the overall employment elasticity of China has a gradual dropping tendency, that is, contributions that economy growth makes to employment growth are less and less, demand for labor has difficulties in growing while supply of labor are relatively excessive.

2.1.1.2 Employment Peaks of Kinds of Employment Main Body interact together.

Employment situation is extremely stern at present, that is, employment of the urban newborn labor force, the rural surplus labor force, the laid-off workers, the veterans and the university graduates interweave mutually, all of which aggravates the situation of university students' employment.

2.1.1.3 Employment Positions suitable for university students are far from enough at present.

High-tech industry is an important impellent of modern economic development. And in Chinese domestic market there is a huge demand for the high tech products , the majority of which, however, are imports from overseas , only a few made at home.

With its insufficient development and not big scale, the lag of domestic high-tech industry results in the lack of high tech industries' posts which on the other hand is the main battlefield to solve the employment problem of university students.

2.1.2 governmental reasons

2.1.2 .1The employment problem of university students is directly caused by the fact that university enrollment increases too fast.

Since1999 when Chinese University started increasing enrollment on a large scale, the higher education has been entering into an accelerative development period. The number of ordinary university students has increased from 3,400,000 in 1998 to 18,000,000 in 2007 after successive years' increase in enrollment. Including adult and network students, the overall scale of national higher education has broken through 25,000,000 with a gross enrollment rate above 23%, which indicates high education has entered into its popularizing period.Growth rate of university enrollment exceed that of employment position.

2.1.2 .2

The direction and scale of university enrollment is separated from those of the employment position.

It was too hasty and careless for the national education department to formulate the policy of increasing university enrollment in 1999 since it only aimed at constantly increasing enrollment number without insufficient evaluation on the overall and long-term demand for social talents.The oversimplified behavior finally leads to the fact that the so-called talents fostered by universities not only surpass social demand in quantity but also cannot adapt to social demand in quality.

2 .2 Microscopic Reasons of University Students' Employment Predicament

2.2.1Enterprises' Reasons

Many enterprises lack scientific standards when they select talents and just look for persons when they lack ones, not using any human resources management technology. For a long time, in their fast development period such enterprises select talents without any development plan of human resources just like putting out fire only when there is any.With no arrangement for organization and position and no position demand plan, most enterprises select talents on the basis of experience and feeling which is unscientific. Such conducts have limited enterprises' development and affected the success ratio of selecting talents.

2.2.2 Universities' Reasons

2.2.2.1Universities have no marketing consciousness, lack marketing survey and analysis as well as foresight, which are all necessary for establishing majors.

Many universities, without considering their actual level practically, set up similar majors, which causes talents surplus and thus adds employment difficulty for university students.

2.2.2.2 Universities' career guidance is not proper.

In their crucial phase of entering into society, university graduates know far from enough about society and feel puzzled and confused about their work and future, which accordingly requires their schools to offer them helpful advice on occupation plans, but unfortunately many universities have done rather poorly in guiding university student's career.

2.2.2.3 The students' knowledge structure taught in universities has flaws.

Knowledge students learn in university is too theoretical and obsolete to keep pace with the development of time and society.

2.2.3 Students' Reasons

2.2.3.1 University students have misunderstanding on employment.

Some university students hold too high expectation for themselves, such as hoping to work in a high-paid company or to occupy an important position in a company and etc., all of which are impractical.Graduates pay all their attention to overseas-funded enterprises, governmental agencies and so on, while unwilling to work in basic units. Their impractical behaviors only make them end up in getting no job even at the time of graduation.

2.2.3.2 University student's ability has flaws

At present university students have insufficient comprehensive qualities and necessary abilities, which is vividly justified by their lack in practical social work experience, in abilities to deal with realistic problems and in hardworking and enterprising spirits, their difficulty in cooperating and communicating with others, their arrogance and impetuousness etc.

Except book knowledge, their limited interests put them in disadvantage in the position competition.

.Although there is a high demand for the high-tech and high-skill talents in recent years, the graduates still lose this good employment opportunity due to their shortage of work experience and skills.

3. Countermeasures of Solving University Students' Employment Predicament

3.1 Government's measures

3.1 .1 Expansion in Employment

The fundamental way to solve employment's problem of university students is nothing but to vigorously develop economy, unceasingly increase employment's posts and expand employment channels.Government should increase posts for university graduates by adjusting industrial structure, especially by supporting high technology industries.

3.1 .2 Excavating employment information vigorously and providing more channels and platforms for employment of university students.

The quality of analyzing labor demand information should be improved, and especially the analysis of demand for university students should be emphasized. Employment information resource should be integrated together and network advantage should be fully used so as to regularly issue the employment information and policy.

3.1 .3 Expanding population of graduates enlisting in army and increasing enrollment of postgraduates

A considerable number of excellent graduates join the People's Liberation Army, which is helpful to improve the quality of army as well as university students and to a certain degree alleviates the pressure of employment. Expanding enrollment of graduate student is helpful to cultivate high-level talents and put off the time of their employment.

3.2 The enterprise's Measure

Enterprises should formulate proper standards for selecting talents and recruiters according to their own scale, nature and development conditions.

3.3 Universities' Measures

3.3.1 Universities should properly forecast the specialty demand of the coming years so as to adjust specialties and curriculum according to market demand.

3.3.2 Universities should adjust teaching materials, reform teaching process and explore new teaching methods.

Universities should reform traditional talent training pattern, integrate the cultivation of innovative and career consciousness into the teaching process, thus finally enabling students to be multi-skill talents of firm foundation, high quality and strong ability according to the demand of social development.

Universities should perfect the practice teaching system and make sure that students obtain both diploma and professional credentials at the time of graduation.

3.3.3 Universities should perfect career guidance system as soon as possible.

Universities should establish occupation instruction organization to instruct students to conduct self-appraisal and formulate seeking work strategy.

3.3.4 Universities should make detailed investigation on employment rate of each specialty every year in order to adjust specialty direction to society demand.

3.4 Students' Measure

3.4.1 University students should make appropriate professional plans.

University students should keep enhancing themselves, striving for harmonious development of their potential and occupation skills.

3.4.2 University students should transform employment concept and mind-set.

University students should eliminate impractical ideas, instead of which they should start from ordinary worker, seeking development in basic unit and creating career in hard places.

3.4.3 University students should have an accurate orientation and a clear realization of their own quality and condition. And instead of comparing blindly, they should look for companies suitable to them according to their own condition.

3.4.4 University students should work hard to extend their qualities and improve their comprehensive abilities.

University students should have a reasonable knowledge structure, a innovative spirit, a flexible thinking mode, good psychological quality, tenacious self-control, firm faith, the ability of processing information and handling interpersonal relationship and so on.

3.4.5 Increase social practice experience

University students should take part in social practice in vacation by unifying theory knowledge with practical work to enhance their ability of processing problem and accumulate work experience.

3.4.6 University students should grasp opportunities of employment with the aid of kinds of ways.

University students should have confidence and courage and be able to study and weigh the situation to find out the appropriate employment position. And by taking advantage of talent meeting and network resources, they can seize the hard-won employment opportunity and take the initiatives to market themselves.

In summary, the reason of employment predicament is not due to a single factor, but is the result of kinds of factors together.Therefore in order to solve the difficult problems of university students' employment, we should combine the enthusiasm of all sides to form a concerted force with which the employment problem of university students can be solved fundamentally.

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A Study on the Coupling Rules

between Ecological Environment and Urban Competitiveness

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Abstract

The relation between city and ecological environment forms in the coupling process of urban systems and environmental factors, in which there is a definite rule. Urban competitiveness embodies the evolvement and development of the city, using the dissipative structure principle and mathematical analysis, this paper probes into the coupling rule between urban competitiveness and ecological environment. It is indicated that the amicability degree of human environmental behavior determines the shape of environmental Kuznets curve, the human amicable behavior and technological progress are significant for coordinating the city development and improving the urban competitiveness.

Keywords: Urban competitiveness, Ecological environment, Coupling rule

1. Introduction

At present, many scholars divide the stage of city according to the changing rule between the extrinsic landscape changing and economic growth or the proportion of the investment in environmental protection to urban economy. Urban competitiveness is an important symbol to evaluate the development of the city; the coupling state between urban competitiveness and ecological environment thoroughly embodies the harmony degree of the city, and is an objective method to evaluate the ecological construction in the city. This paper probes into the coupling rule between urban competitiveness and ecological environment, so as to judge the harmony degree of urban environment development and provide rational reference for the harmonious development of city.

2. Interactive coercing and restricting effect between ecological environment and city

Urban system and ecological environment system are the two subsystems of the huge human-earth system. The environmental quality of certain urban region is determined by the quantity of contaminations; the units of the city will continuously divide, proliferate, develop, consume energy and discharge wastes that will influence the environmental quality, after getting the information about pollution degree, the decision-making department will regulate the human activity and pollution control through policy and market mechanism, accordingly realize the balance between city and ecological environment.

Urban economic development menaces the environment: more resources and energy were consumed to increase economic aggregate, which will lead to the change of industrial structure and the manner to act on ecological environment; the change of enterprise scale and land occupation will increase the spatial pressure of ecological environment. In the process mentioned above, there is behavior that will increase the pressure of ecological environment; also there is regulation that will reduce the pressure. The economic development will introduce more environmental protection investment, while the policy interference and the popularization of cleaning technology will reduce the total amount of environmental pollutant and the environmental pressure. The menace of economic development on ecological environment is the result of the mutual interaction of the above two reverse forces.

The comfort degree of the city influences the float of human resource. In the modern world, people are paying more and

more attention to the ecological environment around their house. The residents' pursuit of beautiful environment is the main driving power for the large city to extend to the circumjacent region. The deterioration of ecological environment will lead to the effect of "bad money drives out good money (Huang, et al., 2003), the high-quality residents will be "banished " out of the city, accordingly the lost of technology and capital will induce the recession of the city and change the spatial structure of urban area.

3. Probing into the coupling rule between ecological environment and urban competitiveness basing on the dissipative structure principle

There is certain evolvement rule between the city development and environment development. According to the ergodic hypothesis, in a sufficiently large space, the development of the same region at different periods of time (time series) can be identified by the development of different regions at the same period of time (spatial spectrum) (Yang, et al., 2003). If the time is long enough and the space is large enough, the mutual interaction between city and ecological environment will show a dynamic alternant time and space variation. Hence, the mutual interaction rule between ecological environment and urban competitiveness could theoretically be revealed through the relationship between city evolvement and ecological environment and the relationship between economic development and ecological environment (Yang, et al., 2003).

