YANGON UNIVERSITY OF ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME

A STUDY ON IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT PLAN (EMP) IN BREWERY AND DISTILLERY INDUSTRIES IN YANGON REGION

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EMPA - 69 (16th BATCH)

AUGUST, 2019

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A thesis submitted as a partial fulfillment towards the requirements for the degree of Master of Public Administration (MPA)

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August, 2019

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This is to certify that this thesis entitled **"A STUDY ON IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT PLAN (EMP) IN BREWERY AND DISTILLERY INDUSTRIES IN YANGON REGION''** submitted as a partial fulfilment of the requirements for the Degree of Master of Public Administration, has been accepted by the Board of Examiners.

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ABSTRACT

Water and Wastewater management constitutes a practical problem for the brewery and distillery industry. The study aims to identify the awareness of brewery and distillery industries on Environmental Management Plan (EMP) and to examine the implementation of EMP by breweries and distilleries factories/industries. For this analyzing survey, a questionnaire is used to collect data from selected distillery industries that have submitted their Environmental Management Plans to Environmental Conservation Department and also key performance indicator interview to the owners or manager of factory from Shwe Pyi Thar Industrial Zone in Yangon Region. The survey revealed that 50% of factory managers in Yangon Region were not aware of the National Environmental Quality Emission Guideline (2015). Weak monitoring and enforcement of industrial waste management practices are not properly managed. Training and awareness-raising program was promoted and widely implemented, to reduce bad practices. Existing facilities are not highly technical and their environmental performance is poor. Current infrastructure for treatment and disposal of industrial waste is practically limited because of lack of awareness and seriously limited human resources for monitoring enforcement.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my deep gratitude and thank to the Master of Public Administration Programme Committee, Yangon University of Economics for providing me with this opportunity to undertake this postgraduate course. I also would like to acknowledge Professor Dr. Tin Win, Rector and Professor Dr. Ni Lar Myint Htoo, Pro-Rector, Yangon University of Economics.

I would like to express my gratitude to Professor Dr. Kyaw Min Htun, Pro-Rector (Retd.), Yangon University of Economics, Professor Dr. Phyu Phyu Ei, Programme Director of Master of Public Administration Programme and Head of Department of Applied Economics and Associate Professor (Retd.) Daw Khin Chaw Myint to have entrusted me with the task of writing this thesis.

My special thanks go to my deepest gratitude to my supervisor, Dr. Tin Tin Wai, Professor, Department of Applied Economics and Yangon University of Economics. I wish to express my deep gratitude and grateful thanks to her valuable and constant supervision, inspiring guidance and constructive suggestions and unfailing interest throughout my study from the inception of this work to its completion and for her presence; enthusiasm, monitoring and close guidance to accomplish my thesis. And then, I am also grateful to all of teachers, EMPA Programme for their perspicacious guidance and sharing knowledge and experiences during my study.

Finally, my deepest thanks with all my heart are saved for my parents and my beloved family. I offer deep gratitude and gratefulness to all the persons who contributed in different ways and who has given me kind help throughout the compilation period of this thesis.

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LIST OF ABBREVIATIONS

ASEAN	Associations of South East Asian Nations
AWGESC	ASEAN Working Group on Environmentally Sustainable Cities
BEMPs	Best environmental management practices
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
DISI	Directorate of Industrial Supervision and Inspection
DO	Dissolved Oxygen
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EE	Environmental Education
EIA	Environmental Impact Assessment
EMA	Environmental Management Accounting
EMP	Environmental Management Plan
EMS	Environmental Management System
EQS	Environmental Quality Standards
ESD	Education for Sustainable Development
IEE	Initial Environmental Examination
IZ	Industrial Zone
IZMC	Industrial Zone Management Committee
MIA	Myanmar Industrial Association
MOECAF	Ministry of Environmental Conservation and Forestry
MOI	Ministry of Industry
MONREC	Ministry of Natural Resources and Environmental
MONREC	Ministry of Natural Resources and Environmental Conservation
NEAC	National Commission for Environment Affairs
NEQEG	National Environmental Quality Emission Guideline
NSDS	National Sustainable Development Strategy
SEZ	Special Economic Zone
SMEs	Small and Medium Enterprises
UASB	Upflow Anaerobic Sludge Blanket

UMFCCI	Union of Myanmar Federation of Chambers of Commerce and Industry
VOC	Volatile Organic Compound
YCDC	Yangon City Development Committee

CHAPTER I
INTRODUCTION

1.1 Rationale of the Study

Twenty-first Century can also be called as industrial developing era because more industries are developing in every country including Myanmar. Although various industries can give development approach, more environmental problems are happening due to industries. Myanmar has moved to institutionalize a more democratic system of governance and open up the economy, following decades of repressive rule and self-imposed isolation. Rapid urban growth and industrialization in Myanmar has led to significant challenges with the management of waste and significant technological improvements. In the brewing industry, energy and water, consumption, wastewater, solid waste and air emissions remain major environmental challenges. Rapid industrialization of many developing countries increased the pollution load on the existing cities. Clean drinking water and pollution free environment is basic right of every human being (LaGraga M.D, 1994).

Myanmar has been blessed with rich natural resources. Protecting with unique environment and valuable natural resources is critical to the sustainable development of Myanmar. It`s economy has been transformed from agricultural-based economy towards industry-oriented economy through natural resources based large scale investments in the areas of energy, mining, hydro power and industry-based investments to establish, industrial estates and special economic zones. Sustainability of natural resources and environmental management are critical issues to be achieving sustainable development with the integration of environmental consideration into the national and regional development processes (Hla Maung Thein, 2015).

Myanmar is the developing countries, it gains experience rapid urbanization, rapid growth in industrialization and high economic growth. This cause growing to the generation of industrial waste and hazardous waste. It has been facing considerable challenges in environmental management, such as pollution of water and air, due to increasing infrastructure development in industrial, urban and rural

development sectors. In order to control and limit such drawbacks, the Government of Myanmar (GOM) adopted Environmental policy in 1994. Environmental consideration is getting involved in the economic development of Myanmar since 2012. The Government of Myanmar enacted Environmental Conservation Law in 2012, subsequently established the Environmental Conservation Rules for implementation of the Law in 2014. To compliance the law and enforcement of the rule Environmental Impact Assessment procedure was released in 2015 and Environmental Quality Emission Guideline (EQEG) also developed in Myanmar. To eliminate the negative impacts of environment due to the industries EIA/IEE and EMP are needed to be conducted by every factory based on the categories as the approval of the Government to start the business in the country. Myanmar National Environmental Policy was ratified in 2019.

The new economic development policy is in parallel with environmental conservation as a foundation of sustainable development is being developed with the participation of the people and civil society. Because of the cross-cutting nature of environmental issues, the challenges how the way the involvement of all relevant sectors to mainstream environmental consideration into the effective and efficient implementation in order to development process to be ensure sustainable development. The practices and awareness of the environmental conservation are still limited.

In this regard, there are many obstacles such as lack of base line information on environmental quality data and environmental management plan in Myanmar. There is a critical issue for foreign investment and industrial development in Myanmar and that the industrial growth will increase significantly in the near future. The highly increase in volumes, diversity and perilousness of the waste is emphasizing the challenges that the Government of Myanmar already facing, at the national and the regional level. Environmental problems, both at regional and global levels, are mostly caused by infinite demands for better living. The effects of environmental impact not only exist at the short time, but also extended to the future generations.

The solid waste and wastewater of the brewery and distillery industries are expected to affect the environment in somehow. Monitoring and inspection activities related to pollution control and hazardous waste management are very limited. Enforcement capacities will be much more challenging as the regulatory base and

implementation is widened and the number of industries growing. EMPs are supposed to mitigate negative impacts and reduce pollution on environment and to improve the health and safety of communities. Therefore, the implementation of EMP is conducted by environmental managements team (ECD, 2017).

In the food and beverage industry, the brewing factories have a critical problem for wastewater management and water consumption of economic standpoint. The major raw materials for production of alcohol, brewery and distillery industries are using molasses byproducts from sugar mill and broken rice, from rice mill. The worst waste is more in the alcoholic fermentation process using broken rice as main substrate.

