

Guideline for future policy-making to jointly develop renewable energy in China and ASEAN

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Received: 20/11/2019, Accepted: 24/12/2019

Abstract

Rapid economic and population growth of the ASEAN countries have solidly driven a solid growth in energy consumption. There is a widespread consensus in the ASEAN region that indigenous fossil fuel resources are insufficient to meet the rapid growth in energy demand brought about by the rapid population and economic growth in population, and that renewable energy is increasingly the least-cost option for energy supply, particularly for power production. To encourage development of renewable energy, most ASEAN countries had adopted supportive policies. However, it is still not clear how these policies have affected the renewable energy industry and what should be the direction of future policy-making to promote the development of the renewable energy industry. Therefore, this paper aims to analyse how current policy frameworks have affected the renewable energy development to provide guidelines for future policy-making. This is a participatory research involving collection of data from both primary and secondary sources. Primary data collection involved a survey using a questionnaire for 408 respondents consisting of government officials, researchers and entrepreneurs. It included interviews for 24 of them. Secondary data were collected from reports from the ASEAN Centre for Energy and related documents acquired from ASEAN governments. Information collected through the questionnaire were analysed quantitatively: value of Mean, Standard Error of Mean, Standard Deviation (Std.) and Variance for each question asked were calculated. Information collected from interviews were analysed qualitatively. The results showed that although governments of China and 5 middle-income ASEAN countries had national-wide policies or regulations to encourage the development of renewable energy, the accessibility, feasibility and sustainability of current incentive policies were not sufficient enough for future development of the industry. In conclusion, this paper proposed five aspects to guide future policy-making in ASEAN and China to develop the renewable energy industry and encourage cooperation between ASEAN and China.

Keywords:

Guideline; Policy making; Renewable energy

1. Introduction

1.1. Research background

Driven by economic and industrial development and higher living standards, electricity demand in Asia and the Pacific is projected to more than double between 2010 and 2035. There is a clearly growing concern about how energy can be used on a more sustainable basis along with the growing of

energy consumption. Over the past 20 years, the joint efforts of all parties from the United Nations Framework Convention on Climate Change (UNFCCC) have achieved a successful development progress of global actions on climate change. On the Paris Conference on Climate Change in December 2015, attended parties recalled the paramount importance of setting up incentive mechanisms to encourage countries to pursue green, circular and low-carbon development featuring both economic growth and an effective response to climate change. The later Paris Agreement reveals 2030 Agenda for Sustainable Development, acknowledging the specific needs and concerns of developing countries arising from the impact of the global greenhouse gas (GHG) emissions. Meanwhile, the Paris Climate Agreement invites all developing and developed Parties continuously make contributions towards achieving the objectives on climate change (The Paris Agreement, 2015). As to be seen international communities have focused on balancing economic development and climate change since 1972. The Stockholm conference in June of that year had brought the world's attention to environmental consequences for rapid industrialization, later the Rio de Janeiro's Earth Summit in 1992 had brought other world issues on energy and climate change, and the Kyoto Protocol in 1997 had provided opportunity to the developing countries, especially the ASEAN, to help avoiding GHG emissions by substituting fossil fuel with renewable energy and simultaneously helping the country to grow economy in a sustainable way.

1.2. Literature review on renewable energy policies of ASEAN

The ten member states of ASEAN, namely Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam are located in the tropical and sub-tropical climatic zones and have a combined land area of 4,500,000 KM². The total population of ASEAN was 615 million by the end of 2014 (IRENA & ACE, 2016). There is widespread agreement that the rapid population and economic growth of the ASEAN countries have made this region one of the global growth areas. This growth solidly driven growth in energy consumption. This considerable growth of both the economy and energy demand are challenged by several issues, such as sustained increase in global petroleum prices, higher investment requirements for infrastructure building and development, and global negative environmental impacts from the increased use of fossil fuels, particularly climate change (ACE, 2015).

Renewable energy sources are abundantly available in most of the ASEAN countries. The increasing energy demand led ASEAN countries. Including many other Asian countries to adopt programs for energy source diversification, focused on the promotion of renewable energy such as solar, wind and hydro power. To develop renewable energy and re-shape the existing energy structure under today's dynamic global economy and environment, ASEAN communities had adopted plans or policies that encourage the development of renewable energy industry, that included supporting technical and business cooperation in this field.