The development of urban competitiveness and the evolvement track of ecological environment could be characterized by dissipative structure entropy change equation. "Dissipation" is a common concept in physics, which means the process of energy transformation from high efficacy energy to low efficacy energy. Dissipative structure is an ordered structure status of system in the nonlinear balance: an open system far from equilibrium state exchanges substance, energy and information with the external world, the various factors in the system form a ordered status in the aspect of time, space and function when there is complex nonlinear effect between the factors. "Entropy" indicates the chaotic degree of system, if the entropy is larger, the system will be more chaotic. Urban ecological system satisfies condition of dissipative structure: firstly, urban ecological system is an open large system, the city is based on the environment and exchange substance, energy, information, capital and population with the environment; secondly, urban ecological system is far from equilibrium state, in which various factors are equal, single, chaotic and are in unordered state, it is obviously that urban ecological system keeps orderly in the aspects of time, space and function, the relationship between the internal factors of urban ecological system and the subsystems is nonlinear, for example, the population grows nonlinearly, there are nonlinear feed forward multiplier effect and feed back saturation effect among the industries and departments of the city; thirdly, the urban ecological system is continuously influenced by the external world and produces numerable "small fluctuation", which will make the urban ecological system deviate from equilibrium state, when the influence of fluctuation accumulates to a certain degree, urban ecological system will produce "giant fluctuation", city will transit from the present state to more ordered state, and form a new dissipative structure, and accordingly promote the development of urban ecological system. It can be seen that as a typical dissipative structure, ecological system will surely keep to the rules of dissipative structure; the development trend of urban system will be essentially understood if the urban development rule is studied in accordance with the characteristic of dissipative structure.

The entropy change of the city includes two parts: $ds = d_i s + d_e s$ (1)

$d_e s$ means the entropy change induced by the inflow and outflow of substance and energy when the urban ecological system communicates with the external world, it is termed as systematic entropy change; $d_i s$ is the entropy change in the inner process of system, it is termed as entropy production. According the dissipative structure principle, $d_i s$ must be greater than zero, while $d_e s$ can be positive or negative. For an open system, if the ds is to be less than zero, $d_e s$ should be less than zero, and satisfies the condition: $|d_e s| > |d_i s|$, the system will be more ordered when the entropy decreases. The entropy of system is alterable (Cao, 1998), which can be ratiocinated by the following methods: firstly, the entropy production $d_i s$ and entropy flow $d_e s$ should be calculated, then the entropy change of system ds can be calculated according to the formula (1), if $ds < 0$, the entropy flow into the ecological system is larger than the entropy production of the ecological system itself, the urban ecological system will develop toward the ordered direction and be in a "growing" state; if $ds > 0$, the entropy flow into the ecological system is smaller than the entropy production of the ecological system itself, the urban ecological system will develop toward the chaotic equilibrium state and decline; if $ds = 0$, the entropy production equals to the entropy flow of the system, the system is in temporal "equilibrium" state. Different measures can be taken according to the different states of the system to make the system develop toward the direction that is propitious to the human society.

According to the characteristic of urban system, the industry, finance, insurance, foreign trade and architecture are the entropy flow of urban ecological system. The city mainly communicates with the external world through those channels. City takes in the raw material and labor force that contain much low quality energy and produces products that contain

much high-quality energy, and discharges waste that contain low quality energy to the environment, there is a entropy flow between the system and external environment, the function of which is to lower the entropy of the system. Entropy flow means the input and output of ecosystem, it embodies the exchange capacity between the system and the external world. If the absolute value of entropy flow is larger, the output of system will be larger when the inputs are the same, and the function of system will be stronger. Other industries, such as road, city planning, infrastructure, education and environmental protection, are to maintain the normal running of system, they have no direct profits and are entropy increase processes, so investment should be carried out in these projects to counteract the entropy production, and the investment can be taken as the reference to calculate the entropy production of the system, larger investment ratio means larger entropy production of the system (Wu, et al., 2000).

4. Classification of the coupling models between urban competitiveness and ecological environment

Urban competitiveness, ecological environment development and the coupling system between urban competitiveness and ecological environment are set as $d_c s$, $d_s s$, and $d_{c-s} s$. According to the definition and characteristic of ds, both $d_c s$ and $d_s s$ have three entropy change trajectories, by combining the evolvement trajectories of city and ecological environment, five kinds of coupling model are put forward, and each kind contains several similar ones as shown in table 1.

4.1 Coupling coordination model

It includes type B, if $d_c s < 0$ and $d_s s < 0$, the $d_{c-s} s < 0$, that is to say, urbanization and ecological environment development bring out the best in each other, they will become more and more ordered. Coupling coordination model is the ideal model for the development of urbanization and ecological environment.

4.2 Basic coordinating model

It includes type A, C and type M, J. Type A, C means that the urbanization or ecological environment develops orderly and both of them are in equilibrium state, the coupling system between urbanization and ecological environment tends to become ordered. Type M, J means that the urbanization or ecological environment degenerated to a certain extent, but they develop orderly and the coupling system between urbanization and ecological environment still tends to become ordered.

4.3 Conflicting model

It includes type H and K. When $d_s s > 0$, $d_c s < 0$ or $d_s s > 0$, $d_c s > 0$, the $d_{c-s} s > 0$, indicating that the urbanization develops orderly but the ecological environment tends to become chaotically, or the urbanization tends to become chaotically but the ecological environment develops orderly, generally, the coupling system tends to recession. This kind of coupling model can only exist for a short period of time, or else, the urbanization and ecological environment system will break down.

4.4 Coupling recession model

In this model, $d_{c-s} s > 0$, and it includes type E, F and G. The type G ($d_c s > 0$, $d_s s > 0$) shows strongest conflict, in which the urbanization develops chaotically and the ecological environment tends to become chaotically. This kind of model leads to the breakdown of system easily.

4.5 Critical model

In this model, $d_{c-s} s = 0$, and it includes type D, I and L. This is the "threshold" for the coordination or conflict of coupling. It includes positive mutation (from conflict to coordination, usually happens at the high-level stage of urbanization) and negative mutation (from coordination to conflict, usually happens at the preliminary stage of urbanization).

5. Mathematical analysis on the coupling between ecological environment and urban competitiveness

Commoner (1991), an economist, put forward the famous environmental quality equation (IPAT), he thinks that the population scale, economy scale and technological progress determine the contaminations produced by human, to reduce the contaminations or keep the total amount constant, the broad sense technological progress should be equal to or exceed the economic growth speed (Wu, et al., 2000). The relationship between economy and ecological environment development can be shown with environment Kuznets curve in inverse "U" (EKC), which exhibits the characteristic of mutual development of economy and environment. At the beginning of modern economy, resource-intensive industry that severely polluted the environment took the dominant position, people paid little attention to the environment, and there was little cleaning technology, the environmental pollution became more and more severe with the development of economy; after a period of time, knowledge intensive industry and cleaning technology were developed and popularized, environmental pollution was gradually alleviated. Basing on the data from 157 countries in 1977, Zhou Yixing, a Chinese scholar, put forward that the relationship between urbanization and economic growth could be expressed with logarithmic curve, on the basis that proportion of urban population

represented the urbanization level, and the per capita GDP represented the economic development level (Zhou, 1995; Xu and Zhu 1988).

The coupling relation curve between urbanization and ecological environment is the logic combination of environment Kuznets curve and logarithmic curve (Huang, et al., 2003). According to algebra and geometry, the formula $z = m - a[10^{\frac{y+b}{a}} - p]^2$ (2) can be deduced, in which z is the ecological environment index, Y is the urbanization level, m is the ecological environment threshold, a, b, P are non negative parameters. The coupling rule between urbanization and ecological environment can be qualitatively analyzed in accordance with the formula (2): when $10^{\frac{y+b}{a}} < p$, ecological environment will gradually deteriorate with the development of urbanization; when $10^{\frac{y+b}{a}} = p$, the deterioration of ecological environment will achieve critical threshold; when $10^{\frac{y+b}{a}} > p$, ecological environment will gradually improve with the development of urbanization.

With the development of urbanization, more contaminations will be discharged, the change of pollutant quantity can be reflected with exponential function $z = \alpha e^{\delta t}$, and the GDP growth in a period of time can be expressed with exponential function $x = \beta e^{\theta t}$ (α、 β、 δ、 θ are constants, t is time), the environmental pressure function will be $p = \alpha\beta e^{(\delta+\theta)t}$ ($\delta < 0, \theta > 0$), δ means the enhancement of people's consciousness to protect the environment, the optimization of industrial structure and the improvement of technology, so it is negative; θ is positive. If $\delta + \theta > 0$, the environmental pollutant quantity will increase with the high-speed development of economy, and the environmental pressure will be increased; if $\delta + \theta = 0$, environmental pollutant quantity will keep constant, and the environmental pressure will be stable; if $\delta + \theta < 0$, environmental pollutant quantity will decrease with the development of economy, and the environmental pressure will be decreased (Liu and Li, 2006). Hence, the precondition to realize the environment Kuznets curve in inverse "U" is $\delta + \theta < 0$, δ and θ can be controlled, the shape of environment Kuznets curve in a short period of time depends on the influence of human activities, if the human activity is friendly to environment, the turning point of environment Kuznets curve will present itself early.

6. Conclusion

There is a certain rule in the development of urban environment, the coordinated development of city demands that subsystems of the city don't damage each other. The shape of environment Kuznets curve depends on the amicability degree of human activity to a great extent, man-made amicable environmental behavior and the implicit technological progress are of great significance for coordinating the urban development, accelerating urbanization and improving the urban competitiveness.

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Table 1. The coupling models between city and ecological environment

coupling models	$d_c s > 0$	$d_c s = 0$	$d_c s < 0$
$d_s s > 0$	$G(d_{c-s} s > 0)$	$F(d_{c-s} s > 0)$	H, I, J
$d_s s = 0$	$E(d_{c-s} > 0)$	$D(d_{c-s} > 0)$	$A(d_{c-s} s < 0)$
$d_s s < 0$	K, L, M	$C(d_{c-s} s < 0)$	$B(d_{c-s} < 0)$

H, K: $d_{c-s} s > 0$; I, L: $d_{c-s} s = 0$; M, J: $d_{c-s} < 0$

The Prevention of "Valley Effect"

in the Olympic Games of Beijing

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Abstract

The Olympic Games of Beijing will speed the steps of the economy construction of Beijing area even of the whole country; meanwhile, the valley effect will be unavoidable. The essay analyses the economic value of previous Olympic Games and makes suggestions for the prevention of possible valley effect and realize continual development from the point of financing, gymnasium construction, and industry continual development.

Keywords: the Olympic Games of Beijing, Valley Effect, Prevention

The success of Beijing bidding for Olympic Games will largely quicken the pace of Beijing's and even our country's economic construction. In the terms of the history of Olympic Games, from the 1984 Olympic Games of Los Angeles in the USA, each host of Olympic Games all gained benefits. Olympic Games promote the basic facilities construction of host and encourage the rapid development of the host. But when the investment cycle of Olympic Games comes to the end, different extent of "Economic Valley Effect" emerges in each host. Therefore, seriously analyze the economic values of all previous Olympic Games and prevent the economic development in Beijing area from being impacted after Olympic Games, makes a practical significance for Beijing on the success of holding the 2008 Olympic Games.