Weak or poorly enforced environmental laws have allowed corporations to dump waste and pollutants with impurity in Myanmar. Industrial discharge wastewater has damaged livelihoods of communities and ecosystems. Breweries and distilleries effluent wastewater characteristics like colour, turbidity, soluble organics, suspended solids, nitrogen and phosphorous may be completely treated by primary and secondary treatment processes (Eckenfelder, Industrial water Pollution Control, 1995). The advanced technologies for brewery industries provide financial incentives to communities using wastewater treatment alternatives that reduce cost of water usages and energy consumption over conventional systems. Even so, regularly sampling, monitoring and in order to treatment of the acceptable level is necessary to assure that critical parameters do not turn out above requirement thresholds value (Bausmith & Neufeld, 1996; Ford, 1998).

In order to control such problems, the Ministry of Natural Resource and Environmental Conservation instructed all existing industries, factories, which are entitled under the 9 sectors (Alcohol, Wine and Beer production factories, Food and Beverage processing facilities, Pesticide Manufacturing, Formulation and Packaging Plants, Cement and Lime Manufacturing, Textile and Dying Facilities, Foundry Industry, Tanning and Leather Finishing, Pulp and Paper Mill, Sugar Manufacturing Plant) as the notification no. (03/2018) and established before releasing the EIA procedure, 2015, to submit the EMPs. An improvement of water environment management is the main focus and need to enhance the capacity for developing basic water pollution control measures based on obtained information and to establish the regular monitoring activities for EMP compliance. The overall goal is to alleviate the

impact of industrial effluents from industrial zones on river water quality and the advanced EMP approach for complicated issues.

1.2 Objective of the study

The objectives of the study are-

(1) To identify the awareness of brewery and distillery industries on Environmental Management Plan (EMP).

(2) To examine the implementation of Environmental Management Plan (EMP) by Breweries and Distilleries factories/industries.

1.3 Method of Study

This study is used the descriptive method. The structured survey questionnaire is used to collect the primary data through selected distillery industries from Environmental Management Plan submitted to Environmental Conservation Department and key performance indicator interview to responsible persons, especially the owners or manager of factory from ten distillery industries mostly from Shwe Pyi Thar Industrial Zone at the Yangon Region. Moreover, the secondary data utilized in this study are collected from Ministry of Natural Resources and Environmental Conservations, Environmental Conservation Department(ECD), Ministry of Industry (MOI), Myanmar Industrial Association (MIA), Union of Myanmar Federation of Chambers of Commerce and Industry(UMFCCI), Myanmar Food Exporters Processors & Association, library, literature books, research paper, various Environmental Management and Conservation journals and relevant issues from websites.

1.4 Scope and Limitations of the Study

The study area is among the 35 Large and Medium Brewery and Distillery Processes in Industrial Zone of Regions and States. This study mainly focuses on ten distillery industries/factories from selected Yangon Region. These factories are protected and conserved on environment. This study is to provide environmental information to the consumer, who has the chance of taking his/her decisions with more respectful social behavior towards the protection of the environment. Alcohol or Beer production itself has been found to be accountable for a small portion of the environmental performance of the life cycle of product. To support recycling

activities for more environmentally-friendly raw materials can be considered as alternatives to promote sustainable development.

This study reviews and analyzes the concept and implementation of environmental management process as well as real practices in cooperation with private sector in line with the changes of rule and regulation of government sector. Only bottling is not surveyed in this study. The implementation of EMP of distillery industries survey was carried out in industrial zones at Yangon region in order to develop a pollution source database for near River basin. The study consisted of a questionnaire survey targeting 35 factories from Yangon and Mandalay region, Ayeyawady region, Bago region and Mon and Shan State and especially in Nay Pyi Taw Union Territory. In Yangon region areas, the 26 target distillery factories could be selected sampling for the questionnaire survey. Actually, 10 factories were collected and analyzed for implementation of EMP. While not all factories in these areas were investigated, the survey revealed overall picture of diverse environmental management issues of manufacturing industries in whole country. An improvement of wastewater management is the primary focus of the environmental issue.

1.5 Organization of the Study

This study is organized into five chapters. Chapter one presents introduction, which describes rationale, objectives, method of study, scope and limitations and organization of the study. Chapter two is followed by chapter one, which presents the literature reviews of the concept of environmental management, environmental management system and SMEs, best environmental management practices and Limitations, key concepts of environmental management plan, core environmental issues, water pollution and aquatic ecosystems, pollution prevention and control for brewery and distillery industry and review on previous studies. Chapter three is The Environmental Governance in Myanmar and, based on the data available. Chapter four describes survey analysis on Environmental compliance for the Distilling Industry. Finally, conclusion, findings, and recommendations are presented in Chapter five.

CHAPTER II
LITERATURE REVIEW

2.1 Concept of Environmental Management

Environment is a fundamental and most essential part of life. Environmental management provides a better livelihood by ensuring proper management in different sector of life. Environment consists several types of effects such as physical, political, cultural, social, moral, emotional and economic. This is the sum of effects, influences and conditions, which affect the life, nature, behavior development and the growth of living things. Environmental management is an effort to control negative impact on the environment in order to conserve natural resources. It is focusing on the better of human wellbeing for all generations. Environmental management system is just a collection of activities to control that environmental issues are handled. It provides the following functions; Systematically complying with environmental laws; Improving overall environmental performance; Treating environmental obligation to good responsible practices; Great investment in environmental matters; Integration of environmental targets; Offering safety environment workplace. Basically, an Environmental Management Framework is Plan, Do, Check and Act with a continuous cycle (Ouano E.A. R, 1978).

Environmental management is a tough concept, but not precise, use and evolved quickly, concluded a very short time span, considered to other management studies and related scientific areas. Environmental management resources different things to different people, depending on the setting and the purpose for which it is exploited. It is a management or governance strategy that is at long last aimed at changing the behavior of people in their environment. Environmental management involves not only a simple management of environment but it is essentially the management of various activities with unbearable restraints imposed by the environment itself and with consideration of ecological factors (Lochner, 2005).

Environmental resource management is very wide viewed and involved all the technical and economic aspects for economic development. It is not management of

the environment that comes its authority from a well- established sound mandate. Its target is the regulation of the effects of people activities, products and services on the environment. An industry uses limited resources of environmental several ways in its production process. The growth of population and industrialization leads to amount of environmental issues. Environmental processes are the basis form of resource management and economic development. Environmental protection has become a very usual issue all over the world. Economic development does not impact negatively on the environment, but enhances the national resources base and builds resilience to climate change. The environment and natural resources are used optimally and sustainably to contribute to economic growth and human development. The global market is turning dying to environmental degradation, naturally more and more stress is being assigned to environment-friendly outputs. Environmental degradation or pollution addresses for preserving management of environment which in turn is essential for sustainable development. The community services have to determine the best practice for environmental resources and sound environmental management for environmental pollution or degradation. Industrialization is the requirement of economic growth only unintentional industrialization and release of waste by industries existing environmental pollution or degradation. Most of the environmental protection issues are directly related to environmental resources and natural (Eckenfelder, Industrial water Pollution Control, 2000).

Environmental Management is entirely a rising and active conception. Environmental Management is concerned with the management for environment surrounding a business. It constitutes the organizational structure, responsibilities successions, processes and preconditions for the implementation of an environmental collective policy. Environment plays together all nonliving organism and drives operation in nature. The essential procedures of good environmental management are goal setting; information management; support of decision making; organizing and environmental management planning; environmental management syllabus; control and implementation; communication; internal and external auditing. The present level of economic development, including the environmental express, produces it necessary to diversify management's arrangement of natural environment. The wastewater treatment technologies practiced in both developed and developing countries look simple but attention must be given to their cost and appropriateness. Thus, it has become integrated in all sectors and investments for the consideration of ecological

issues. To reduce the environmental pollution, technology is available now and it must be exploited to adjust the excesses of ecological brutality and to minimize the degree of environmental degradation. The right accounting and reporting of environmental information can lead to good "Environmental Management". So, it requires environmental planning, conservation of resources, environmental status assessing and environmental administration and legislation (UNEP, Environment Management in the Brewing Industry, 2012).