After the 34thAMEM of the Energy Ministers of ASEAN Member State, the 2016 Renewable Energy Outlook for ASEAN was published. In addition, ASEAN countries had made specific policies and regulations to promote the development of solar energy, wind energy, biomass and other types of renewable energy, depending on each country's actual and fundamental situation. Table 1 illustrated the type of policies each country had adopted for developing renewable energy.

Table 1 Policies for renewable energy development in ASEAN.

Types of Policy	Rated Selling Price	Incentive	Financial grants	Licensing	R&D
Brunei Darussalam	No	No	No	No	No
Cambodia	No	No	Yes	Yes	Yes
Indonesia	Yes	Yes	Yes	Yes	Yes
Lao PDR	Yes	Yes	Yes	Yes	Yes
Malaysia	Yes	Yes	Yes	Yes	Yes
Myanmar	No	No	No	No	No
Philippines	Yes	Yes	Yes	Yes	Yes
Singapore	Yes	Yes	Yes	Yes	Yes
Thailand	Yes	Yes	Yes	Yes	Yes
Vietnam	Yes	Yes	Yes	Yes	Yes

Sources: as stated in Reference [1]-[7], [9] and [10]

Most governments had rate-selling price policy, for example, fixed feed-in tariff policy to encourage renewable energy investment. These governments also had other incentive policies such as deduction of corporate income tax, low-interest-rate loan for financing, tariff-free from equipment importing. Other types of subsidy policies included providing one-time subsidy at initial stage were also available for renewable energy practitioners.

1.3. Research objective

Policy is the key to the development of renewable energy. Although a literature review has indicated there were national-wide policies for renewable energy for most countries, it is not clear how these policies have been effective in promoting the development of the renewable energy industry, especially small-to-medium enterprises.

For the development of renewable energy through more cooperation between China and ASEAN, this paper provides guidelines for future policy-making based on analyses of current policies and regulations in promoting renewable energy industry of ASEAN.

In this paper, Renewable Energy refers to solar, wind, biogas, biomass, waste-to-energy and small-size geothermal energy. Other types of renewable energy which construction cannot be handled small-to-medium enterprises such as e, hydropower station, and tidal energy and will not be discussed.

2. Experimental Detail

2.1. Research Design

To analyze how effective are current policy frameworks in developing the renewable energy industry, and to formulate guidelines for future policy-making, quantitative and qualitative data were both collected in two phases.

Phase 1: Collection of quantitative data: Questionnaire-based survey was used. to collect quantitative data. The questionnaire used guidelines for questionnaire construction, layout and question

content (Sarantakos, 2005). Score-rating questions were included in the questionnaire to ask respondents' evaluation on:

- (1) whether there was a nation-wide policy that encouraged developing renewable energy in his/her country;
- (2) whether the feed-in-tariff (FiT) or a one-time subsidy for initial investment can better stimulate the development of the renewable energy industry; and
- (3) the feasibility, accessibility and sustainability of current governmental subsidy and other types of incentive policies for small-to-medium enterprises for developing renewable energy in his/her country.

To obtain better quality of data, each question was designed to avoid ambiguous replies; participants were invited to score their approval on descriptive statements/situations by giving a score from 1 to 5, corresponding to "strongly disagree, disagree, neutral, agree, and strongly agree", respectively. There were 8 questions in this anonymous questionnaire, and it was sent to 408 respondents.

Phase 2: Collection of qualitative data. After analyzing the quantitative data, interviews were conducted to obtain in-depth points of view. The interviews asked about effective future policy for encouraging renewable energy development. 24 respondents were selected for the one-on-one interview.

Research scope

There are ten ASEAN countries, and the renewable energy market may differ from each other significantly. In order to narrow down the research scope, a top-down approach was taken. After taking assessment of the theoretical technical and economic feasibility, the study focused only on the five ASEAN middle-income countries, namely Indonesia, Malaysia, Philippines, Thailand and Vietnam, where Chinese SMEs has market potential.