1. Analysis about the economic values of previous Olympic Games

Through holding Olympic Games, hosts can attract large sum of investment, go on constructing and reconstructing large scale of basic facilities. Meanwhile, it can also encourage the rapid development of related service trades and promote the host's economic growth.1984 Olympic Games of Los Angeles brought 3.29 billion dollars worth of benefits for South California district, Olympic Games of Barcelona, Olympic Games of Atlanta and Olympic Games of Sydney brought 26.048 billion dollars worth, 5.1 billion dollars worth and 6.3 billion dollars worth of benefits respectively.

1.1 Holding Olympic Games' influence on the improvement of national economy

In the terms of each year, the income of host from Olympic Games presents the tendency of steady increasing —— rapidly increasing —— progressively falling. The benefits from Olympic Games focus on the 2 or 3 years before and after the beginning Olympic Games. The gained gross output value of Utah reached to 4.48 billion dollars on account of the Winter Olympic Games of Salt Lake City from 1996 to 2003. In the period of rapidly increasing (from 2001 to 2003), the gross output of Utah's related trades reached to 3.37 billion dollars which occupied 75.2 percentage of the total value. (As Graph 1)

1.2 The influence of holding Olympic Games on improving the standard of employment

Holding Olympic Games need to construct and reconstruct a large number of sports facilities and complete set of basic facilities. Therefore, a great deal of labor and material is needed to invest in. Considerable athletes and tourists will also promote the development of service trade and service trade's demand to labor will gigantically increase during Olympic Games. All previous Olympic Games made an important effect on improving the standard of employment in host. Each

year, there were nearly 60 thousand work posts increased in Barcelona during 7 years preparing Olympic Games, 1996 Olympic Games provided 84 thousand employment opportunities for Atlanta and Olympic Games provided 28 thousand new employment opportunities just in 2000.

Meanwhile, we should also notice that, the work opportunities related to Olympic Games are not annual, steady posts. Except that constructing basic facilities and sports facilities can provide a large number of steady work posts, most service posts related to Olympic Games is just short-terms. New South Wales provided approximately 70000 work opportunities during Olympic economic cycle from 1994 to 2002 and there were approximately 22000 increased labors just in the holding year which was the year when labors increased most. But after holding Olympic Games, there were 2000 unemployment because of the end of Olympic Games in 2002. (As Graph 2)

1.3 The influence of holding Olympic Games on industrial structure

The influence of holding Olympic Games on different industries is different. Construction, traffic transportation, trade, finance, and other non-goods trades industries are the main benedictory. In the income from holding 1996 Olympic Games of Atlanta, benefits from lodging and amusement, commercial service, catering, retailing, transportation were 0.678 billion dollars, 0.596 billion dollars, 0.412 billion dollars, 0.321billion dollars and 0.235 billion dollars respectively, which occupied 43.7 percentage of all income (as Graph 3). But the influence of Olympic Games on agriculture, mining, smelting, mechanical manufacture and other trades is almost small, and even minus.

2. Prevention of "Valley effect" in 2008 Olympic Games

From the view of investment, the negative economy of Olympic Games at least resides in two aspects, first one is so called "Siphon Effect" which means the host cities will attract investment from other place and lead to "Outer Loss". Moreover, the huger promotion function which the Olympic economy through direct investment exerts on economy, the larger impact it brings to the economy of host cities and host countries when the investment cycle of Olympic Games ends (usually after the close of Olympic Games). This feature of Olympic economy is called "Valley Effect" in the foreign countries.

Olympic Games of Beijing will have an encouraging effect on economy through huge direct investment. We learn from experience that Olympic economy have evident periodicity. According to the statement of cash flow listed by the Beijing 2008 Olympic Games Bid Committee, the period when Olympic economy promote employment mainly focuses on 6 years from 2004 to 2009, and the summit of Olympic economy approximately comes about from 2006 to 2008. Although this cycle may be postponed due to the 60th National Day in 2009, Olympic economy will still begin entering the Valley period after 2010. As the host city of Olympic Games, Beijing will undoubtedly experience "Economic Valley Effect" after the ending of Olympic Games. So we should make a long-term schedule and draw lesson from the successful experience of previous host, through which make sure the steady growth of Beijing, Tianjin and even the whole country, and prevent "Valley Effect" from arising.

2.1 Creating various source of assembling money and making effective use of money. Be vigilant for the blind investment in the name of Olympic Games, which lead to the sharply decreasing of investment and impact on the economic development after Olympic Games

As an unindustrialized country, Beijing needs to construct and reconstruct more basic facilities to hold 2008 Olympic Games than the USA, Australia, and other industrialized countries, and needs more construction money. The amount of investment related to 2008 Olympic Games will be almost 35 billion dollars.

According to the source of money in all previous Olympic Games, the input from government occupied 95 percentage in 1976 Olympic Games of Montreal, but in 1994 Olympic Games of Los Angeles and 1996 Olympic Games of Atlanta, it only occupied 2 percentage and 15 percentage respectively, compared to 46 percentage, 38 percentage and 30 percentage respectively in Olympic Games of Seoul, Olympic Games of Barcelona and Olympic Games of Sydney (as Graph 4). In reality, the model that the input is from both government and personality is more helpful to the economic development. 2008 Olympic Games should also acquire this model to gather money in various ways. Government mainly invests in construction of basic facilities and public facilities which have long-term influence; enterprise mainly invests in the development of items which can gain economic benefits in short time with the instruction of government. Thus, on the one hand, it can decrease the financial pressure of government, and on the other hand, it can promote the balance development of cities.

In the capital market, we should value the analysis to the traditional way of gathering money, and strive for combining it with financial creation, like issuing long-term construction debenture, forming project enterprise to list, gathering insurance fee and so on. Actively mobilize the activity of personal investment to participate in the construction of Olympic Games items on the purpose of reducing the pressure of government.

In the other way to gather money, sports lottery has already become the main source of money to develop our sports undertaking. There is a margin of 1 billion Yuan increased in sports lottery each year from 2002 when sports lottery

began to issue. Its public finance is specially used in the preparation of Olympic Games to make sure the successful fulfill of the construction items during Olympic Games.

2.2 Making long-term schedule and reasonable constructing stadium to make sure the reuse of the stadium after Olympic Games and avoid wasting.

Canada constructed a lot of stadium and facilities in order to hold 1976 Olympic Games together with the expensive maintenance fee and demolishment fee which made Canadian government in huge debt. Japanese government spent 19 billion dollars in constructing high speed train, skiing track and other facilities in 1998 Winter Olympic Games of Nagano. Expensive maintenance fee to stadium and the low utilization ratio after Olympic Games made Nagano the highest record of Japanese regional economic depression after World War Two.

2008 Olympic Games of Beijing is one of the most investments in all previous Olympic Games. It's very important to make a long-term schedule to the construction of these stadiums. We can draw lesson from Olympic Games of Sydney to make a reasonable arrangement to the facilities of Olympic Games. The utilization of holding Olympic Games and pro- Olympic Games should be combined.

Construction of stadium should be considered combining with the construction of dwelling, which makes it is the citizen's gymnasium thus, being utilized further. Meanwhile, the newly developed housing district can also rise in value. Lodging facilities can be built according to newly constructed stadium, constructing shopping catering, amusement and other facilities in order to make stadium socialized and convert it into "commercial stadium".

Stadium should be converted into the arena which can hold other activities, and utilized in sports, leisure, culture, exhibition, commerce and other aspect. In the recently constructed stadium, The Beijing Sports University Stadium and so on all can be used as school's sports facilities to utilize after Olympic Games and the exhibition hall of China International Exhibition Center which was reconstructed by investment can still be used as large-scale exhibition arena after Olympic Games.

2.3 Speeding up the adjustment of industrial structure, instructing the healthily development of related industries, avoiding leading to the economic depression after Olympic Games on account of blind competition and achieving sustainable development

The adjustment of industrial structure in Beijing should be sped up. The enterprise which is highly costly and seriously polluted should be moved away from the secondary industry, and replaced by new and high-tech enterprises, urban type industrial enterprises which make people convenient and the head quarters and research or sales center of large enterprise. Meanwhile, the non-goods commercial trades which can embody the advantages and features of Beijing area, like touring, finance, information, exhibition, culture, sports, catering, commerce, hotel, real estate, transportation and so on, to optimize the industrial structure of city.

What needs to point out is that Olympic economy can bring in the high speed growth of service trades' demand in a certain terms, but not long term. So, as to the government, it should prevent ahead of time, strictly control and acquire various way to prevent enterprises from entering into blindness, and avoid the disordering entering of the enterprises which is poor in competence.; as to the enterprise, it should make schedule to the development strategy and goal of enterprise through risk estimation, develop in the fair marketing economic order from the improvement of own capacity,. At the same time, enterprises should strengthen self discipline and avoid behave which do harm to the development of trades, like blindly extending scale, vicious competition and so on.