2.2 Environmental Management System and SMEs

Environmental Management System (EMS) is a limit of treatments and practices that enable an organization to reduce its negative environmental impacts and growth in operation efficiency. In the social organizational, planning and resources for development, implementation and maintenance policy for environmental conservation. EMS is actually only a formal planning tool to support an organization, organize priorities and pursue goals. It needs a continuous improvement of the system and provide management on organization`s environmental issue. For more effective EMS; confirms a variety of goals, controls the impact "owner'' is responsible, is in opinion and action with recognizes continual improvement.

Environmental management system evaluates physical and social environment impact of the enterprise or project. It contributes to the progress of planned investment at the first of the production chain rather than drove investment in cleansing up the goal. The crucial information of environmental management are; to make clear modern environmental concept like how to maintain biodiversity; to recognize the greater sustainable way of living; to utilize natural resources more efficiently; to know the behavior of natural conditions; to experience the interrelation between populations and communities; to aware and develop environmental issues and problems at national, regional and international levels. Environmental management is crucial to adapt socio-economic development issue to environmental safety and ensure sustainable development. The impact on the environment is increasing, ahead to rapid deterioration in environmental consideration. It supports the planning and management to take long term measures for effective management and environment conservation (Envocare, 2017).

Industrial wastewater normally contains more than organic substances of nitrogen and phosphate compare with carbon. Wastewater characteristics that can

affect sludge bulking include fluctuation in flow rate and pH, temperature, optimum nutrient content, and the concentration of waste components. The destructive influence of man's economic activities on the environment in the name of sustainable global economy is not of recent origin (CSIR, 2005).

SMEs are defined as enterprises which have less than 150 employees. SMEs are far from being a homogenous group. They have many features in common, and do certainly encounter similar problems in relation to environmental compliance and performance. Some of the significant SMEs have impact on the environment, they represent a large percentage of economic activities. The environmental problem does not totally issue if individual firms considers, although in some cases there can be negative impacts on environments and social communities exerted by SME, but concern their combined and cumulative impact. The main problem of SMEs has a compliant on their environmental aspects, but most of them do not know about legislation applied on aspects to about their emission.

SMEs is due to lack of concerned and knowledge of their own capabilities, incomprehension of environmental legislation, how to manage their negative impacts on the environment, and need the support for technical assist for administrative sector and financial accountability could be responsible for environmental compliance. Environmental compliance is the perception of conservation by costly and has little benefit for the concern. Most of the SMEs have little awareness of their own environmental impacts and of how to handle them (Massarutto, 2007). Moreover, literature emphasizes that most SMEs are 'vulnerably compliant', they are not good at acquire an environmental performance for smooth to environmental safeguard. Environmental legislation is applicable to SMEs, they are complying and, total compliance is the consequence of external action following an inspection, preferably an on-going process of checking that legal prerequisites are being met (Robyn, 2005). SMEs do not have the requirement legal and environmental expertness to manage with environmental legislation.

Regarding environmental matters, SMEs have to struggle opposing their cultural gap and lack of resources. The main problem for SMEs looks to be invest in the improvement of environmental operation. The implementation of Environmental Management System costs connected with the adoption of a strategy could represent a starting time of barrier for SMEs (Fablo Iraldo, 2010).

2.3 Best environmental management practices and Limitations

Best environmental management practices (BEMPs) focus the control of all wastes source generated relatively inexpensive modification to operating procedures and this can be considered to Environmental pollution prevention. The effectiveness and efficiency of a particular BEMPs should be accompanied and supports the EMP in guiding effective environmental governance in order to achieve its targets (UNEP, Environmental Management in the Brewing Industry, 1996). More stringent effluent quality requirements and growing complexity of the wastes impair their treatment performance when subjected to flow and load transient. Almost all traditional system remains ineffective when dealing with strong waste generated from some brewery and distillery industrial activities. These are some of the best environmental management practices.

Resource consumption: Regularly the environmental conservation measures has been on emission control and reduction in many industries. The use of inputs natural resources (water, energy and raw materials) in a distillery industry have an adequate amount of environmental impacts. According to industrialization policy, most of the distillery plants are located in industrial zone. Environmental standards usually decide the concentration basis for polluting elements. Also, the rules and regulations are usually established with the limits of concentration of toxic or polluting elements of the effluent from industrial plants (Europe, Brewers of Europe, 2002) (Commission E. , 2006).

Water use: The reduction of water consumption in brewery industries would have several environmental and economic aspects, including conservation of water resources, and reduce wastewater discharge volumes. This is effectively and reduce costly wastewater treatment equipment (RCL (Ltd.), 1995). Water conservation should be intended to reduce the pollutant loadings in the effluent, natural resources and by-product recovery, production modifications and waste reduction (Partners, Water and Wastewater Management in the Malt Brewing Industry, 1986).

The following are currently employed in several production modifications to reduce water consumption at brewery industry (Commission, Reference Document on Best Available Techniques (BAT) in The Food, Drink and Milk Industry, 2006).

(i) Online monitoring and control of water meters at various sectors of the operation;

(ii) Stopping water flow during breaks, with the exception of water used for cleanup;
(iii) Dry milling of grain and broken rice in breweries;
(iv) Minimization of transfer of last running;
(v) Improved production efficiency, especially in the packaging lines;
(vi) Installation of low-flow nozzles or equipment sprays;
(vii) Reduction of water pressure on equipment spray nozzles;
(viii) Installation of flow control valves and an automatic valve to interrupt the water supply when there is a production stoppage; and,
(ix) substitute of new equipment.

These considerations should be paid to the water consumption during cleanup procedures:

(a) apply a closed system for cleaning operations;
(b) use a stiff broom or brush to remove attached solids prior to wash down, so as to reduce effluent pollutant loadings;
(c) need low-volume high-pressure washers, or use equipment for mixing water jet and a compressed air stream which will reduce water consumption by 50-75% when compared to a low-pressure system;
(d) compressed air should be employed instead of water whenever possible; and,
(e) hoses should be utilized with shutoff nozzles to prevent wastage.

Large amounts of water can be lost due to the lack of appropriate maintenance. Logically, preventative maintenance is very important if water consumption in a distillery industry is to be run more efficiently Implementation of a preventative maintenance plan to improve its productivity.

Many of the country`s natural resources and environmental assets are under pressure. Government has recognized these challenges and has committed to a series of environmental and sustainable development policy reforms. Mainstreaming environment, building resilience to climate change and disaster management concerns into other economic and development sectors and levels of governmental is crucial to attain sustainable development objectives (Environmental, 1995). Best environmental management practices (BEMPs) is a `tool` to control the impact of its activities, products or services on the environment. Environmental control refers to control of working conditions surrounding the work. Control of working conditions is becoming an increasingly important responsibility of any organization. BEMPs can be expected

to initiative in production operations and management in the brewery and distillery industries. The first priority of a brewing industry is to eliminate material losses, improve brewing and packaging efficiencies and determine cost effectiveness, environmentally-preferable ways to managing waste. To assist in promoting best practice in environmental management and guideline used in efficient and cost-effective is the best improvement (World Bank Group, 2007).

The purpose of wastewater treatment works is to remove impurities to such an extent that the treated effluent will meet water quality requirement and be suitable for disposal or reuse. Both the processes of removing objectionable constituents from the wastewater and the final disposal must be accomplished in an environmentally acceptable manner (Europe, Guidance Note for Establishing BAT in the Brewing Industry, 2002) (European, 2006).

These limitations are potentially allowed for low costly wastewater treatment processes; while energy conservation measures reduce the amount of pollution created in the production or use of energy (e.g., CO2, NOx, SOx, ash, etc.), to reduce the energy, pollution prevention measures requirements for waste management (Agency, 1991). Every industry can consume significant amounts of electricity in both production processes and operation of the maintenance objectives (Grossman, 2010). The conservation and reduction of energy is based on strategy. It will focus on harmonizing and connecting existing and proposed systems and actions. The fuel consumption (e.g., oil, coal, natural gas, etc.) would be decreased by operating and implementing processes to prevent and maintenance schedules. Distillery operations follow internationally-recognized food safety standards comply with the principles and practice of Hazard Analysis and Critical Control Point (HACCP) provides for effectively. Environmental monitoring programs can vary significantly in the scale of their spatial and temporal boundaries.

For the emission reduction, improvement of the emission can be reached in an existing plant with factors such as change in fuel, optimization of the burner or change of burner and smothering of flue gas. The emission sources of volatiles in distillery process are well known, to control the pollutants for food processing industries especially for the ‘zero emission brewery’ (Robbins, 2002).