Population and sample scope

The top-down research method focused only on five ASEAN member states; Indonesia, Malaysia, Philippines, Thailand and Vietnam. Covering all of the ASEAN member states was not appropriate not all population have present links with the renewable industry. The following sampling method was selected:

(1) Sample of questionnaire

To determine the sample size for the questionnaire survey, the Taro Yamane Formula (1) method was used; sample size was based on the total population of 548.46 million of ASEAN and 1.42 billion in China (2018). Given the N was 548.46 million and the acceptable error is 5%, the number of samples were not less than 400.

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

The questionnaire survey respondents came from a random sampling from governmental departments, R&D institutes and the renewable energy private sector, covering the five ASEAN member states and China. Career background (governmental official, researcher and entrepreneur) of the respondents from each country was designed to be as equal as possible.

Table 2 (below) shows the questionnaire survey respondents by country and career background.

Table 2 Respondents of questionnaire by country and career background.

Country	Researcher	Entrepreneur	Government official	Total
China	24	32	15	71
Indonesia	27	23	14	64
Malaysia	20	29	20	69
Philippines	20	31	14	65
Thailand	27	27	16	70
Vietnam	27	26	15	69
Total	145	168	94	408
Weight	35.54%	41.18%	23.04%	100%

(2) Sample of interview

To determine the sample size for the one-on-one interviews, the Taro Yamane was used again. With N given as 408 and with an acceptable error is 20%, the number of samples should not be less than 24. The sample for these interviewees were selected through purposive sampling method. The interviews were conducted to get the opinions of the participants coming from the policy/government sector, research institutes and the private sector in both China and 5 ASEAN countries.

Table 3 Respondents of interview by country and career background.

Country	Researcher	Entrepreneur	Government official	Total
China	1	2	1	4
Indonesia	2	1	1	4
Malaysia	1	2	1	4
Philippines	2	1	1	4
Thailand	2	1	1	4
Vietnam	1	2	1	4
Total	9	9	6	24
Weight	37.5%	37.5%	25%	100%

2.2. General research procedure

The research lasted for approximately 12 months. Data collection, both quantitative and qualitative, were collected during several international conferences.

Research procedure for collecting quantitative data

638 questionnaires were sent to political officials, research personnel and entrepreneurs during international conferences such as The China-ASEAN New Energy Forum and SNEC 2019 PV Power Expo, and through email. 408 questionnaires were returned and found valid for this research.

Research procedure of collecting qualitative data

Interviews were conducted during SNEC 2019 PV Power Expo and 2019 South and Southeast Asia Technology Transfer and Matchmaking Conference. All 24 interviews took place in the venue of Conferences and lasted approximately 5-10 minutes. The interview contained questions which aimed to capture respondents' views and experiences on future policy-making for jointly developing

renewable energy industry in ASEAN countries, together with China.

2.3. Data analysis

Data collected for this research included quantitative data and qualitative data. Quantitative data were first collected and analyzed through SPSS 22.0, while qualitative data were then collected and analyzed through content analysis methods.

Quantitative data analysis

Respondents' rating score were the resources of quantitative data and mean value of the scores was used as the main indicator for influence analyses. Given the rating scale and definition of each score (score 1 to 5 represented strongly disagree, disagree, neutral, agree to strongly agree respectively); "3 and lower "scores were considered not supportive of and disagreed with the statement , "score 3" was recognized as the dividing line: scores higher than 3 (>3) were considered supportive of and agree with the statement.

Qualitative data analysis

Content analysis was done on the information obtained from interview. The content analysis is relatively important to this research because it gives the researcher better understandings on how to interpret quantitative data.

After the integrated analysis of all the descriptive statistics through the quantitative method and all other nonparametric statistics through the qualitative method, the research had concluded the guidelines for future policy-making to encourage jointly developing renewable energy in China and ASEAN middle-income countries.

3. Results and Discussion

3.1. Illustrations Quantitative data

The quantitative analysis of the results of the questionnaire survey is presented in the following Table 4.

Table 4 Descriptive statistics of observational questions in survey.