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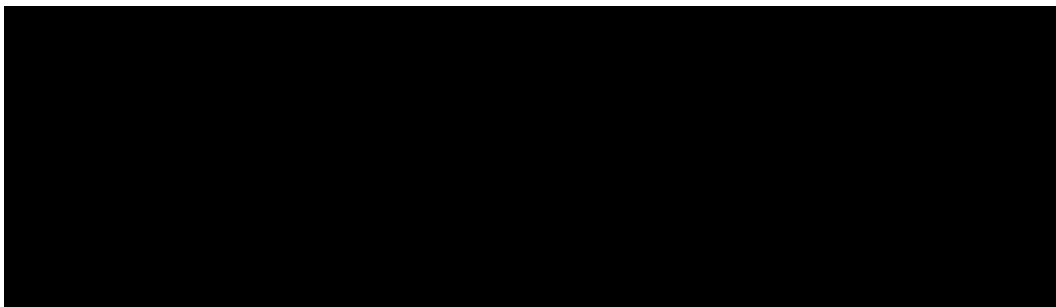
Figure 1. the influence of Winter Olympic Games of Salt Lake City on the economic gross value of Utah
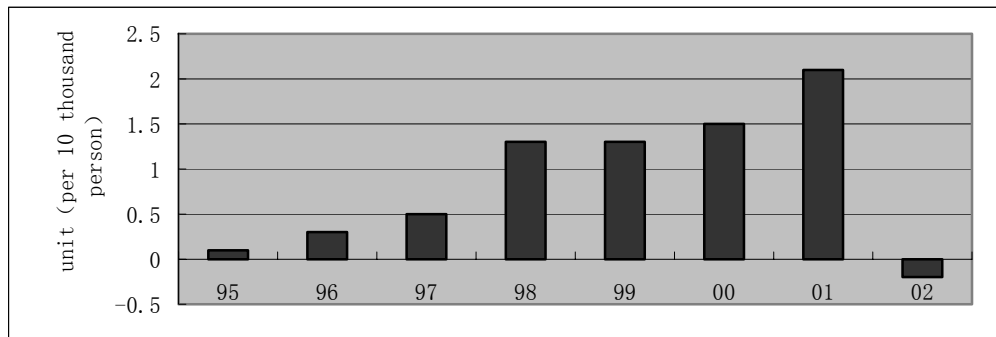
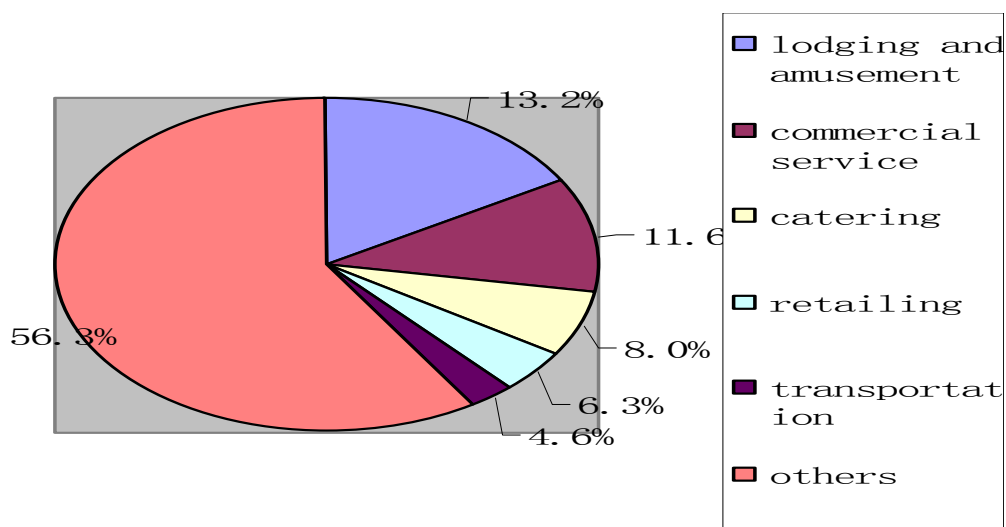Figure 2. the newly increasing number of employment related to Olympic Games of Sydney

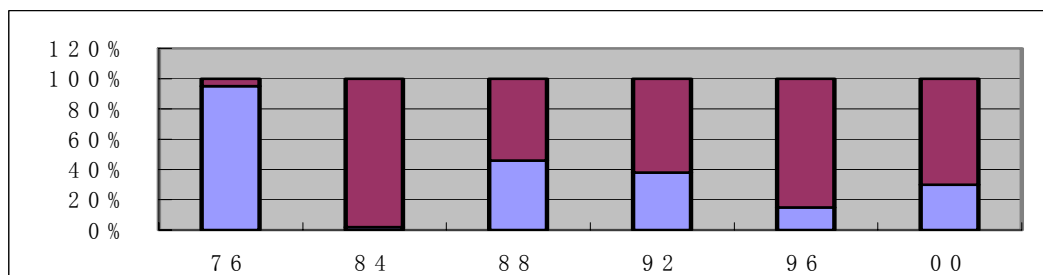Figure 3. the influence of 1996 Olympic Games on each industry in Georgia

Figure 4. the financial resource of the all previous Olympic Games

Psychological Wellbeing of Elderly Caregivers

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Abstract

In this article, the author reviews the concept "psychological wellbeing" from western and eastern perspective, and the concept of adult child caregiver, finally analysize several cases from psychological wellbeing perspective.

Keywords: Psychological wellbeing, Elderly caregiver

Psychological well being is closely related to caregivers' stress and burdens. Thus, it follows logically to review the concept. First, the author will review the concept of psychological wellbeing, and then review the various avaluable measurement scales used in the current study, namely, Affect Balance Scale (ABS), including Positive Affect Scale (PAS) and Negative Affect Scale (NAS).

The Concept of Psychological Wellbeing

Although psychological well-being has been extensively evaluated (e.g., Diener, 1984; Diener & Emmons, 1984), when it comes to articulating the basic structure of psychological well-being, the researchers always center the discussions around the distinction between positive and negative affect and life satisfaction (Andrews & Withey, 1976; Bradburn, 1969; Bryant & Veroff, 1982; Diener & Emmons, 1984; Liang, 1984,1985).

Diener (1984) grouped the definition of wellbeing into three categories. Firstly, wellbeing is defined by external criteria such as virtue or holiness. In this normative definition, wellbeing is not thought as a subjective state but rather as one possessing some desirable qualities. Secondly, social scientists have focused on the question of what leads people to evaluate their lives in positive terms. This definition of wellbeing has come to be labeled life satisfaction and relies on the respondents to determine what a good life is. Thirdly, the meaning of wellbeing comes closest to the way the term is used in everyday discourse and denotes a preponderance of positive over negative affect (Bradburn, 1969), which emphasizes pleasant emotional experiences.

In Diener et al.'s study (1999, 2003), they explained that the field of subjective well-being (SWB) comprises people's moods, emotions, and self-evaluative judgments that fluctuate over time and that exists between individuals and societies. General reviews of SWB can be found in Argyle (2001), Diener (1984), Diener & Lucas (1999), and Kahneman (1999). Each of the components of SWB reflects people's evaluations of what is happening in their lives, the facets of SWB such as positive affect, lack of negative affect, and life satisfaction show some degree of independence (Andrews & Withey 1976, Lucas et al. 1996) and therefore should be measured and studied individually.

The field of SWB has several different lines of research. Diener (1984) and Veenhoven (1984) brought these various strands in integrative reviews. Firstly, Diener (2003) concluded that sociologists and quality of life researchers who conduct surveys to determine how demographic factors influence SWB has a major influence on the field of SWB (Bradburn 1969, Andrews & Withey 1976, and Campbell et al. 1976). Secondly, mental health researchers who extend idea of mental health beyond depression and distress to include the presence of happiness and life satisfaction have another influence on the field of SWB (Jahoda 1958). Thirdly, personality psychologists who studied the personalities of happy and unhappy people have influence on the field of SWB (Wessman & Ricks 1966). Finally, social and cognitive psychologists who studied how adaptation and varying standards influence people's feelings of well-being have influenced the study of SWB (Brickman & Campbell 1971; Parducci,1995).

Ryff (1995) distinguished two primary conceptions for the study of psychological wellbeing for more than 20 years. The first primary conception, traceable to Bradburn's (1969) study, distinguished psychological wellbeing between positive and negative affect and defined happiness as the balance between the two parts. The second primary conception has gained prominence among sociologists, which emphasizes life satisfaction as the key indicator of psychological well-being. Many scholars (Andrews & McKennell, 1980; Bryant & Veroff, 1982; Campbell, Converse, & Rodgers,

1976) viewed life satisfaction as a cognitive component and concluded the more affective dimension of positive functioning.

Researchers (Boey & Chiu, 1998) in the field of psychological well being agreed that psychological wellbeing generally consists of two important aspects, namely positive and negative affect. Hence, both positive mental health (e.g. happiness and life satisfaction) and mental ill-health (e.g. anxiety and depression) are taken into account in the evaluation and measurement of psychological wellbeing. In line with this division, also considering the discussions above, we can finally conceptualize that psychological wellbeing as including both positive and negative aspects. One may ask whether positive mental health and mental ill-health are opposite poles of the same continuum of psychological wellbeing or whether they refer to two independent constructs and realities that should be measured on two independent axes. It has been proposed that positive mental health and mental ill-health are two interrelated but globally independent constructs that should be measured on two independent axes (Atienza, Stephen, & Townsend, 2002). Here, positive affect is used to indicate mental health, and negative affect to indicate mental ill health, on the basis of the reasons provided below.

Positive Affect Scale and Negative Affect Scale (PAS and NAS)

In the 1960s, Bradburn developed a scale to measure emotional wellbeing (1969) and found that positive and negative affect items were relatively independent of one another. Bradburn proposes that happiness is composed of two separable components: positive and negative affect. Although the positive and negative affect scales were virtually uncorrelated with each other, they each showed independent and incremental correlations with a global wellbeing item (Bradburn, 1969). Bradburn hypothesizes that happiness is really a global judgment people make by comparing their negative affect with their positive affect. Thus, his Affect Balance Scale (ABS) score is derived by subtracting the sum of negative items from the sum of positive ones. Bradburn's positive affect scale asks whether the respondents, during the previous few weeks, have felt, for example, proud because someone complimented them about something they had done, or pleased about having accomplished something. The negative affect scale asks, for example, if the respondent had felt upset, depressed, or very unhappy when criticized by someone.

Humanistic psychologists such as Rogers and Maslow maintain that concern with psychopathology overlooks the positive aspects of life. Bradburn's conclusion that positive and negative affect are independent supports the long-standing argument of the humanists that psychologists focus too exclusively on the negative, and Bradburn's proposal supports the idea that absence of negative affect is not the same as the presence of positive affect. According to Bradburn's findings, attempts to enhance life satisfaction must both reduce the negative and increase positive affect.

In the present study, since stress is oriented to negative rather than positive experiences, the identification and detection of negative affect are considered essential for the maintenance and promotion of psychological wellbeing under stress. However, it is also important to increase positive affect. Therefore, this study adopts Bradburn's two-factor theory as the indicator of psychological wellbeing.

As explained in the previous chapter, the city of Guangzhou is chosen as the site for this study. The various aspects of filial piety, caregiver burden in caring for ageing parents, and their possible impacts on caregiver's psychological well-being are conceptualized in the context of a modernizing China especially in the urban regions of China. Guangzhou has been one of the leading cities in China in the path towards modernization. It has undergone the major socio-economic as well as cultural transformations accompanying modernization, and thus will definitely exhibit the corresponding problems of caregiver problems in the context of an ageing population. It thus warrants taking Guangzhou to investigate the possible relationships existing in the various domains explored in the above literature review, which might make reference to other Chinese cities undergoing similar processes of modernization. Admittedly, as China is a vast country with great regional disparity, the present study may not be entirely applicable to the rural and other less developed regions of China.

Wellbeing of Adult Child Caregiver

In addition to describing the physical and mental conditions of aged parents, subjects were invited to talk about the experiences of caring for the elderly parents, the difficulties they met during the process of taking care of the parents, the motivations of looking after parents, opinions of filial piety, the burden in the process of caring and their received support from others. In the following section, the method of content analysis was used to identify the attributes of well-being from the in-depth interview data in order to build a model of well-being of adult children caregivers theoretically.