The industrial plant has to solve the waste problem either become aware of good community relations or due to enforcement of government rules and regulation. The environmental management plan should provide clear guidance on supporting

role of national and regional standards. Reliability of data provided is also a concern as sometimes in absence of data, the industries make estimates on raw material use, wastewater and waste generation. The industries 'owner or Government should arrange any protection for peoples' health safety (ISO, 2005).

Environmental issues in every factory are generally very complex, and available information is often very scarce to make judgement about potential risks with confidence. To properly enforce environmental regulations and to avoid infringement of related laws and regulations should be fully aware of responsibilities of environmental authorities, and related issues in implementing environmental control activities under less than perfect legal framework of environmental laws and regulations. In addition to inspection for licensing and registration, inspection is also conducted to resolve an environmental problem. In formal environmental litigation, only an evidence, is admissible in court. First, evidence has to be authentic unreliable data and information are scrutinized and refuted as evidence. Also, an evidence should be relevant in establishing the fact, such as violation of regulatory requirement.

(a) Policy and regulatory barriers: Policy and regulatory oversight systems can influence the priorities and manner in which energy efficiency measures are implemented. Policies include both national and local government policies. Regulations that support inappropriate tariffs can limit interest in energy efficiency. Environmental policy and regulatory for energy conservation include goal setting, mandatory or voluntary should be developed and strategies for encouraging energy efficiency can be considered.

(b) Lack of awareness and information: Generally, industries are not aware of the economic and social benefits of energy efficiency measures. Economic policies must recognize that environmental protection is a condition, and a prerequisite, for long-term economic growth. Environmental problems are really serious in LDCs because changes in technology and institutions lag behind changes in resource endowments. With rapid growth of population, resources become more and more scarce (Olajire A. A., 2012).

(c) Lack of initiatives management: The economy and the environment are complex interdependent systems. It depends on natural resources used in production and on the life-supporting services of ecosystems. But overuse of natural resources and discharging polluted waste into the environment may

threaten the ecosystems. Environmental maintenance and safety many include part of their management systems.

(d) Lack of technical capacity; it is not much difficult to counteract environmental degradation by designing the institutions and policies to promote adoption of anti-pollution technologies. In many countries there will be a need for training and for a technical certification scheme in order to improve technical capabilities and provide incentives for acquiring official qualifications.

2.4 Key Concepts of Environmental Management Plan

Environmental monitoring plan (EMP) should first technical details identify whether direct or indirect monitoring is required. Different approaches can be chosen to monitor a parameter, including direct measurements, surrogate parameters, mass balances, emission factors and other calculations. These monitoring should be a balance between the availability of the method, its reliability, its level of confidence, the costs and the environmental benefits.

The following steps are involved in developing a monitoring plan for implementation by operators; (a) Specify goals setting (b) Establish responsibilities (c) Identify the programme's scope (d) Decide on the approach and monitoring methods (e) Specify the technical details of a particular standard or other measurement method and the units of measurement (f) Specify the timing requirements of sampling and measurements (g) Specify unambiguously the location where sampling and measurements should be performed (h) Define the operational conditions, including production loads (i) Establish appropriate quality assurance and control requirements (j) Define the recording and reporting requirements (k) Make arrangements for the assessment and reporting of exceptional and accidental releases (l) Establish an internal framework to ensure compliance (m) Provide a clear statement of the compliance control procedures and the response in case of non-compliance.

Environmental monitoring activities should be included in an overall quality management system for an installation. Quality management systems (e.g. BS EN ISO 9000) are useful for ensuring that the equipment and methods used in the measurements as well as the various monitoring tasks are carried out according to the requirements. Quality assurance includes maintenance and calibration procedures. Environmental management systems assist in the systematic management of

monitoring data, for instance, in relevant documentation and in the practical organization of the tasks.

The EMP gives institutional arrangements for mitigation and monitoring measures to strengthen environmental management capability in the organizations. Responsible for implementation, EMPs contain the following topics: (a) technical assistance programs, (b) procurement of equipment and supplies, and (c) organizational changes. The aspects of mitigation, monitoring, and capacity development, the EMP provides a schedule for measures with implementation plans, the capital and recurrent cost estimates and sources of funds for implementing the EMP.

Environmental Management plan takes into consideration all conditions required for the survival of corporate sectors. The principles and concepts of environmental monitoring design are dynamic and iterative in nature. The need has never been greater for integrated programs that collect, analyze, evaluate, and disseminate relevant environmental measurements at various scales on an ecosystem and multimedia basis. Conceptual approach to these issues is intended to help scientists, researchers, decision makers, and other leaders develop, implement, and maintain integrated monitoring on a comprehensive basis but relevant to local, regional, national, and global perspectives. Between the economic development and the environmental management processes have tendency achieve impact for Sustainable development. Sound of environmental management is the essential for sustainable development for the present and future generation. EMP is vital for management initiatives with environmental focus, including cleaner production, supply chain management, environmentally preferable management systems.

Environmental Management Accounting (EMA) is one of the management tools and more important not only for environmental management decisions, but for all types of managerial functions and the decisions affected by environmental issues is gradually increasing. Environmental management helps corporate related to overall management of operations and performance of the factory. In order to respond to the environmental needs and to execute and reassess the general premise of environmental policy, a wide strategy of Environmental Management Plan and a through system of performance monitoring. Environmental Management Plan (EMP) is established mainly based on the Environmental and Social Impact Analysis. The EMP takes account of the implementation of environmental protection and mitigation

of significant environmental impacts. The measure will cover the production processes and ensure to comply with applicable rules and regulations and reduce or eliminate adverse impacts associated with the production activities.

According to the outcomes from the Environmental and Social Impact Analysis, Plan for environmental and social management is addressed to mitigate the potential impacts. The EMP generally take account of the following crucial management plans. Air Emissions Management is controlling the fugitive gases and particulate matters form potential emission sources into the ambient air. Wastewater Management is establishing a treatment system and ensure to maintain the acceptable water quality before discharge into the public water course. Waste Management is implementing proper solid and liquid waste management of industrial and domestic wastes, the secure disposal of waste reusing and recycling of certain wastes through functional methods. Public Health and Safety Management ensure to control the any potential health hazards to acceptable level during production through pollution management plan, regular monitoring plans, emergency preparedness plans and implementing all requisite control plans to protect public safety.

The concept of sustainable development is focused on the quality of life, avoiding the unbalanced utilization of natural resources. Recently, various concepts have been developed to evaluate the use of resources and manage a global wide. Life Cycle Assessment has been considered for the environmental analysis of products consumption. (Almudena Hospido, 2005).

2.5 Core Environmental Issues

Environmental issue has been brought up globally and nations of the world have attempted in various ways to tackle these problems mostly by all levels of administration in each and every country. For decades, environmental concerns have been in acceleration throughout the world, especially in developing world as degradation of the environment has resulted in many problems restraining the development for certain nation.

The manufacturing sector act a vital role in country's development. However, the provision of electricity to manufacturing industries that require a steady supply of electricity, access to quality transport infrastructure and need skilled workforce key challenges for the manufacturing sector. (UNIDO Project & MOI, 2017) The economic and environmental problems facing the developing world are staggering in

their magnitude and their complexity. Problems include overcrowding, pollution, inadequate sewage disposal etc., land degradation, deterioration of natural resources, especially deforestation leading to soil erosion and drought etc. Also, environmental issues are brought up concerning pollution effects on land, air, and water. Environmental pollution also contributes directly to biodiversity loss by habitat modification. Among various types of pollutions, water pollution in the rivers and costal water is widespread; making many water bodies unsuitable for the life and the increasing pollution in these costal and marine water is also affecting biodiversity.

As the world become more industrialize and smaller due to better communications and trade, accidental and purposive hazardous damping has contributed to pollution. It also results from disposal of chemical waste, household waste into the creek, streams and rivers. As waster become polluted there is the big problem of scarcity of drinking water in developing countries and these countries do not have enough water sources. Currently the countries of the world have been arranging to monitor the use and allocation of water to prevent from water scarcity. (ENVIS Centre, 2001) There are many disasters such as Minamata disease, Itai-itai disease, Love Canal, Seveso disaster and Bohpal disaster. Once occurred, they inflict devastating damages to the environment and the societies, responsibilities of the environmental administrative would become focal of inspection.