Content of Question	Mean		Std. Deviation	Variance
	Statistic	Std. Error	Statistic	Statistic
Q1 The presence of national-wide policies	4.002	0.0424	0.8571	0.735
Q2	3.973	0.0396	0.8003	0.641
Q3 Accessibility of incentive policies	3.865	0.0372	0.7511	0.564
Q4 Role of policies	4.203	0.0400	0.8086	0.654
Q5 Role of FiT	4.017	0.0434	0.8768	0.769
Q6 Role of one-time subsidy	2.931	0.0457	0.9221	0.850
Q7 Feasibility of policies	3.493	0.0386	0.7806	0.609
Q8 Sustainability of policies	3.816	0.0367	0.7406	0.548

The quantitative data analysis shows the following:

- (1) The governments of China and 5 middle-income ASEAN countries have nationwide policies and/or regulations to encourage the development of renewable energy;
- (2) Policies played a paramount role in developing the renewable energy industry;

(3) Compared with the one-time subsidy, the FiT policy is more preferable for renewable energy practitioners; and

(4) The accessibility, feasibility and sustainability of current incentive policies are not enough for the future development of the industry.

Qualitative data

The interview was designed to ask the respondents' opinion on whether policy had influence on successful entry of renewable energy. All twenty-four respondents expressed their opinions that a good/mature policy environment is essential for developing solar energy. They described especially what policy environment is beneficial to renewable energy development, in other words, what a mature policy environment should be for developing renewable energy industry, and what is lacking in terms of supporting small- and medium-size renewable energy industry. For example, an entrepreneur from Indonesia mentioned "we had a national strategic plan to develop renewable energy, but it is hard for small companies to get benefits from those policies directly, especially finance support". Similarly, an expert and entrepreneur from China and another professor of Malaysia expressed the same point of view.

"Although the government has plans to develop renewable energy, it is sometimes hard to implement these plans. For example, there is FiT policy for solar PV farm, but it is still hard to actually obtain the stable subsidy as income, by just simply uploading power to the grid" (Entrepreneur, China, Translated).

Respondents also mentioned the role of financial incentive as a good policy for renewable energy projects. Financial support was recognized by all respondents - research personnel, entrepreneurs and officials - that financial support plays a paramount role in developing the renewable energy industry and encouraging new practitioners to get involved. They pointed out that generally, renewable energy projects need large amount of initial investment and have long period of economic return. They said that financial incentive can assist companies from these financial burden by ensuring fixed cash inflow from the investment. Regarding as to what types of financial support, respondents from China and Thailand especially expressed the importance of FiT for a sustainable financial operation of renewable energy powering projects.

"Feed-in tariff (policy) is effective in getting economic benefits after investment, thus we would like to invest renewable energy project" (Entrepreneur, China, Translated).

Entrepreneurs from Vietnam and Malaysia mentioned the importance of one-time grant when they were asked which one between FiT and one-time grant at initial stage can help the development of renewable energy in a long-term. However, they recognized that FiT works better for sustainable operation in the long-run, but one-time grants give SMEs possibility to start business.

"Feed-in tariff is good, but if government does not provide money for initial construction, then the project cannot be built; especially for SMEs, they don't have enough money to start" (Entrepreneur, Vietnam).

Continuing to the discussion on financial incentive, four entrepreneurs and two officials also mentioned the sustainability of preferential policies. For example, government officials from China and Thailand have said "The sustainability of preferential policies in ASEAN countries is one major concern during the process of cooperation. It has directly impact on cooperative achievements and economic return from investment".

In sum, the presence, availability, accessibility and sustainability of supportive policy, and a mature policy framework are important to develop renewable energy in China and ASEAN middle-income countries.

3.2. Policy guidelines for developing renewable energy

To develop cooperation between China and ASEAN middle-income countries to jointly develop renewable energy industry and ultimately bring mutual benefits to both sides in the future, the policy guideline needs to be focused on these five aspects

(1) Build mechanism for high-level cooperation and policy dialogue

All-round cooperation in renewable energy should be included as one of the major agenda in high profile visits and communications. The detailed action plan and mission for China and ASEAN on renewable energy cooperation for a ten-year or even a longer period time should be explicitly described. It is the basis for following-up multi-level cooperation and communication.

Apart from the cooperation in commerce, industry and other high-level cooperative forum between China and ASEAN, building a regular China-ASEAN energy minister negotiation mechanism is very helpful in exploring cooperation opportunities and in reaching consensus for questions related to developing renewable energy such as; country missions, general cooperation frameworks, key focus areas, priorities for development, and revenue distribution between governments of China and those of ASEAN. On the basis of political mutual trust and win-win cooperation, cooperation on mega-projects and joint research between countries regarding to renewable energy technology can be reached. Experience on cooperation between China and ASEAN will be accumulated, which will help in deepening cooperation and the further marketing of products through improved commercial linkages.