The in-depth interview data were analyzed to identify the meaningful verbatim responses. For example, a subject reported that she divorced and took care of her father alone, and this made her feel depressed. This statement implied that caring for the elderly alone was a difficulty to the subject. Thus, the first level code "difficulty in caring process" was identified. Using this analytic process, other attributes emerged subsequently and the model of well-being of adult child caregivers was constructed.

Reciprocity (*Hui Bao*) for Parents' Raising Efforts

Six subjects spontaneously reported that taking care of their aged parents was their responsibility. The statements in the case studies of F1, F2, M1, and M2 provided good examples of the importance of valuing repayment. Some western studies (Kinney, 1996; Wicclair, 2000) show that reciprocity for having been raised by one's parents is one of the motivations to care for them.

My mother did not find it easy to raise me. I never think that she is a big burden for me. I have not such thoughts. I think I should have filial respect for her. (F2)

The state propagandizes the value of filial piety. I regard it as a necessity. It is our duty. (M1)

My father cared for my son for a long time. He took him from the kindergarten to home. (F1)

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Blood Cell Morphology, Some Hematological and Serum Biochemistry Values of Common Kestrel (*Falco tinnunculus*)

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Abstract

In this study, morphological characteristics of peripheral blood cell, and certain hematological and serum biochemistry values were determined in 16 clinical healthy adult common kestrels in order to establish normal reference values for this population. Seven different types of blood cells were determined, such as erythrocytes, thrombocytes, big lymphocytes, monocytes, heterophils, basophils, small lymphocytes. According to the results, hematology of red blood cell counts, white blood cell counts, hemoglobin, packed cell volume, mean corpuscular hemoglobin (MCH), mean cell volume (MCV), mean corpuscular hemoglobin concentration (MCHC) were $2.47\pm0.55\times10^{12}$/L, $6.02\pm1.42\times10^{9}$/L, 124.6 ± 16.74g/L, $39.94\pm3.84\%$, 523.01 ± 119.49pg, 523.01 ± 119.49fl, $314.29\pm48.80\%$. The results showed that serum biochemistry concentration of uric acid, total protein, albumin, alkaline phosphates were 2.22 ± 0.68 nmol/L, 6.94 ± 0.61g/L,4.91 ± 0.44g/L, 10.17 ± 2.93mg%. And, the different counts of leukocytes in the peripheral blood of clinical healthy common kestrel were determined as follows as $49.80\pm1.03\%$ heterophils, $43.80\pm5.44\%$ lymphocytes, $1.80\pm1.48\%$ monocytes, $0.00\pm0.00\%$ eosinophils, $3.60\pm1.24\%$ basophils. These hematology and serum biochemistry values can be used as standard profiles for healthy adult common kestrel in captivity.

Keywords: Biochemistry, Common Kestrel, Hematology, Blood cell characteristic

Campbell (1995) introduced that evaluation of avian hematologram has become a useful tool for the diagnosis of avian diseases. As the same to, hematologic and blood biochemistry analyses are valuable tools for evaluating health of wildlife, both diagnosing disease and clinical monitoring of the patient (Karesh *et al.*, 1997. Lanzarot *et al.*, 2001. Lanzarot *et al.*, 2005. Toro *et al.*, 1997. Villouta *et al.*, 1997. Wyk *et al.*, 1998.). However, Lanzarot et al. (2005) presumed that proper interpretation of these parameters requires appropriate reference values for each species to minimize the effect of species differences. Morphologic characteristics of avian blood cells are heterogeneous.

Common Kestrels (*Falco tinnunculus*) belong to the genus *Falco*, family *Falconidae* which include 13 species in the China (Zhen, 2005). They have grey with black tip and yellow cere bill (Li, 2004). They are normally distributed in Heilongjiang, Beijing, N Neimenggu, N Xinjiang (Zhen, 2005). A previous study reported morphological observation of digestive system of Common Kestrels (Niu *et al*, 2004).

At present, Common Kestrel is an endangered species. However, basic hematological values, morphological characteristics of peripheral blood cell and serum biochemistry values have not been described in these species. The purpose of this study is to obtain the hematology and serum biochemistry values in Common Kestrels. Knowledge of the morphological characteristics, hematological and serum biochemistry values may be applied in physiological study, health diagnosis or in-depth study directed toward their conservation.

1. Materials and methods

1.1 Experimental animal

Sixteen adult Common Kestrels (*Falco tinnunculus)*, clinically healthy and in good condition, were kept at the Beijing wildlife rescue and rehabilitation Center. The Common Kestrels were divided into six groups of 4 animal, each group was kept in middle house (500mm×200mm×600mm).

1.2 Blood sampling

Common Kestrels were restrained manually without applying sedation. All birds were examined and sampled in the nest between eight o'clock to ten o'clock AM. Each bird was handled for approximately 10 min for physical examination as described by Samour (2000), and the blood sample was obtained at the beginning of the handling period. Blood samples for the biochemical examination and the hematological profile examination were collected from the wing vein. A total 1.5 ml of blood was collected from each of experimental animals.

1.3 Blood cell morphology

Blood samples for morphological characteristics of peripheral blood cell were obtained without any anticoagulant. Blood smears were immediately and air-dried. The method of Wright's stain (Bounous *et al*., 2000. Driver, 1981. Kuiken *et al*., 1999) for the basal blood cells type's characterization was used. The leukocyte differential counts were assessed by enumeration of 200-cell in each smear. Each cell type was measured and characterized.

1.4 Hematology

The blood from each Common Kestrel was mixed immediately in tubes with the anticoagulant natrium ethylenediaminetetraacetic acid (1.5 mg/dl). After collection, whole blood was used for the complete blood count. White blood cell counts (WBC) and red blood cell counts (RBC) were applied by an improved Neubauer hemocytometer (Brand, Wertheim, Germany) and Natt and Herrick's solution in blood cell dilution pipettes (Campbell, 1995). Packed cell volume (PCV) was tested by centrifugation at 3,000×G for 30 min (He *et al*., 2003). Hemoglobin (Hb) content was studied by cyanide-free hemoglobin determination (Campbell, 1995). Mean cell volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were calculated using the following formula (Campbell, 1995): MCV= (PCV/RBC) ×10; MCH= (Hb/ RBC) ×10; MCHC= (Hb/PVC) ×100.

1.5 Serum biochemistry

The blood from each Common Kestrels was transferred to tubes without anticoagulant, and serum were collected by centrifugation (3,000×G for 30 min) for biochemistry and protein electrophoresis analyses. The samples were maintained at 4–6 ^{0}C and in the dark. Blood samples were processed in the laboratory within 12 hr, and hematological analysis was investigated on the day of collection by the same person. Protein electrophoresis was performed by a spectrophotometer. Total protein (TP) was determined with the Biuret method (Lumeij *et al*, 1996).

1.6 Statistical analyses

Statistical analyses of hematologic and serum biochemical values were applied arithmetic mean, standard deviation (SD) and range.

2. Results

2.1 Blood cell morphology

Matured erythrocytes of Common Kestrels were ellipsoidal cells (13.2±0.68μm×7.30±0.79μm, Figure 1) with rounded

poles and uniform orange-pink cytoplasm. They were centrally positioned oval nucleus (7.27±0.59μm×3.37±0.57μm) that contained dense and dark-staining chromatin. Its long diameter was parallel with long diameter of the cell.

Heterophils (Figure 2), 11.35±0.77μm×10.52±0.64μm, was a single round or irregular cell with spindle or oval shaped cytoplasmic granules .They were shorter and wider than matured erythrocytes. The nucleus had 2 -3 lobules with contained dense and dark-staining chromatin. Wright solution only stained these granules slightly.

Basophiles (Figure 3), 8.7±0.71μm×8.1±0.60μm, was slightly smaller than the heterophils and matured erythrocytes, their cytoplasm contained strong basophilic granules. These cells were often easily identified on Wright stained in the blood smears by the appearance of numerous, deeply basophilic, round cytoplasmic granules.

No eosinophils were identified in blood smears.

Lymphocytes had compact dark nucleus and thin cytoplasm fringe of blue color. They had two modes, which one was small lymphocyte (8.35±0.72μm×7.77±0.73μm, Figures 4), other was big lymphocyte (10.38±0.83μm×9.38±0.88μm, Figures 5).

Monocytes, 12.01±0.52μm×11.03±0.82μm in diameter, were the largest leukocytes found in the blood film (Figure 6), these cells with large quadratic nuclei with pale and fine chromatin.

Thrombocytes were small oval or round cells, the nucleus was the cytoplasm colorless. Nuclei were oval with dense chromatin. When thrombocytes aggregated, they turned into round cells. The morphologic features of blood cells from Common Kestrels were similar to those of other species of avian.

2.2 Hematology and serum biochemistry

Results of hematology and serum biochemistry analyses are summarized in table 1

WBC=white blood cells. RBC=red blood cells. PCV=packed cell volume. Hb=hemoglobin. MCV=mean cell volume. MCHC=mean corpuscular hemoglobin concentration. MCH=mean corpuscular hemoglobin. TP=total protein; AKP =alkaline phosphates. UA= uric acid. AP= albumin. DC=different white blood cells

3. Discussions

The first record of hematological, morphological characteristics of peripheral blood cell and serum biochemistry values of Common Kestrels are presented in this article. Sixteen adult clinically healthy Common Kestrels were studied. All birds appeared to be in good condition, and no abnormalities were noted during physical examination or in hematological analyses throughout the observation period (30 days). All indexes did not have a normal distribution. No eosinophil was identified in blood smears. Blood cell characteristics were the same to *Chrysolophus pictus* (Chen *et al*., 2007). The morphology of erythrocyte and white blood cells of Common Kestrels are showed in Figures 1 - 6. Their reference intervals can be used as baseline information for further studies. It is important to use healthy animals in the establishment of reference values. However, it can be difficult to determine the health of individuals when studying field-caught wild species (Weber *et al*., 2002).

All blood smears in the present study were prepared immediately after venipuncture from animals, to prevent any possible effect of anticoagulant on cell morphology. Blood exposed to heparin for several hours will usually not stain as slides made immediately after collection (Walberg, 2001). Hemolytic destruction of chelonian cells by EDTA was described (Mc Arthur, 1996; Muro *et al*, 1998). EDTA is wildly used in avian practice; however, it is reported to cause hemolysis of blood in some avian species (Walberg, 2001).

Hematological and blood biochemistry values are widely used in avian veterinary medicine, for example, in the interpretation of laboratory results during disease. Besides, hematological and serum biochemistry values are also very important in detecting various metabolic and nutritional disorders in avian species, but it is important to have hematological data on each species in order to interpret the results accurately for a particular individual(Aengwanich *et al*., 2002). Hematological values are important for clinical pathological diagnosis such as traumatic injury, parasitism, organic disease, bacterial septicemia and nutritional deficiencies. Besides, anemia was defined as the presence of a below-normal red cell count, hemoglobin concentration, and/or packed cell volume, and increased mean corpuscular volume.