Environmental Education (EE) has been defined helping people education for understanding skills and values to active participate and development of an environmentally sustained and socially society. Good environmental practice is inculcated at the organizational and community levels. For poor environmental management and environmental neglect and degradation are explained about EE. It aims to make knowledge and skills to preserve, conserve and utilize the environment in a sustainable manner for the present and future generations. It is a key integrated part of Education for Sustainable Development (ESD), involves how to learn new technologies, increase productivity, avoid environmental disasters, alleviate poverty, utilize new opportunities and make wise decisions for a sustainable future (UNEP H. S., 2008-2012).

2.6 Water Pollution and Aquatic Ecosystems

Rapid movement of industrialization throughout the world has been seriously menacing mankind’s ability to maintain an ecological balance. Clean and unpolluted

water is an essential resource for the survival of living things and for environmental balance of the world. Water has life-giving properties which are crucial to the world`s global ecosystem. Water pollution is a serious problem for the entire world. The rational of water resources and aquatic ecosystems management is a crucial element of environmental management for sustainable development. (summary, 2000)

Water is a very important environmental resource; it sustains life and economic activities and is used extensively as a waste sink. Population and economic growth in the regional have exerted pressure on water resources used of quantity and quality, with adverse impacts on aquatic ecosystems. The most important natural resource, water is required for quality of life. Nowadays, adequate supply of fresh and clean drinking water is a basic need for all human beings. Without clean water neither human nor the environment can sustain and survive. About 97.5% of world's water occurs as salt water, of the remaining 2.5% two third occurs in the polar and alpine region as snow and ice so about only 1% of global water occurs as fresh water liquid (Mr. Imram Ahmad, 2015).

Groundwater is the underground water that occurs in the saturated zone of variable thickness and depth, below the earth's surface. More than 98% of fresh water present on the earth surface is ground water while streams, lake and rivers hold only 2% of the total available water as the most valuable natural resource. The fresh water demand has increased and led to scarcity in all over the world. The situation of water pollution or contamination is aggravated problem. Recently, groundwater is highly susceptible to pollution by natural, anthropogenic activities, industrial effluent, and agricultural field run off and leaching, landfills refuse dumps, septic tanks and improper collection of solid wastes.

Problems related to water resources and aquatic ecosystems vary in extent and severity among ASEAN Member Countries depending on socio-economic conditions, the effectiveness of environmental management practices, and the natural resources to absorb external pressures. Compared to most regions of the world, ASEAN has adequate renewable water resources but seasonal and some local pressures on clean water availability are increasing. The ASEAN region is a major producer and exporter of fish products but the resources on which they depend – clean waters, mangroves and coral reefs – are deteriorating. ASEAN has established over 90 marine and coastal Protected Areas covering nearly 100,000 sq. km to better protect these resources (Mays, 1996).

2.7 Prevention and Pollution Control for Brewery and Distillery Industry

Prevention and control of Pollution is best practiced for effective management, maintenance and processing that incorporates water conservation and recycling, energy conservation, and disposal of solid wastes. Some are as follows; (Industrial Pollution Prevention and Abatement: Breweries, 1997)

- Use clean-in-place (CIP) methods for decontamination equipment;
- Use high pressure, low volume hoses for equipment cleaning;
- Install recirculating systems on cooling water circuits;
- Use girt, spent grains from grain cleaning as chicken feed;
- Dispose of solid waste as animal feed, after evaporation;
- Filter from final fermentation tanks and use as animal feed;
- Reduce energy consumption and water recycling;

Potentially by-products of distillery operations include; Spent grains used an adsorbent for removing VOC emissions or organic material from effluent, or to produce fertilizers, bread, and animal feed. (BPEC, 1986) (Manning J. F.jr., 1991) (Chaing, 1992) (UNEP, Environment Management in the Brewing Industry, 1995) Yeast collected from fermentation and storage tanks and the filter line for animal consumption (Lange, June, 1993) Fermentation gases carbon dioxide from breweries would reduce ethanol emissions.

The distillery industry is the largest industrial users of water resources. Even though substantial technological improvements have been made in the past, energy consumption, water consumption, wastewater, solid waste and by-products and emissions to air remain major environmental challenges in the brewing industry. The significant technological improvements in breweries, waste reduction, gaseous emission reduction and energy efficiency improvements which does not compromise the quality of products (Olajire A. A., 2012).

One of the most significant waste products of distillery operation is wastewater, it has been estimated waste effluent is generated ten times per liter of alcohol produced (Kanagachandran, 2006). The quantity of wastewater will depend on the production and the specific water usage. Distillery waste has high organic content and easily biodegradable (Europe, Guidance Note for Establishing BAT in the Bewing Industry , 2002). Wastewater from breweries is divided into three types; viz: (a) process wastewater (PWW) (b) sewage wastewater (SWW) from toilets and

kitchens; and (c) rain water. Rain water discharged to a separate drainage system, as it can trouble with the wastewater treatment plant (Brauer, 2006) (Huige, 2006) (Porter, 2006).

The amount of process wastewater will depend on the extent of production and water usage efficiency. The pollutant load of effluent is primarily composed of organic material from process activities and also generate liquids should reuse rather than allowing to enter the effluent stream (USEPA, 1992). The concentration of organic material is usually measured as chemical oxygen demand (COD) or biological oxygen demand (BOD) (Wen, 2010). BOD is measured for a five-day period at standard incubation period. Nutrient levels are mainly dependent on the raw material and the amount of yeast present in the effluent.

The brewing process generates large amounts of effluent and solid wastes that must be disposed or treated in the least costly and safest way to meet the strict discharge regulations by government entities to protect life and the environment. Wastewater treatment is an end-of-pipe of controlling water pollution. It is estimated that one liter of product that is brewed, close to ten liters of water is used. After that, this water must be disposed or safely treated for reuse. As a result, many industries are searching for ways to cut down water usage during the brewing process, and to cost effectively and safely treat the wastewater for reuse (Simate, 2011).

Physical treatment is removing coarse and large materials, rather than dissolved pollutants. The sequence of physical treatment of wastewater is given: Flow equalization is used to consolidate wastewater effluent in holding tanks for "equalizing" processes or directly into the municipal sewage system. Typically, the wastewater is first screening to remove solid materials. Gravity sedimentation carried out the wastewater still contains dissolved organic and inorganic constituents along with suspended solids. It can be removed from the wastewater with further treatment such as sedimentation or chemical flocculation.

For the chemical treatment, pH adjustment and flocculation are commonly used at breweries in removing toxic materials and colloidal impurities. The pH of wastewater needs to remain between 6 and 9 to protect organisms. Alkalis and acids can alter pH thus inactivating wastewater treatment processes. Flocculation is the stirring or agitation of chemically-treated water to induce coagulation. Flocculation enhances sedimentation performance by increasing particle size resulting in increased settling rates.

Biological treatment has undergone physical and chemical treatments, the wastewater can then undergo an additional biological treatment. Biological treatment can be either aerobic or anaerobic. Aerobic biological treatment is performed in the presence of oxygen by aerobic microorganisms that metabolize the organic matter in the wastewater, thereby producing more microorganisms and inorganic end-products. Aerobic treatment utilizes biological treatment processes, in which microorganisms convert non settleable solids to settleable solids. Common types of aerobic wastewater treatment plant (WWTP) systems are, activated sludge process: In this process, the wastewater flows into an aerated tank that is primed with activated sludge. This complex mixture containing bacteria, fungi, protozoans, and other microorganisms is referred to collectively as the biomass. The suspension of aerobic microorganisms in the aeration tank, are mixed vigorously supply oxygen to the biological suspension. "Attached Growth (Biofilm) Process" is also aerobic biological treatment system, that deals with microorganisms fixed on a solid surface. The other types of biofilm process are Trickling filter process, in this process the wastewater is sprayed over the surface of a bed of rough solids and is allowed to "trickle down" through the microorganism-covered media. A variation of a trickling filtration process is the bio-filtration tower or bio-tower. The bio-tower is packed with plastic or redwood media containing the attached microbial growth. The rotating biological contactor process consists of a series of plastic discs attached to a common shaft. Lagoons are slow, cheap, and relatively inefficient, but can be used for various types of wastewater. They rely on the interaction of sunlight, algae, microorganisms, and oxygen.