(2) Build multi-channel investment-raising mechanism

Under the cooperation frameworks such as China-ASEAN New and Renewable Energy Action Plan and China-ASEAN Free Trade Area, science and technology authorities of both China and ASEAN member states should endeavor to increase funding resources and investment from international funds, regarding them as the complementary finance in addition to government inputs. International financing agencies such as Asian Infrastructure Investment Bank, Asian Development Bank, OPEC Fund, APEC Fund and Saudi Arabia Development Fund are supportive towards promoting renewable energy. Research institutes and SMEs of China could also seek domestic funding, such as the South-south Cooperation Fund, China-ASEAN Cooperation Fund, China-APEC Fund, China-ASEAN Investment Cooperation Fund, Clean Development Fund, as well as Foreign Aid Program.

To ensure continuity of renewable energy development, central governments and provincial governments of both China and the ASEAN countries should encourage capital raised from bank, industry and venture capital to be involved, especially for those projects that have low risk and have stable income in a long-run. It will be good to have “cheap” funding at beginning, such as low-rate loan and government funding. However, such fund should be regarded as an effective tool to ease financial worries for private small-to-medium enterprises in the initial stage. The ultimate goals of introducing “cheap” fund and building cooperation is to form a self-reliance circle which make profits by its own. Only when the project (or newly-built entity, if necessary) builds a positive income stream, the continuity of it in the long run is ensured and therefore, it survives even without governmental support.

(3) Complete the incentive policy for technology innovation and commercialization

Quantitative analysis indicated that although there were national plans to develop renewable energy in the ASEAN and China, it was not easy for renewable energy practitioners to actually obtain the benefits of the preferential policies. In addition, respondents reflected the importance of ensuring

policy sustainability in developing jointly the renewable energy industry. Therefore, governments of ASEAN member states should provide a stable good policy environment for SMEs to develop renewable energy. Among all types of incentive policy include income tax and tariff exemption, land rental reduction, and the optimum one is to build a long-run, stable feed-in tariff plan for the SMEs. Feed-in tariff works effectively in bringing stable cash flow to the companies, and thus stimulate sustainable operation for the SMEs.

For renewable energy, science, technology and innovation are the keys to industrial development, and plays paramount roles in national capacity building and independent R&D programs. Therefore, in addition to incentive policy for SMEs, governments of both China and ASEAN member states should work together to formulate incentive policies towards technology transfer and commercialization. These incentive policies should emphasize first, “commercialization promotion” policies for research institutes and universities; second, “technology transfer service promotion” policies for third-party intermediary technology transfer agencies; and third, “international cooperation promotion” policies between China and ASEAN.

(4) Jointly construct R&D platforms

Governments should increase inputs to construct joint R&D platforms between China and ASEAN countries, for example, joint laboratories among enterprises, research institutes and universities. The platforms should tightly link the needs of renewable energy development of ASEAN countries, with concerns on the mutual important development needs of both parties, so that stable cooperation strategies can be made in a long-run. Considering the technological development of renewable energy industry of middle-income ASEAN countries, the following principles for joint platforms are suggested:

- launch mega-science projects focusing on basic research of new technologies, applied research of high-technologies and international interdisciplinary research;
- implement high-level joint research, development of new technology into new products and personnel exchange and training.

After reviewing the previous cooperation programs and activities between China and ASEAN countries, and the industrial focus and the joint R&D platform can be individually organized for each of the five ASEAN member states. For example, to be more specific, solar PV application has huge market potential in Thailand, and joint R&D platforms among private sectors, research institutes and universities of China and Thailand can be established on solar PV theoretical and high-tech research. Although geo-thermal energy is the priority for renewable energy developing in Indonesia, the Building-integrated PV (BIPV) materials are very welcomed there, hence leading technology on BIPV and other industrial application products can be a focus for joint R&D platforms built between China and Indonesia. Vietnam has abundant solar and wind energy; therefore, the R&D platforms could focus on theoretical and high-tech research on solar and wind power generation devices and projects. Similarly, in Malaysia, solar and hydro-power energy are well developing, and power generation is the priority of their renewable energy developing, as such joint R&D platforms can emphasize on new technologies such as smart grid for grid-connection of solar power generation.