Total and differential leukocyte counts vary widely in avian species, probably reflecting interspecies variability and different capture, restraint, and blood collection methodologies (Padilla et al., 2003). Total white blood cell count greater than 10,000 cell/μl was considered suggestive of leukocytosis. General causes of a leukocytosis may include infection, trauma, toxicities, hemorrhage into a body cavity, rapidly growing neoplasms and leukemia (Aengwanich *et al*., 2002). The mean WBC for these Common Kestrels is lower than values reported in nestling bald eagles (Bowerman *et al* ,2000), supposedly because of different analytic methods and interspecies variability.

The leukocyte differential aids in the assessment of the leukocytosis. Because a leukocytosis is often caused by inflammation, a heterophilia usually present. The magnitude of the heterophilia usually indicates the magnitude or

severity of the initiating inflammatory process. Heterophils were the most numerous leukocytes in the blood of these Common Kestrels, the same as has been reported in nestling bald eagles (Bowerman *et al*, 2000). A leukocytosis and heterophilia can be associated with infectious agents (e.g. bacteria, fungi, chlamydia and parasites). A slight to moderate leukocytosis, heterophilia and lymphopenia can result from either an exogenous or endogenous excess of glucocorticoids (stress response). A lymphocytosis may be expected with antigenic stimulation associated with certain infections. A lymphopenia also may be expected with certain viral disease. A monocytosis can be found with certain disease that produce chemotactic agent for monocytes. These conditions include avian chlamydiosis, mycotic and bacterial granuloma and massive tissue necrosis. An eosinophilia associated with gastrointestinal nematode infections has occasionally been reported. Avian basophils are similar to mammalian basophils in their ability to produce, store and release histamine. Basophils are appeared to participate in the initial phase of the acute inflammatory response in birds, but this is not always reflected as a basophilia in the leukogram.

In this experiment, no eosinophils were identified in the blood smears, probably because the granules within avian eosinophils are water soluble and may stain poorly with Wright's stain (Bounous *et al*., 2000; Driver, 1981; Kuiken *et al*., 1999).

Mean corpuscular hemoglobin (MCH), PCV and Hb values were higher than the reference data reported by Bowerman et al (2000), supposedly due to adaptation to flight, at which the time they need for oxygen is greatly increased.

In this experiment, the concentration of the serum total protein in Common Kestrels was higher than those described for plasma in nestling bald eagles (Bowerman *et al*, 2000). According to Rosental (2000), protein electrophoresis is used to determine the exact blood albumin concentration, to evaluate whether a disease process is acute or chronic, and to detect whether a patient has an infection.

In this study, uric acid was different to those reported in nestling bald eagles (Bowerman *et al*, 2000), possibly because of different analytic methods.

Normal values for blood constituents vary widely for different species (Wyk et al., 1998). Lanzarot *et al* (2005) indicated that to assess the physiologic and pathologic condition of wild birds it is of paramount importance to know normal blood values for individual species. The hematologic, blood biochemistry, and the characteristic of blood cell obtained in this study for Common Kestrels will possible be useful for the interpretation of laboratory findings in future studies and clinical cases.

In this paper, the biochemical and hematological profile reported may be used as a standard profile for healthy Common Kestrels kept in captivity. Nevertheless, some differences could be expected, especially when it comes to young Common Kestrels with rapid growth and/or to adult females during the reproductive season.

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Table1. Hematological and blood biochemistry values of Common Kestrels

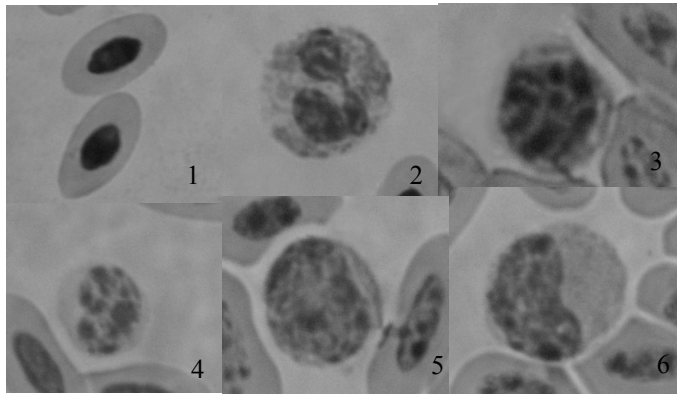| Parameter	Mean±SD	Range
AKP (mg%)	10.17±2.93	7.69—15.23
AP(g/L)	4.91±0.44	4.34—5.95
DC (%): Basophils (%)	6.94±0.61	1.00—5.00
Eosinophils (%)	0.00±0.00	0.00-0.00
Heterophils (%)	49.80±1.03	42.00—55.00
Lymphocytes (%)	43.80±5.44	35.00—56.00
Monocytes (%)	1.80±1.48	1.00—4.00
Hb(g/L)	2.47±0.55	88—145
MCH(pg)	523.01±119.49	341.08—669.90
MCV(fl)	169.15±44.51	114.10—281.97
MCHC (%)	314.29±48.80	204.36—361.11
PCV (%)	39.94±3.84	32.40—45.83
RBC(1×10^{12}/L)	2.47±0.55	1.52—2.92
TP(g/L)	6.94±0.61	6.00—8.30
UA(nmol/L)	2.22±0.68	1.62—3.78
WBC(1×10^9/L)	6.02±1.42	4.25—9.75

Figure 1. Matured erythrocyte. Wright's stain method×1000.

Figure 2. Heterophil. Wright's stain method×1000.

Figure 3. Basophil. Wright's stain method×1000.

Figure 4. Small lymphocyte. Wright's stain method×1000.

Figure 5. Big lymphocyte. Wright's stain method×1000.

Figure 6. Monocyte. Wright's stain method×1000.

The Application of Energy-saving and Environmental-protection Materials in Landscape Design

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Abstract

The development of the society has continually enhanced human material living quality, at the same time, human environmental-protection consciousness has been continually enhanced, and the opinion of energy saving and environment protection has gone into many aspects of human living. People have begun to know that natural resource is limited, and the human can not take from the nature unendingly. Everyone should make great efforts to make the harmony between human and nature. And the landscape design is the ligament between them without fail, and it is the industry with flourish life in recent years in China. It includes the urban square design with hundreds of thousand square meters and the courtyard design with a few square meters, and if the energy problem of landscape design can not be solved better, it will induce large of energy wastes. The problem how to work out real green landscape has been the problem that people more and more noticed. The selection of materials in the construction process of landscape design has become into the very important aspect to make green landscape undoubtedly.

Keywords: Harmony, Environmental protection, Energy saving

The technical advancement of modern science and the rapid development of social productivity have quickened up the course of human civilization. At the same time, the human society is facing a series of serious challenges of important environmental and developmental problems. The leap of population, the excess consumption of energy, the variance of climate, the environmental pollution, the destroyed zoology and other problems have threatened human existence and development. Before serious reality, people have to rescan and rejudge the present urban development view and value system that we trust. Many insight men have gradually cognized that the human is one part of the natural system and is closely linked with the environment supported by the natural system. In the process of the urban development and the construction, we must first consider the problem of ecological environment, and put it on the same important status with economy and society, at the same time, we must further survey the reasonable utilization problem of limited resource, respect the natural rule, follow the nature, realize the existence philosophy of harmony and intergrowth and the human value view.

In recent 20 years, the course of urban construction and urbanization are in the ascendant in China, and with the development of urbanization, the construction of urban park is unparalleled whether on speed or on amount. The landscape design of park which had not been noticed at past has been emphasized now. From traditional park to urban virescence and to the landscape of urban and village integration, the park layout design concept is being gradually deepened and perfected, and the domain is developing, and more and more products occur. The landscape design of China has gradually formed its own system in the continual development process. There are bad aspects and good aspects in the whole system. Therefore, we should develop excellences, avoid and correct wrong opinions in the landscape design. The green environment-protective landscape should be established and really serve for people.

1. Main problems existing in the landscape design at present

1.1 The extravagance of design standard works unnecessary wastes

The essential of the landscape on the natural meaning is the base of human existence, but not only the beautiful landscape, and it is human living area, so it must accord with the basic demand and certain cultural demand of public leisure, and its chance is mainly to create public opening space for the leisure activities, not the environmental beatification concept. The modern landscape design is not absorbed in creating concrete things or building certain picture any more, and it must create the new relationship between human and whole environment, and cause the occurrences of public space and communication space. Therefore, in the process of landscape design, more

practicability must be considered, and a great deal of granites, marbles, stainless steels, glass curtains, super lamps and lanterns, import conduits and other expensive landscape materials are not used in the landscape design to make up so-called urban bright points, because it not only loses the natural beauty and harmonious beauty contained in China classical park, but also induces a sort of situation imitating each other and mingling with culture. And it not only wastes limited natural resources, but doesn't achieve anticipated effects for the design. The park landscape is a synthesis with multiple functions of society, nature and arts, which should not fulfill the social functions of ecology, environmental-protection, leisure and urban beautification, but also accord with the natural rule of botany, and embody the philosophy and individual style on the arts at the same time. So we should not emphasize the materials such as luxury and exquisite materials, but consider the cost and practicability of the landscape and its influence to the environment, and decrease meaningless burdens to the natural resource.

1.2 The complication of simple design

The complication of simple design is the usual problem occurring in modern landscape design. In the process of landscape design, though few resources can obtain effects, but complex representation is often used to induce wastes with different forms. For example, the road virescence in some house areas can adopt simple design method such as planting footway trees to achieve good effects. But in many luxury house areas, many unnecessary decorations are added to induce wastes of resources. The peripheral Chinese pines around the Monument to the People's Heroes in 1950s in Beijing and the poplar tree street on the Beijing airdrome in 1980s are good examples of simple design. The simplicity can sometimes embody status and the austerity is the concept. So there is not necessary to pursue so-called "bright point", and more exterior ornament looks unstable. Large of ground lays occupy the proportion of greenbelt, which destroys the whole harmony of the landscape and induce necessary wastes of natural resource.

1.3 The rockiness of deficient green shadow

The deficient green shade and excessive square lays are other problems in the design of present landscape. The trees planted newly can not form green shade, and many greenbelts are occupied by various lays, which make the area of greenbelts more reduced. Many waterscapes use concretes to make pool bottom and shores, which obstructs the land atmosphere and can not circulate the ecological system favorably.

Facing these problems existing in the landscape design, designers strive to look for methods to solve these problems. In the exploring process, the design path and design concept are gradually formed to fit Chinese situation.