Biological treatment of wastewater without use of oxygen is anaerobic wastewater treatment. It is characterized by biological conversion of organic compounds by anaerobic microorganisms into biogas which can be used as a fuel (Briggs.D.E., 2004).

2.8 Review on Previous Studies

In are. Indian is increasing economic development and a rapidly growing population that has taken rapidly the environmental problems. In this country from 300 million people in 1947 to over one billion people today is putting a strain on the environment, infrastructure, and the country's natural resources. Rapid industrialization, urbanization, and land degradation are growing problems as occurred industrial waste pollution, deforestation and soil erosion. Over exploitation

of the country's resources has resulted in environmental degradation of resources. The cost of environmental damage in India would have 4 percent off of the country's gross domestic product. Lost productivity from death and disease due to environmental pollution are the primary culprits (Prasad P. N, 2010).

The government agency responsible for environmental affairs is the Ministry of Environment and Forests (MoEF). India's industrial pollution is coping with the top priority agencies. MoEF recognizes the need to strike a balance between development and protecting the environment in administering and enforcing the country's environmental laws and policies. The government heightened the Ministry's powers with the passage of the 1986 Environment Protection Act. This act built on the 42nd amendment to India's constitution in 1978 that gave the government the right to step in and protect public health, forests, and wildlife. This amendment however had little power as it contained a clause that stated it was not enforceable by any court. India is the country to pass an amendment to its constitution ostensibly protecting the environment (Prasad P. N, 2010).

About 80 percent of urban waste in India ends up in the rivers, and urban growth across the country combined with poor government oversight getting worse. The growing body of water in India are unfit for human use, and in the River Ganga, holy to the countries 80 percent Hindu majority, is dying slowly due to pollution. New Delhi's body of water is little more than flowing garbage dump, with 50 percent of the city's waste finding its way to the Yamuna. It is that three billion liters of waste are pumped into Delhi's Yamuna every day. Only 50 percent of the 15 million Delhi residents are connected to the city's sewage system. The remainder flush their domestic waste, wastewater and just about everything else down pipes and into drains, most of them empty into the Yamuna. According to the Centre for Science and Environment, between 75 and 80 percent of the river's pollution is the result of raw sewage. Combined with industrial runoff, the garbage thrown into the river and it totals over 3 billion liters of waste per day. Nearly 20 billion rupees, or almost US $500 million, has been spent on various clean-up efforts.

The frothy brew is so glaring that it can be viewed on Google Earth. Much of the river pollution problem in India comes from untreated sewage. Samples taken recently from the Ganges River near Varanasi show that levels of fecal coliform, a dangerous bacterium that comes from untreated sewage, were some 3,000 percent higher than what is considered safe for bathing (Garg, 2015).

Groundwater exploitation is a serious matter of concern today and legislations and policy measures taken till date, by the state governments (water is a state subject) have not had the desired effect on the situation. In 1976, when the Indian parliament passed its constitution safe guarding the environment, it became the first "endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country." The duty of Indian citizen "to protect and improve the natural environment and to have compassion for living creatures." According to the Environment Protection Act of 1986, Environment is the "inter- relationship which exists among and between water, air, and land and human beings, other living creatures, plants, micro-organism and property." Essentially, The Water (Prevention & Control) Act, 1974 can be considered to be truly the first regulations. Basically, there are seven Pollution regulations (Garg, 2015).

Regulatory agencies are now enforcing the regulations more and more. In 1987, enforced the "Polluter pays" principle. In April 1996, the Supreme Court ordered the closure of 513 polluting industries. India's approach for the safeguard of the environment by Mahatma Gandhi when he said, "earth has enough to cater to our needs, but it surely will not put up with our greed" (Garg, 2015).

CHAPTER III
ENVIRONMENTAL GOVERNANCE IN MYANMAR

3.1 Historical Background

The country`s wealth is its people, its cultural heritage, its environment and its natural resources. Myanmar's National Environment Policy of December 1994 instituted environmental regulations on the utilization, conservation and prevention of environmental degradation, which integrates environmental protection in economic development. The Myanmar National environmental policy is aiming to do achieve harmony and balance between these through the integration of environmental considerations into the development process for every citizen. Every country has the sovereign right to utilize for natural resources. Environmental policies must be taken great care not to exceed its jurisdiction of infringe. States and every citizen are the responsibility to preserve its natural resources in the future generations. Environmental protection is the primary issue for the future developments.

National Commission for Environment Affairs (NCEA) established in 1990. The Ministry of Natural Resources and Environmental Conservation (MONREC) was established 30th March 2016 following a restructuring of ministries by the newly elected Parliament and Union Government. As a consequent of this, the portfolio of Ministry of Mines was merged with the portfolio of Ministry of Environmental Conservation and Forestry (MOECAF). Ministry of Forestry became the Ministry of Environmental Conservation and Forestry in October 2011 and now renamed as Ministry of Natural Resources and Environmental Conservation. The Environmental Conservation Department (ECD), established on 11th October, 2012, one of the eleven departments under the Ministry of Natural Resources and Environmental Conservation. ECD was related to lay down the basic principle for systematic integration of the environmental conservation in the sustainable development process and to enable to cooperate with Government organization, international organizations, non-government organizations and individuals. The Environmental Conservation Department has presently Head Office in Nay Pyi Taw, 14 state and region offices

and one union territory office (Nay Pyi Taw) under the supervision of Director General. Myanmar Agenda 21 (1997) was made to implement integrated natural resources management. In 2009, the country's National Sustainable Development Strategy (NSDS) was prepared, as this guiding document aim to ensure development remains in harmony with the three main pillars of sustainability, environment, economy and society. To introduce the basic principles and guidelines for sustainable development and systematic integration of environmental conservation: Environmental Conservation Law was developed in March 2012 and Environmental Conservation Rules was enacted in June 2014. All of these focus on the environmental quality standards, to lay down and carry out a system of environmental impact assessment and social impact assessment, sustainability of natural resources and conservation of environment.

Environmental Impact Assessment (EIA) procedure was established in December 2015.National Environmental Quality (Emission) Guidelines was launched in December 2015 by MONREC aiming to provide the regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution of productions and for purposes of ecosystem and human health. These guidelines apply as the instrument regarding environmental quality standard to protect and control pollution before formulating national environmental quality standards.

Poor waste management practices contribute significant environmental and public health impacts in Myanmar. Transportation and disposal systems, much of Myanmar's generated waste ultimately becomes pollution. Leachate from unmanaged disposal sites has been linked with soil and water contamination. The open burning of waste is directly leading to a reduction in air quality and more broadly speaking climate change. National Waste Management Strategy and Master plan (2018-2030) benefited from financial support of the Ministry of Environment Japan (MOEJ) in partnership with UN Environment and based on agreement of ECD of MONREC and the institute for Global Environment Strategies Centre Collaboration with UNEP on Environment Technologies (IGES-CCET).

The National Waste Management Strategy and Master plan (2018-2030) has identified with 6 goals and each goal is discussed with some key targets and proposed activities. The vision; 'Sustainable, Green, Clean and Healthy Environment towards a

Brighter Future for Myanmar' was identified as a common declaration for this Master Plan.

Myanmar is thriving in not only the development of urbanization and industrialization but also the development of foreign investments across the country. In this regard, wastewater management from the industrial sector will be the key issue for environmental concern in Myanmar. Government committee laid down by guidance as following matters;

(a) Planning and management of land use including zoning,

(b) Management of the construction in urban centers,

(c) Management of housing settlements,

(d) Management of wastes,

(e) Pollution control including land, water, air and noise pollution,

(f) Other necessary environmental management.

The Ministry may give, as may be necessary, advice for environmental conservation, persons ask for advice for the management of urban environment contained in section 17 of the Law with the guideline laid down by Committee, necessary to give advice. AWGESC (ASEAN Working Group on Environmentally Sustainable Cities –ESC) formed in June 2013 including eight AMC's (ASEAN Member Countries of ASEAN. The AWGESC has been presenting the ASEAN ESC Award to the cities every three year. The objective is to make ASEAN cities clean in the areas while ensuring environmentally sustainable cities with less environmental degradation. Besides, it aims at becoming a network for future coordination among the cities. The criteria for the ASEAN ESC award are Clean Air Activities (AQM), Clean Water Activities (Industrial/Domestic Wastewater Management), Solid waste Management (Waste to Energy), Green Growth, Green Economy, Water Supply and Sanitation.

