Green Skills for Green Industry: A Review of Literature

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Abstract. Apart from technical and generic skills, employers start looking for manpower with green skills which are much needed for promoting sustainable development in social, economic as well as environment. This article aimed at finding out the major green skills demanded by the green industry based on the existing literature. In the present study, document analysis was employed. The published articles and technical reports related to green skills in various disciplines were identified from electronic databases that includes ScienceDirect, Google Scholar, ResearchGate, and Academia. The findings from literature review revealed that there are ten most common green skills demanded by various industrial sectors, namely, design skill, leadership skill, management skill, energy skill, city planning skill, landscaping skill, communication skill, waste management skill, procurement skill, and financial skill. The role and directions of skill training institutions should be aligned with the needs and wants of the industrial sectors. Therefore, it is imperative for the skill training institutions to revise and revamp their curriculum in order to produce graduates with green skills to cater for the demand of manpower market.

1. Introduction

Two major types of skill have been demanded by the employers, namely, technical skills and generic skills. In general, technical skills are regarded as the skills that are related to occupation, such as programming, repairing car, and it is hands-on oriented [1]. Whereas generic skills are the abilities for dealing with job and persons such as communication skills, team work skills, problem solving and critical thinking [2, 3]. Both technical skills and generic skills are important for getting a job. However, this scenario has changed. Someone who has technical skills and generic skills are no more sufficient for him/her to secure a job [4].

Apart from the above-mentioned skills, employers start looking for manpower with green skills which are much needed for promoting sustainable development in social, economic as well as environment. To date, most economic activities do not contribute to sustainable development of social, economic and environment due to low technical and technological levels [5]. Countries around the world, especially the developing ones, have paid a very high cost on environmental pollution and climate change, which in turn will affect the social and economic activities [6]. Environmental pollution and climate change are negatively affecting the sustainability of various economical activities across the world with Malaysia being one of them. The changes of climate and environmental issues will bring for changing weather pattern, more extreme droughts or monsoons, rising sea levels and so on [7]. These consequences will cause devastating impacts on social as well as economy if effective measures and pragmatic actions are not taken to mitigate the problems.
2. The Impacts of Climate Change on Economy

One of the major challenges of today is to prevent the climate change. According to Omar [8], major human activities that cause climate change are as follows;

i. Industries - factory smoke emissions such as carbon monoxide and harmful gas causing the greenhouse effect; depletion of ozone due to the use of chlorofluorocarbons (CFCs) in aerosol product and air conditioners.

ii. Transportation - the burning of petrol causing the greenhouse effect.

iii. Logging - deforestation cause the unbalanced air content (carbon dioxide vs oxygen) in the air.

iv. Urbanization and agriculture - increase the temperature due to over-development for building construction and agriculture.

From the economy perspective, the developing countries such as Thailand and the Philippine have been affected with climate change [9]. Specifically, in 2007, Thailand has experienced economy losses of about RM17 billions due to the drought event. The worst affected sectors were agriculture and livestock [10]. Likewise, the Philippines has also encountered enormous losses due to climate change such as typhoon has caused RM24 billion, earthquake caused RM22 billion, volcano caused RM10 billion, and flood caused RM19 billion losses [11]. According to Ueda et al. [12], the climate change has negatively impacted on the economy of almost every country in Asia. Table 1 shows the probability of damage in Gross Domestic Product (GDP) due to climate change.

Table 1. Percentage of gross domestic product (GDP) by probability of climate change occurrence

| Developing Asian Countries | GDP 2011 (USD billion) | Probability of Damage |
|----------------------------|------------------------|-----------------------|
|                            |                        | 5.00%  | 1.00%  | 0.50%  | 0.10%  | 0.01%  |
| Afghanistan                | 16.70                  | 0.33   | 1.27   | 1.51   | 1.73   | 1.79   |
| Bangladesh                 | 108.55                 | 0.26   | 0.93   | 1.09   | 1.24   | 1.28   |
| Cambodia                   | 12.56                  | 0.75   | 1.78   | 2.23   | 3.27   | 4.75   |
| People’s Republic of China | 6,254.76               | 0.26   | 0.70   | 0.80   | 0.88   | 0.90   |
| India                      | 1,587.83               | 0.17   | 0.28   | 0.30   | 0.32   | 0.32   |
| Indonesia                  | 767.75                 | 0.17   | 0.89   | 1.10   | 1.30   | 1.35   |
| Kazakhstan                 | 148.51                 | 0.11   | 0.20   | 0.22   | 0.23   | 0.23   |
| Laos                       | 6.67                   | 0.95   | 4.08   | 4.89   | 5.66   | 5.85   |
| Malaysia                   | 241.22                 | 0.16   | 0.41   | 0.46   | 0.50   | 0.51   |
| Maldives                   | 1.98                   | 1.24   | 2.48   | 4.96   | 14.89  | 100.59 |
| Mongolia                   | 7.55                   | 2.00   | 5.96   | 9.94   | 11.93  | 16.03  |
| Myanmar                    | 48.03                  | 0.20   | 2.19   | 2.94   | 3.73   | 3.93   |
| Nepal                      | 16.58                  | 1.00   | 3.53   | 4.14   | 4.70   | 4.83   |
| Pakistan                   | 175.61                 | 0.98   | 4.01   | 4.79   | 5.51   | 5.69   |
| Philippines                | 193.31                 | 0.19   | 0.30   | 0.32   | 0.33   | 0.34   |
| Sri Lanka                  | 53.84                  | 0.60   | 1.44   | 1.60   | 2.10   | 3.03   |
Refers to Table 1, China was recorded as the country that has the highest GDP (USD6254.76 billion). On the other hand, Tonga has only USD0.35 billion, which was the lowest compared to other Asian countries. If the probability of damage is 1.00% for both countries, China was faced with USD 62.5476 billion loss of money, whereas Tonga USD0.0035 billion. This statistical data reflects that a country needs a large amount of capital to stimulate and recover the economy which many countries cannot afford to execute the economic plan due to lack of capital [12].