2. The basic concepts to solve the problems in the process of discussion

2.1 The application of the sustainable development design view in the landscape design

The environment and energy crisis is more serious to China which is in the course of industrialization than the Europe and American countries in after-industrial times, and this situation is pricking up in the super-urbanization course. The environment and the energy are a pair of contradictions that can not be obtained together for the developing countries, because the development must consume large of energies and destroy environment, so we can not follow the same old disastrous road in the process of the development, and we should summarize gain and loss and find out our own development mode from developed countries.

This sort of new development tendency must induce a sort of new design concept, i.e. the design concept of sustainable development. The design view of sustainable development is to protect ecology and create human existence environment of sustainable development, which can not fulfill the human demands to the environment, but also can not take the destroyed environment as the cost and consider the benefits of offspring, and it is the basic task of 21st century environmental landscape design. The concept of sustainable development puts forward the ethic obligation and social responsibilities assumed by the landscape designers. The landscape designer's obligation is to put the landscape, construction and basic establishment into the continually development and great system composed by all artificial things and natural things to consider problems, which can effectively supervise large of wastes and unequal occupation induced by this sort of behavior. The effective utilization and economy to the resources are modern landscape designer's responsibility, and we should understand this mission.

With the further deterioration of environment and energy crisis, the concept of sustainable development has been a sort of application method to deal with the triangle among environment, healthy and development, and been the center of gravity of modern landscape and architecture research. The concept of sustainable development makes designer and owner reconsider the rationality of the design from the view of ethic and landscape consumption, which changes the organization method in the traditional design and advocates the design of subtraction in the design process, even only leaves the core content of ethic relation between human and subjective world. The utilizations of regeneration materials and the extension of lifecycle of materials through protection can reduce the amount of demands of materials. The materials which lose efficacies can be simply separated and dismantled, which can not influence the continual use of the materials that can exert efficacies.

2.2 The application of ecology and ecological design in the landscape design

The ecology is a sort of science about the relation between human and nature. The western environment and energy crisis pushed the modern ecology to the historical stage, but the ecology concept of China has not gone into public view, and the ecology is equaled with green, even it had been a camouflage of the tree replantation which seriously destroys the ecology for a time. The ecology is the basic subject of the landscape ecological layout, and the design of landscape locale should follow the ecological principle. The modern landscape design understands the landscape locale as a part of natural ecological system, seriously and reasonably uses natural resource, reduces the destruction to the ecosystem to protect natural resource, and reduces the invasion of landscape local to the nature to the least level and accordingly sustain the integrity of natural system, and establishes regional ecological space based on the principle of ecology. The measure of ecological design is used to pursue natural atmosphere and obey natural living environment. The sustainable development of the landscape is the final objective of ecological layout. In the design of community environment, the ecological design is embodied in displaying nature, weakening building, advocating the harmonious status between human and propagation. Therefore, when we implement concrete environment design, we should advocate creating natural environment and making biology more diversifiable.

3. The application of environmental-protection and energy-saving materials in future landscape design

3.1 The introduction of environmental-protection and energy-saving materials

Facing so many problems, the landscape designers are exploring their own development roads in continual practices and looking for the methods to solve problems. From courtyard design to square design, from greenbelt plan to urban layout, the environment-protective and energy-saving materials have gone into every part of landscape design and been exerting important functions, and the materials have become into the important correction and selection to face the challenge of ecological environment crisis and meditate human behaviors for modern human society, that is to say, we should change the predatory even devastating development mode that takes environment scarification as cost, make economy and society and environment develop harmoniously, and make landscape design walk up the road of good circulation. We should not only protect circumjacent ecological environment, but also reuse energies and reduce the irreproducible solid castoff which seriously harms environment. We should continually recognize that the environment protection is the premise and base of social development, and we should use environment-protective and energy-saving materials in landscape design, change old view of energy, which can not only save limited natural resources and benefit offspring, but protect environment and create good environment for our existence.

In the day that the scientific technology changes quickly, many scientific research results about materials of landscape have been applied in landscape design, which has brought concrete advantages for us. Some human imaginations in former days has become into realism and been exerting irreplaceable functions in actual living.

3.2 The applications of three sorts of environmental-protection and energy-saving materials in the landscape design

3.2.1 SF synthetic material

The SF synthetic material is a sort of new high strength synthetic material which takes old plastic and useless coal powder as main raw materials to be processed through scientific machining craftwork and activator. The character of SF synthetic material is the nonuse of wood, which can protect environment and solve the problem of deficient wood when the natural forest is protected. In many examples of landscape design, we can see that large numbers of woods are used to make park chair, flower frame, tree pool and other basic establishments in the earth project, which can induces not only meaningless wastes of forest resource, but also some unavoidable deficiencies such as easy cauterization, short use life and continual replacing. Therefore, the wood resource will be consumed endlessly, but SF synthetic material will successfully solve this problem, and it is synthesized by castoff through harmless disposal, and it can not only reduce the harm of castoff to the environment, but also replace woods to be the important materials in landscape design. Its anticorrosive and anti-insect abilities can make it not only possesses the advantage that woods don't have, but also ensures that its using year is longer than woods and its repairing charge is fewer than woodwork. With the birth of green energy-saving and environment-protective material, SF synthetic material, it will be extensively adopted in many projects such as architecture, square, road and urban construction, and it will add a beautiful landscape line for our life and bring healthy and harmless environment to us.

3.2.2 New pigment disposal technology: envelope titanium white

Large numbers of color brick will be used to lay earth or build flower pool in landscape design, and many production flows of pigment will produce much pollution and depredate the environment. Therefore, it is the key problem to eliminate the pollution of pigment in the production process for building environment-protective landscape.

The titanium oxide is a sort of optimal white pigment, and because of its highly chemical stability and excellent pigment performance, it is extensively applied in various domains of national economy such as porcelain, plastic, medication, cosmetic, dope and latex. It offers based for good landscape design and adds beautiful trait for the urban

landscape.

3.2.3 Lava

Except for general characteristics of common stone materials, the lava possesses its own special style and unusual function. Comparing with granite, the low radioactivity of basalt can make it safely used in human living locales. The lava can resist efflorescence and climate, wear well, absorb sound and reduce noise to improve hearing environment. It is simple and unsophisticated and avoids dizzy to improve the vision environment. It can absorb water, resist slide and obstruct heat to improve the feeling environment. Its special "breath" function can condition the air humidity to improve the environment. Its various special advantages can fulfill the new style that modern human pursues primitive simplicity and nature and advocates green environment-protection. Because of its firm stone nature, the lava can produce super thin flagstone material which blare degree can achieve above 85 through extractive grinding. Its color and luster is bright and pure, and its appearance is elegance and sobriety, so it is extensively used in various exterior wall decorations, urban road square and earth laying in house area and it can offer basic materials for environment-protective landscape.

4. Conclusions

At present, the quick urbanization course in China has made the urban environment construction face austere challenge. The landscape is the important part of the urban ecosystem, and it has important function to enhance the function and healthy development of the urban ecosystem. The occurrence of new term always indicates the occurrences of new problem, new concept, new consultation and disputation, and the landscape design is presenting this character since it went into China for almost ten years. It makes traditional theory which takes the taste as the base give place to the pragmatic ecological design which combines professional knowledge and social demands with natural system. The ecological design is one very important aspect to decide whether the landscape design and environment quality are successful, and the effective path to create the landscape with better environment, quality and safety. And the energy-saving and environmental materials can exert important functions in the development. The use functions of energy-saving and environmental materials will be continually perfected in future development process and serve for real green environment-protective landscape. We can forecast that the energy-saving and environmental materials must replace existing materials and exert irreplaceable function in the landscape design.

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A Study on the Pollination Ecology of *Eremurus inderiensis*

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Abstract

Two-year study on the pollination ecology of *Eremurus inderiensis* reveals that the florescence of eremurus is from the middle ten days of May to the first ten years of June, anthesis of a single flower lasts one day. When the weather is rainy and the highest temperature is less than 20 centigrade, anthesis of a single flower can last two days. Pollen dispersal period of single flower can last for 4 to 5 hours from 10:30 to 15:00 local time with the duration of pollen dispersal for single anther approximately 40min. The heterotypical maturation of 6 anthers could significantly prolong the pollen dispersal period of a single flower, suggesting an adaptation to the habitat of *Eremurus inderiensis* in the desert where the pollinators are uncertain. The main pollinators belong to *Apidae*, *Halictidae*, *Syrphidae*, *Bombyliidae* and *Therevidae*. Pollen/Ovule (P/O) reveals that *Eremurus inderiensis* is obligate xenogamy.

Keywords: *Eremurus inderiensis*, Pollination ecology, Heterotypical maturation of stamen, P/O

Eremurus inderiensis, which lives in the dry desert, belongs to *Liliaceae*, *Eremurus* (Cui, et al., 1996). *Eremurus inderiensis* burgeons in the early spring when the snow melts (from the end of March to the beginning of April). The life cycle of *Eremurus inderiensis* is about 60 days; this kind of ephemeral plant contributes greatly to the stabilization of sand (Wang, et al., 2003). But the frequent human activities, including engineering, reclamation of waste land, industrial discharge and over grazing, severely influence the survival and reproduction of ephemeral plants, more and more ephemeral plants are dying out (Zhang, et al., 1998). So it is important to effectively protect this special kind of biological species. At present, little study was carried out in the pollination ecology of *Eremurus inderiensis*, study on the ecological adaptation mechanism of *Eremurus inderiensis* in the desert from the angle of pollination ecology will provide us with more clues about the possible mechanism for this species to accommodate the desert and provide more data for us to protect the species.

1. Materials and methods

1.1 Materials

The wild *E. inderiensis* in the south of Guerbantonggute desert from 2006 to 2007.

1.2 Methods

1.2.1 Flowering Phenology and observation of floral features

1.2.1.1 Flowering Phenology

Chose well growing *E. inderiensis* that was about to flower from the natural population and recorded the whole florescence in 2004 and 2005.

1.2.1.2 Floral features

Feature of single flower (floral design): 20 flowers were chosen to be labeled and observed from 8:00 to 20:00 to record the characteristic of anthesis and anther dehiscence, the variation in perianth structure during the blooming, the heterotypical maturation of six anthers, the structure, color and smell of flower, and the reward for the pollinators.

Feature of flower group (floral display): the number of blooming flowers at one moment and their arrangement in the anthotaxy.

1.2.2 Pollination feature

1.2.2.1 Abiotic pollination medium

In the direction down the wind, simple pollen catcher (glass slide with medical vaseline wiped on the surface) was set up every 1 meter starting from the pollen source, resulting in two parallel lines including 70 glass slides each. Pollen catching time was from 9:00 to 17:00; the number of pollen was examined and recorded under the optic microscope (Olympus) to analyze the influence of wind on pollination(Douglas K L.and Cruden R W., 1994).