3.2 Environmental Conservation in Myanmar

The environment protection branch of the Ministry, ECD, has been established the environmental monitoring activities as the focal institution for pollution control, Environmental Impact Assessment (EIA) review and other environmental management activities: to protect the health for human being and Ecosystem. The healthy development of Myanmar and never leave the any bad remnant to the next generation of Myanmar people. For capacity Development in Enforcement and

Promotion of Environmental Management, need to establish Environmental Quality Monitoring System and Building the National Laboratory to improve the National Capacity for Water Quality Management in Myanmar.

The duties and powers relating to the environmental conservation of the Ministry are as follow; implementing the environmental conservation policies, planning and laying down national or regional work plans relating to environmental management. Now EQEG was issued successfully.

Environmental Quality Standards Technical Committee was established on 4th July, 2013. The main duty of this committee is to promulgate National Environmental Quality Standards (NEQS). The NEQS include for water, air and soil, so it will take long time to adopt. To formulate the National Environmental Quality Standards: prescribe for environmental quality standards on emission, effluents, solids waste, production procedure, process and products for enhancement and conservation of environmental quality. It`s the main indicator of the environmental policy and compliance. It plays as an important tool for EC law. However, International Investments will start in 2015 so we urgently need to control industrial discharges. Therefore, we adopted Environmental Quality Guidelines instead of Environmental Quality Standards in the interim period with the assistance of Asia Development Bank and International Management Group/ European Union.

3.3 Industrial Development for EIA, IEE and EMP

Myanmar is embarking on a journey with large scale industrial development similar to many neighboring countries, but with a unique opportunity to take on-board lessons learned from industrial development of other countries, the results may become different in Myanmar. It has been reintegrating in to global economy and attracting foreign investments since 2011, with slew of economic reforms and easing of the western sanctions. Myanmar`s prosperity natural resources, labour force and dynamic economic has attracted foreign investment in the infrastructure, followed by manufacturing.

Asia`s development experience shows that rapid economic growth can put enormous pressure on environment, which is very costly to rectify later. For Myanmar, the major policy priorities should be to develop legislations and regulations that reflect best practices for environment conservation, follow by enhancing instructional capacity and effective enforcement.

Myanmar remains a challenge any potential foreign investors, regardless of industrial sector. Each and every country around the world is facing the environmental issues including climate change when conducting national development and economic activities. As Myanmar is a developing country, the approach towards the sustainable development in harmony with the economic growth, social and environmental stability is needed to be created. Access to financing, a poorly educated workforce, political instability, tax complexity, weak bureaucracy and inadequate infrastructure were all highlighted as problems (World Bank, 2015).

In Myanmar, most on-site inspection activities are conducted by notifying the target firm about the inspection. Thus, the arrangement with the target firm, and the industrial zones management committee, should be done if it is required. If collection of data and information is the inspection, this is a good opportunity to request the target firm to prepare such documents. When serious problem is suspected or sampling is required, however, it is an option to implement inspection without prior-notification so that the regular condition of the firm can be inspected. This decision should be done by the superior officer.

In addition, arrangements with other relevant organizations may be needed, especially when the inspection is carried out jointly. Projects that require EIA and IEE are stipulated in the EIA Procedures (2015). For those firms that require EIA and IEE, it is possible to incorporate environmental requirements into Environmental Management Plan (EMP) of each firm and then to the conditions of Environmental Compliance Certificate (ECC) to be issued by MONREC. Emission/discharge limitation based on EQEQ (2015), which lists suggested permissible values for emission of air, wastewater discharge, noise and vibration, is a good example of such environmental requirements. EQEG are merely guidelines, and their requirements are not legally- binding by themselves. However, if the requirement is incorporated into the conditions of ECC, it becomes binding. Aside from emission standards, broader environmental measures and considerations should be incorporated into the ECC. Examples of such requirements include, but not limited to cleaner production, resource conservation, 3R, management of hazardous substances, environmental monitoring, adoption of environmental management systems (EMS) and corporate social responsibility (CSR), etc., because such requirements could achieve more comprehensive improvement in environmental performance.

3.4 Current Situation of Industries in Myanmar

3.4.1 Industrial zones

There are 18 major industrial zones in Myanmar, another 6 under development. Of the 18 major industrial zones, Yangon has 4 industrial zones, one each in Eastern, Western, Northern and Southern townships. In these 4 townships, there are 29 industrial zones in Yangon, mostly in the Eastern and Northern townships, 24 of which are under YCDC control (refer to figure 4 for location of major industrial zones in Yangon). There are close to 3500 industries in the industrial zones and another 3200 industries scattered in townships.

Similarly, Mandalay region has 3 major industrial zones- Mandalay, Meiktila and Myingyan but the Mandalay city has 3 industrial zones (zone 1, 2 and 3) in Pyi Gyi Dagon. There are 1500 industries in the three industrial zones, 2500 industries in 6 townships and 7500 industries in Mandalay region (including Meiktila and Myingyan industrial zones in Yangon and in the industrial zones and townships in Mandalay, respectively.

As in Mandalay and Yangon, there are more than 50 industrial zones/parks scattered across the country. Some, like the new complexes at Indagaw near Bago and the two near Kyaukse in Upper Myanmar are exclusively reserved for state-owned factories, rest are for the privately-owned companies. The industrial zones in Monywa, Mandalay, Pakokku, Meiktila, Myingyan (assembling Myay Latt jeeps) and Taunggyi are to assemble automobiles (SINTEF, 2017).

3.4.2 Special Economic Zones (SEZ)

SEZs are created for increased investments (including foreign direct investments), increased job creation and effective administration. In these zones business and trades laws differ from the rest Myanmar. Additionally, companies are offered tax holidays.

There are three SEZs in Myanmar, currently in different stages of construction. Thilawa is the only SEZ to have made considerable progress. The SEZs in Myanmar are governed by Myanmar Special Economic Zone Law 2014 enforced on 23 January 2014 (Myanmar SEZ Law).

In addition to the SEZs, there will be 6 free trade zones in the country: (i) Thilawa port in Yangon, (ii) Mawlamyine in Mon state, (iii) Myawaddi in Kayin state, (iv) Kyaukphyu in Rakhine state and (vi) Pyin Oo Lwin in Mandalay region.

3.4.3 Food and Beverages Industries

Myanmar`s key manufacturing sector is food and beverage products. Food and beverage products, textiles and garments and construction materials are attracted growing investment and, consequently, have rapidly expanded output. Foreign direct investment (FDI) in the country`s manufacturing sector showed considerable growth improved owing to new production sharing contracts in gas sector, investments in garments, construction sectors and telecoms. Singapore, UK, Hong Kong, China and Netherlands are major investors in Myanmar.

MIC under MOPF plays a key enabling role in terms of attracting and promoting investment. MOI has a mandate to facilitate industrialization from agriculture to heavy industry, supporting by the establishment of private small- and medium-sized enterprises (SMEs) and public-private partnerships. The MOI manages state-owned enterprises for improvement in industrial activities.

In Myanmar, the foreign investor attention can be interested in Foreign Investment Law 2012 which allowed for 100% foreign ownership, increased the duration of land leases, granted three-year minimum tax exemptions, and reduced taxes and duties on raw materials and imported capital goods. DICA is preparing streamlining investment procedures and a new company's law (strengthening corporate governance). These legislations will improve Myanmar's ranking in ease of doing business and initiating a new business.

More than 90% of Myanmar's overall economy was composed of private companies, with the remaining 10% made up of state-owned enterprises (SOEs). There are 44 496 private manufacturing industries in Myanmar- more than 60% is food and beverages industries. The state has aggressively privatized SOEs in recent years. SMEs and micro-enterprises account for a considerable percentage of private sector.

Food processing is one of the oldest economic activities. Agriculture is the backbone of the economy of Myanmar. 67 percent of the population is rural, and agriculture accounts for 32 percent of the gross domestic product (GDP), 56 percent of employment, and 21 percent of exports. Most agricultural products are not

consumable in their original form, so they are processed. For instance, wheat is converted into flour, paddy into rice and rice bran, sugarcane into jiggery, sugar, ethanol, alcohol etc.