3. Lack of Awareness

One of the main factors that causes climate change is the lack of awareness on environmental protection among people. Previous research revealed that many people have scarce knowledge about climate change and, worse still, they did not know about the risk of climate change [15]. Similar findings have been reported by National Environmental Education and Training Foundation (NEETF) [16] and the Asia Foundation [18] which showed that majority of people do not know causes of pollution happened and do know how to react to climate change. Likewise, Vynne, and Doppelt [17] have also discovered that 97% of respondents involved in their survey did not considered the climate change preparation as their main priority. Although government of many countries have come out with policies and programmes to deal with the issues related to environmental pollution, many people are not aware of those policies and programmes [19,21,22,23]. These appalling findings reflects the fact that many people around the world are not aware of the severity of the impacts caused by climate change.

In Malaysia, the target has been set in which the Malaysian government aims to reduce carbon dioxide intensity by up to 40% by the year 2020 [25]. In line with this aim, Malaysian government had come out with 11th Malaysian Plan (11th MP) which puts part of focuses on sustainable development. There are six strategies thrusts under 11th MP, namely, (i) inclusiveness, (ii) improving wellbeing for all, (iii) accelerating human capital development for an advanced nation, (iv) pursuing green growth for sustainability and resilience, (v) strengthening infrastructure to support economic expansion, and (vi) re-engineering economic growth for greater prosperity [26]. All of these thrusts are to ensure the visions of becoming a sustainable economy and developed nation is achieved by 2020 [26]. Specifically, the fourth thrusts emphasizes on green growth focusing on four key areas such as strengthening the enabling environment for green growth, adopting the sustainable consumption and production concept, conserving natural resources for present and future generations, and strengthening resilience against climate change and natural disasters [27]. In this context, green growth means to achieve a resilient, low-carbon, and resource-efficient economy model that leads to higher quality of living and promote well-being of the citizens.

4. Objective of Study

Some countries especially the developed countries start taking precautions and steps to deal with the environmental issues by shifting current economy model to green economy [13]. Green economy means manufacture, commercial, service and other economic activities are more to environmental friendly which produce lower carbon emissions, and consume lesser unrenewable energy that lead to improved human well-being and social equity [14]. The shift to green economy has increased the pace of change in manpower market and skills demanded by the green industries [13]. The green industries that underpins green economy requires workers with green skills to perform the tasks.
Although workers with green skills are needed by the green industries [20], it has not been given emphasis by the higher learning institutions, especially those focus on Technical and Vocational Education and Training (TVET). The training institutions must go beyond for equipping graduates with technical and soft skills because green skills is equally important and they must have been embedded in all levels of education. In this aspect, TVET institutions have an essential role to play in produce green skills workers since TVET is closely and directly connected with the development of economy and society. This crucial role of TVET is in line with the Malaysia Education Blueprint 2015-2015 (Higher Education) which puts the emphasizes on talent excellence and quality TVET graduates as two out of its 10 shifts [24]. It is meaningless and useless to talk about quality if the skills mastered by the graduates do not meet the needs of the green industries.

To date, it remains unclear concerning the types of green skills demanded by the industries due to varied nature of work in different industries. Therefore, the current study was conducted to find out what type of green skills are actually sought by the green industry.

5. Definition of Green Skills

A long time ago, only the gardeners have green skills, but today green skills are going to be an important skills to people. The term of green skills appeared since the advent of green technologies [29]. Green skills are needed to operate and develop green technologies. In Malaysia, the Ministry of Energy, Green Technology and Water is responsible to plan and formulate policies and program related to green technologies [30]. This reflects the fact that Malaysian government pays attention to deal with environmental pollution and climate change. Although green skills are important for green industry, it is still not unclearly defined. Most of people only know about generic skills, technical skills and employability skills, but their knowledge on green skill is very limited [31].