1.2.2.2 Biotic pollination medium

25 flowers were randomly chosen from five healthy *E. inderiensis* and labeled. The insect species and their behavior to visit the flower were observed at certain time and place. Insects were captured with sweep net when they were about to leave, and then were put into a glass bottle with aether, the killed insects were brought back to the lab to be identified, the number of *E. inderiensis* pollens carried by the   insects were counted under the dissecting microscope.

1.2.3 Pollen viability

When *E. inderiensis* was at full flowering stage, 10 flowers were chosen to do the following experiment: when the first anther was about to dehisce, its pollens were scattered on a clean glass slide, a drop of 0.1% TTC (red tetrazoline) was added right away, the number of pollen grains that changed to red color per 200 pollen grains was taken as the pollen viability index. The pollen viability variation in the whole process of anther dehiscence was observed every 20 minutes, until the anther shriveled. The pollen viability index of one anther of the flower was used to deduce the pollen viability of the single flower. Ten flowers were chosen to get an average.

1.2.4 Pollen grain per flower, ovule per flower and pollen/ovule ration (P/O)

Added 1 Mol/L hydrochloric acid to all the pollen grains of single flower, heated at 60 centigrade in water bath for 15 minutes to remove the wall of anther, then added distilled water and got 50 mL microspore suspension, transferred 5 μL microspore suspension to a clean glass slide, added a cover plate, and made a statistic analysis of the microspore number under the optic microscope. Repeated ten times and got the total pollen grain per flower. The germen wall of each flower was removed under the dissecting microscope to record the number of ovules of single flower, and get the average ovules of each flower. The pollen grain per flower was divided by the number of ovule and got P/O.

2. Results and discussion

2.1 Flowering Phenology and observation of floral features

2.1.1 Flowering phenology and pollination feature

Observation in 2007 showed that the initial flowering stage, first flowering stage,, full flowering stage, end flowering stage and finishing flowering stage of *E. inderiensis* were 15th May, 18th May, 19th-31st May, 4th June and 7th June respectively. The flowering sequence of single anthotaxy was from the bottom to the top, anthesis of single flower lasted one day. When the weather was rainy and the highest temperature was 20 centigrade, anthesis of a single flower could last two days. Pollen dispersal for single anther was approximately 40 minutes. 6 anthers matured heterotypically, i.e. the anther dehisced one by one or two at a time (Fig. 3). Pollen dispersal period of single flower could last for 4 to 5 hours from 10:30 to 15:00 local time, so the pollen dispersal period was prolonged to a great extent. After the six anthers shriveled, the perianth didn't change much, but the bottom of the germen produced nectar (Fig 4), which is an important attractant for *E. inderiensis* to attract insects.

2.1.2 Floral features

Feature of single flower

When flowering, six perianths don't unwrap, looking like a canister, the bottom of the germen produces nectar, the filaments of six androeciums elongate in succession, anther gradually come out of perianths, and dehisce one by one or two at a time. The anther is orange, the chapter looks like needle, and protrudes out of perianths aslant (Fig. 2, 1).

Feature of flower group

The flowers cling to the anthotaxy, which is thin and long. Each plant has 30-40 flowers (Fig. 2). Flowers at the bottom of the anthotaxy bloom first, and then come the upper ones. At full flowering stage, each plant can have 15-20 flowers. Florescence stage is in May and fruit stage is from May to June.

2.2 Pollination feature

2.2.1 Abiotic pollination medium

It was shown that pollens of *E. inderiensis* were captured on the glass slides, indicating that wind force was one of the

pollination mediums for *E. inderiensis*. Pollens could be spread to 70 meters away or more, but the number of pollens decreased with the increase of distance (Fig. 1). No matter the wind speed was 2 m/s or 12 m/s, about 60% of the pollens were spread to no more than 20 meters. When the wind speed was 12 m/s, pollens within 20 meters accounted for 70% of the total pollens. The pollens spread by wind medium increased when the wind power was stronger, so the pollens of *E. inderiensis* could be spread by wind more easily.

2.2.2 Biotic pollination medium

The main pollinators that visit the *E. inderiensis* belong to *Apidae*, *Halictidae*, *Syrphidae*, *Bombyliidae* and *Therevidae* in the nature. The anthers of *E. inderiensis* are close to each other, so when the insects visit the flower, it is easy for them to take away pollens. When the weather is rainy and cloudy, or at low temperature, i.e. the highest temperature is less than 20 centigrade, there are few insects in the desert. Insects are more active from 10:30 to 13:30 every day.

2.3 Pollen grain per flower, ovule per flower, pollen/ovule (P/O) and pollen viability

The number of pollen grains per flower of *E. inderiensis* is 241840; the number of ovules per flower is 12, so the pollen ovule ratio is 20153. According to Cruden's breeding system (Cruden and Hermann-Parker, 1977), if the pollen ovule ratio ranges from 2.7 to 5.4, it is cleistogamy, if the pollen ovule ratio ranges from 18.1 to 39.0, it is obligate autogamy, if the pollen ovule ratio ranges from 31.9 to 396.0, it is facultative autogamy, if the pollen ovule ratio ranges from 244.7 to 2588.0, it is facultative xenogamy, and if the pollen ovule ratio ranges from 2108.0 to 195525.0, it is obligate xenogamy. It can be seen that *E. inderiensis* belongs to obligate xenogamy breeding system.

The pollen viability of one anther of the flower indicates that the pollen viability gradually decreases with the progress of anther dehiscence, when the anther is about to shrivel, the pollens are still viable; the average pollen viability in the whole process of dehiscence is 94.8%.

3. Discussion

3.1 Floral feature and pollination strategy by insects

The floral structure and feature influence the behavior of visitors and the pollination mechanism and accordingly influence the reproductive success rate of female parent (pollen acceptor) and male parent (pollen donor) (Spira, et al., 1992; Fishbein and Venable, 1996). The attractants, i.e. the floral feature, including nectary, pollen, smell and color, are the main factors to maintain the relationship between flower and pollinator.

E. inderiensis lives in the desert, where the temperature is high, the air is dry and wind is strong with sand, in addition, the pollinators are uncertain, the unadvantageous conditions will influence the pollination and existence and reproduction of the plant. *E. inderiensis* has no colorful flowers; the main attractants are the orange anther and the nectar at the bottom of germen. The germen is wrapped by the corollas, so the nectar will be protected from high temperature, heat, wind and sand, so as to attract insects; this is an adaptation of *Eremurus inderiensis* to the habitat in the desert.

3.2 Heterotypical maturation of anther is the adaptation to the extreme desert environment

As shown in Fig. 4 that the anthers of *Eremurus inderiensis* mature heterotypically. In the dry, hot and windy desert, the pollen dispersal time is short, and the activities of insects are restricted to a great extent, only if the insect visit the flower several times, can all the pollens be spread out. The heterotypical maturation of anther is the adaptation to the visiting behavior of insect, the heterotypical maturation of six anthers of *Eremurus inderiensis* will greatly prolong the pollen dispertion time of single flower, and it will increase the possibility to meet the pollinators, and improve the pollination efficiency.

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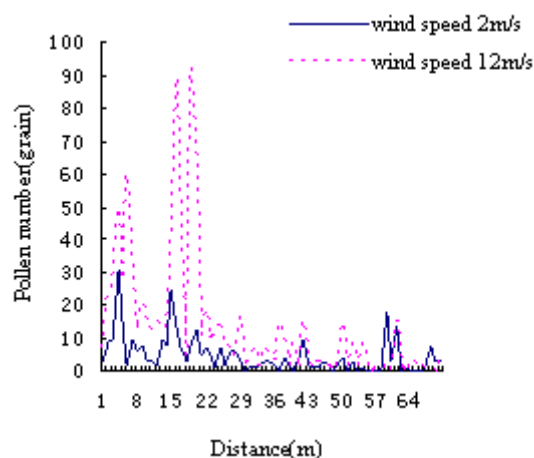

Figure 1. Pollen dispersal of Eremurus inderiensis by wind
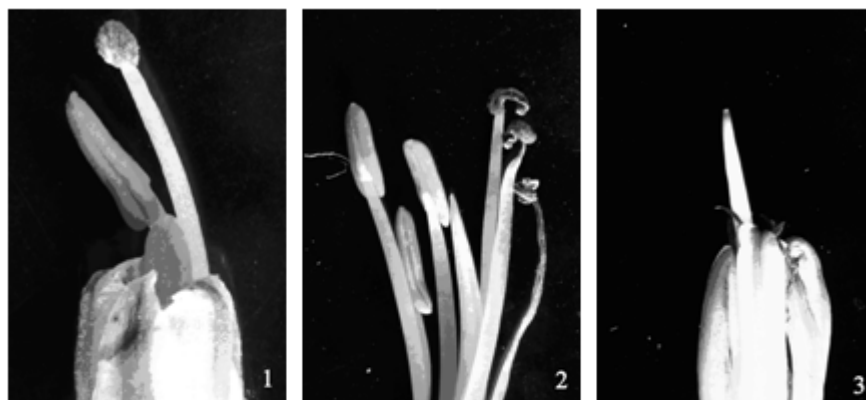

Figure 2. Flower of *Eremurus inderiensis*

Figure 3. Pictures of heterotypical maturation of *Eremurus inderiensis*'s stamina. 1, one anther dehisced; 2, three anthers dehisced; 3, all the anthers dehisced and the gynoecia protrude out of the perianths.
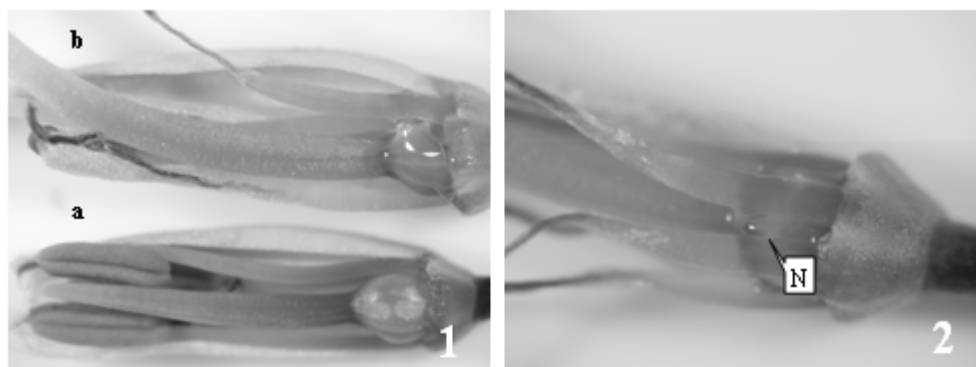
Figure 4. The secretion of *Eremurus inderiensis* at the bottom of ovary. 1, the secretion of *Eremurus inderiensis* at the bottom of ovary (a, anther un-dehisced, no nectar; b, anther dehisced and shriveled, with nectar). 2, the secretion of *Eremurus inderiensis* at the bottom of ovary (anther dehisced and shriveled, with nectar; N, the nectar is bright)

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