(5) Enhancing technology demonstration and promotion

Demonstration plays an important role in promoting new products and facilitating further locally initiated R&D innovations that can support development of the local renewable energy industry. Governmental-level cooperation should be enhanced in a bid to encourage a series of demonstration projects, including possibly science parks for advanced new and renewable energy technologies. As mentioned before, it is vital to create the market by familiarizing the potential users with the advanced

renewable energy technologies and products. It is government responsibility to support these non-profit demonstration projects built around the ASEAN community. Demonstration projects could be jointly constructed by private companies and research institutes from China and ASEAN member states, with a purpose of transferring technologies from laboratories to the communities, from China to the ASEAN countries to promote these new technologies. Private companies and research institutes can provide the technology, the product and do the installation; while the governments, both the Chinese and ASEAN governments, provide the required fund and policy support.

In addition, technology demonstration projects are also important building mutual trust between the technology provider and recipients, particularly in areas which have little understanding of renewable energy application and its benefits. It also serves as a channel between China SMEs to obtain feedbacks and the recipient local communities for getting a better understanding of the technologies. These benefits—better understanding to the advanced technologies and feedbacks after utilization—would have positive influence for future industrial development of solar energy.

Demonstration projects have to be on technologies which are in line with the actual needs of recipients. Based on previous study and literature review, the following technologies are suggested - solar concentrating power generation, solar PV power generation farm, thin film solar cell and other new types of solar cell and other types of BIPV materials.

Science parks on renewable energy applications can give communities and other energy end-users a better comprehensive understanding of different types of renewable energy products at once in one place. A science park which shows how renewable energy can provide power for public lighting, water supply and irrigation, and including solar thermal technology for drying and other heating applications, is a good example of how renewable energy can work together and be beneficial to daily life for the community.

3.3. Discussion

Literature review show that Indonesia, Malaysia, Philippine, Thailand and Vietnam have policies and strategies to promote renewable energy in the next 10 to 15 years, indicating a large potential for installation of renewable energy in these countries. These middle-income countries have adopted Feed-in Tariffs as their main incentive for investments in renewable energy power generation. However, this research also showed that one-time subsidy at initial investment stage is beneficial to the development of renewable energy too. With SMEs not being able to make large investment commitment in the beginning, start-up capital is a key barrier for SMEs to develop renewable energy. Therefore, this research suggests building a multi-channel mechanism for raising investment to support small-to-medium enterprises address their financial constraints in participating in renewable energy project construction.

Previous researches focused on the impacts of policies on the transfer of technology to the ASEAN countries from other countries. However, these studies did not connect the impacts of these policies to the practical needs of renewable energy enterprises. This research therefore addressed this gap. It provided advices to promote the sustainability of business operation in the ASEAN renewable energy market, under current policy framework.

4. Conclusion

The results of this research showed that policies played a paramount role in developing renewable energy industry. Both an effective FiT system and one-time government subsidy or grant, are important especially to small-to-medium renewable energy enterprises. Although the governments of China and

the five middle-income ASEAN countries have these national-wide policies or regulations to encourage the development of renewable energy, the accessibility, feasibility and sustainability of current incentive policies are not enough for the future development of the industry.

This research suggest that the governments of China and ASEAN should:

- (1) Build mechanism of high-level cooperation and policy dialogue;
- (2) Build multi-channel investment raising mechanism;
- (3) Complete the incentive policy for technology innovation and commercialization;
- (4) Jointly construct R&D platforms;
- (5) Enhance technology demonstration and promotion.

Acknowledgements

The success of this research is because of the advice and support from Dr.Worajit Setthapun, Nuttiya Tantranont and Assoc. Prof. Dr.Wattanapong Rakwichian. Their suggestions and encouragements are very important in ensuring the quality of this work. I also would like to express appreciation to Dr.Minxiang Ma and other colleagues in my organization Yunnan Academy of Scientific and Technical Information for providing necessary information and opportunities of collecting data for this work. I would like to thank my family for their generous support to me during my education.

Finally, I wish to thank all of persons who support my work during the study that I could not mention all their names. I truly hope that this dissertation will be beneficial.

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