In general, green skills are regarded as skills for sustainability which are related to the technical skills, knowledge, values and attitudes needed in the workforce to develop and support sustainable social, economic and environmental outcomes in business, industry and the community [32]. Likewise, CEDEFOP [33] defines green skills as the knowledge, abilities, values and attitudes needed to live in, develop and support a society which reduces the impact of human activity on the environment. Taken together, green skills is generally composed of three dimensions, namely, knowledge (cognitive dimension), skills/abilities (psychomotor dimension), and attitudes/values (affective dimension) needed by workers to promote sustainable development in social, economy, and environment. From the cognitive dimension, the knowledge concerning environmental protection can be regarded as an element of green skills. From psychomotor perspective, green skill refer to the ability to, for instance, minimise energy consumption, or reduce greenhouse gases. Green skills also refer to affective aspect, for example, motivation of an individual to conserve natural resources.

6. Method

In order to explore the type of green skills demanded by green industry, document analysis was employed. It is vital to retrieve all relevant research, because loss of information might be leading to bias in the study. However, it is not feasible to obtain every single study on the subject because some of them are not published and, therefore, those articles may not be searchable. In the present study, published articles and technical reports related to green skills in various disciplines were identified from electronic database that includes ScienceDirect, Google Scholar, ResearchGate, and Academia.

7. Findings and Discussion

A total of ten green skills are identified from the existing literature. The skills are commonly demanded by various sectors depending on the duties and tasks. The identified green skills are as follows:

i) Design skill
ii) Leadership skill
iii) Management skill
iv) City planning skill
v) Landscaping skill
vi) Energy skill
vii) Financial skill
viii) Procurement skill
ix) Waste management skill
x) Communication skill

Specifically, design skill is regarded as an important green skill as the element of design is applied in many sectors, such as building design, machine design, and circuit design. The designer of today should be able to integrate green elements into their design in order to produce an idea that is friendly to the environment [34].

Apart from that, leadership skill and management skill are equally important because these skills are needed to change the organizational structure, function, and operation in order to support green activities, such as lean production or life-cycle management [35].

City planning skill and landscaping skill are also considered as one of the important green skills currently and in future. This is because many parts of the world are going through urbanization and the existing metropolitans are evolving to become smart cities that aims to generate a more convenient and modern places to live in [36]. These processes need proper planning and landscaping in order to make the cities livable and sustainable in long run.

Energy skill is seen as another critical green skill. To date, energy productions in the world are mostly from fossil fuel, such as coal, natural gas and petroleum. Based on the data from World Bank [37], the total consumption of fossil fuels was 86% compared to renewable and alternative resources (14%) in 2015. The by-products of fossil fuels consumption during energy generation process are very harmful to the environment [38]. Therefore, it is imperative to train workers with energy skills that help reduce the use of non-renewable resource in energy production and consumption, and at the same time replace those non-renewable resources with the ones that are more environmental friendly and safe to use.

Another green skills needed by the industry are financial skill and procurement skill. These skills are considered as green skills because they are important for economic responsibility that contributes to sustainable development. Financial skill is needed to control the expenditure of an organisation in order to balance up the revenue and responsibility for environmental conservation [39].

Likewise, procurement professionals will have to deal many internal departments of an organization as well as external agencies to manage, coordinate and purchase materials. Within green industrial context, procurement skill is very much needed to ensure the materials purchased are environmental friendly in order to minimise the environment impact during their life cycle [40].

Waste management skill is becoming increasingly significant skill for green industry. Waste management skill means the ability to reduce, reuse, and recycle waste through proper planning, implementation, and coordination of waste management system [41]. Waste management skill is highly demanded nowadays by the waste management sector which contributes enormously to the sustainability of environment and prevention of pollution.

Apart from the above-mentioned green skills, communication skill is another skill that is categorised as green skill and it is equally important for the environmental sustainability. Within the sphere of green industry, communication skill is not only referred to as the skill needed for verbal and non-verbal communication, but it also includes technological skills for communication which minimise energy consumption and more towards to environmental friendly type of communication [42].

8. Conclusion

There are a great demand of workers with green skill in green industrial sectors. These skill are needed to perform tasks that bring in profits without jeopardising our environment and ecosystem and to ensure sustainable economic development. The afore-mentioned green skills are the common skills needed by various industrial sectors. The role and directions of skill training institutions should be aligned with the needs and wants of the industrial sectors. Therefore, it is imperative for the skill
training institutions to revise and revamp their curriculum in order to produce graduates with green skills to cater for the demand of manpower market. We strongly believe that there are many more skills that are not mentioned in this paper. Further studies should be more focused by determining specific green skills needed in certain sectors, such as computer manufacturing sector, construction sector, tourism, waste management industry, and so on. The expected findings might be very useful for skill training institution to redesign and restructure their curriculum based on the industrial needs.

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