One of the highest per capita endowments of cultivable land and fresh water source in the world, and six different climate zones, well-suited to grow tropical as well as sub-tropical crops, Myanmar is uniquely poised to assume a leadership role in the food and beverages sector in the region or perhaps regain its global leadership position as the rice bowl of the world. For instance, Myanmar's water resources are around 19,000 cubic meters per capita, centered on four major rivers and their related tributary systems, i.e., about 9 times the levels available in the People's Republic of China (PRC), 16 times that of India, 5 times that of Viet Nam, 6 times that of Thailand, and 30 times that of Bangladesh. But its labor productivity is lowest in the ASEAN region.

The production scenario in the food and beverages industry paints a bleak picture over the last decade. In almost all sub-sectors, the production volumes have sharply declined with few exceptions in the beverages sector. Select beverage industries have exhibited an increasing trend over the past 10 years, but the rest seem to be on a downward cycle. (UNIDO Project & MOI, 2017)

3.5 Waste Stream in Myanmar

Myanmar is blessed with abundant natural resources such fertile land and water resources which provided the right environment for agro-business development. It is also strategically well positioned between China and India, two of the largest food and beverage consuming nations in the world, and the gateway for India to the rest of South East Asia. Many factories in Myanmar are not taking adequate environmental measures right now, and areas downstream of some factories are already polluted by discharged wastewater and emitted gas. There is no distinction between non-toxic or non-hazardous industrial wastes and municipal solid waste coming from domestic and commercial activities. There is an absence of systemic database and the exact rates of industrial waste generation are not known.

Rapid urban growth and industrialization in Myanmar has led to significant challenges with the management of waste. Waste in Myanmar comprises a number of identifiable waste streams that are generated from different sources, including, households, commercial and business establishments, institutions, public areas,

hospitals and industries. Waste management remains inadequate, and coverage of rural areas is sparse. As the country industrialized and urbanizes, waste composition will change and volumes will grow, requiring a more effective waste management system. Myanmar is trying to implement the 3Rs approach throughout the country.

Yangon city, in Yangon Region, is the largest city of Myanmar. In Yangon region, there are 45 townships, while there are 33 town-ship in Yangon city. Yangon city has a population of over 5 million. Yangon generates approximately 1900 tpd of household wastes which also includes 150 tpd of industrial wastes. Per capita generation of waste is 0.41 kg per day. The Pollution Control and Cleansing Department (PCCD) of YCDC provides on call services for industrial wastes.

There are some wastewater pollution cases in the urban areas of Myanmar. In this regard, wastewater pollution problem in Brewery and Distillery Industries at industrial zone in Yangon Region. The distilling process creates air emissions that are regulated under the Clean Air Act, and wastewater from the process is regulated under the Clean Water Act. In many ways, the issues faced by distilleries are no different than those faced by other industrial facilities. In particular, water discharges (both storm-water and process wastewater) and air emissions from the distilling process present unique circumstances for distillers to address. (Kenneth J. Gish, 2012)When the distillery does not discharge to a municipal sewer, compulsory treatment of the effluent is required. Plants using good industrial practices are able to achieve the relevant pollutant loads. Recycling and reuse of wash waters will help reduce the total volume of liquid effluent. Odour emission can be minimized if exhaust vapors are condensed before they are released to the atmosphere or if they are sent to the boiler and burned. The main pollutants generated in the distillery include wastewater discharge, air emission and solid waste.

The major raw materials for the production of alcohol in Myanmar are molasses by products from sugar mill and broken rice, from rice mill. The worst waste is more in the alcoholic fermentation process using broken rice as main substrate. After the completion of fermentation, alcohol is distilled out and the spent wash is drained out. This fermentation was over a greater range due to wide variation in the rate and composition of wastes. e.g. carbohydrate and proteins coming from different sources. Compared to other industrial wastes alcoholic ferment spent wash is more polluted and thus difficult for a conventional treatment system.

In distilleries, the volume of the waste is in average 10 times that of product alcohol. In a distillation process, sources of fermenter wastewater were discharged directly into the soil or in ground water. The distillery effluent can fluctuate significantly as it depends on various and different processes that take place within the distillery (raw material handling, wort preparation, fermentation, distillation, clean-in-place (CIP) and packaging. etc). The characteristics of spent wash are variable and dependent on feed stocks and various aspects of the ethanol production process. Clean the fermenters wash water, cooling water blow down, and boiler water blow down were used further contributes to its variability.

In order to control the environment, the slop is necessary to treat. The slop contains a considerable high content of organics. The major potential waste at the grain distillery industry is the stillage, or residual of the substance. If carries about 7% residue on evaporation of which one-half is suspended matter and one half dissolved matter. The stillage was fed directly to livestock or was discharged to a river, which makes the industry's reputation for waste nuisance. Industrial discharges are required to be treated to the level obtained by the ‘‘best available technology’’ for wastewater treatment in that particular type of industry. If the industry discharges its waste to a municipal wastewater collection system, the industrial waste must be pretreated so as to be compatible with the untreated municipal wastewater. Untreated industrial wastewater, discharged into sewers and natural water bodies, causes surface and groundwater pollution. Mixed wastes can contain toxic wastes, e.g. solvents, poisons, heavy metals, and other chemicals that could leach into the groundwater and contaminate major source of drinking water.

This is caused by discharging wastewater by climate change, discharging wastewater from Industries without any treatment, discharging wastewater from households in the urban areas and low limit Dissolved Oxygen (DO) in the stream/river. The implementation of environmental conservation plan for Urban Wastewater Management; Data collection and Information, Comprehensive Monitoring system, Measuring Equipment, Laboratory and Technicians, Capacity building, Inspection guidance/manual and Research Development. These are needs for Environmental monitoring; increasing domestic and foreign investments, Industrial Zone Development, Population Growth Area, Coordination, Financial Support and Technical Assistance.

Due to limited facilities and lack of technologies at the same time increasing population and industries in water management is a big challenge causing pollution and health problems. There will be a prevention program will be launched for our citizen's health and the environment against the adverse effects. Myanmar has to take into account the international best practices and experiences to formulate the regulations for water management.

Central Wastewater Treatment Plant is preparing to construct for industrial wastewater from the industrial zone. It can affect to the environment, groundwater and water supply and also human health.

CHAPTER IV
SURVEY ANALYSIS

4.1 Survey Profile

This survey was being basically based on concepts and the opinions. Its express shows light on certain fundamental and theoretical aspects of the concept of "Environmental Management". This is expected to provide insights and a basis from which management can test their current practices and seek to encourage them in terms of providing a better understanding of the natural environment. Special on environmental management and awareness, since there is a crying need for more supposedly.

Among various distillery industries from Industry Zone of Yangon Region, the good Environmental Management System approach has become a popular management plan /model in recent years. Environmental management is an important first step to build realistic pollution control policies and regulations. ECD, CDC, DISI and other authorities are recommended to review thoroughly. The implementation of EMP of distillery industries survey was identified in industrial zones at Yangon region, in order to develop a pollution source database for near River basin. The study consisted of a questionnaire survey targeting all distillery industries and sampling at 10 factories in Yangon region area. While not all factories were investigated, the survey revealed overall picture of diverse environmental management issues of manufacturing industries in whole country.

Volume of wastewater and concentrations of pollutants in wastewater are among the most important parameters in managing water pollution, but improving reliability of measurement of water usage and wastewater qualities encountered serious difficulties in measuring these parameters. Water usage in a factory is known to fluctuate significantly during production, and one or two-time on-site measurement does not give accurate estimate of volume. Some factories are equipped with flow meters to measure water usage, and very often water usage had to be estimated based

on the size of water tanks and other means. As for water quality, laboratory data were not always reliable and should also be considered serious because environmental authorities are going to regulate pollution based on water quality data. With respect to water usage, installation of water meters and measurement of water usage should be incorporated into the requirements of ECC and/or business licensing/registration, at least for major dischargers. The motivation for this is not to seek new solution to the underlying problems facing environmental management survey.

The most important environmental problems faced by brewery and distillery industry is management of wastes. Nowadays emphasis is laid on waste minimization. Pollution prevention focuses on reducing the generation of wastes, while waste minimization refers to small amount of volume or toxicity of hazardous wastes. Wastewater treatment facilities have received increased attention in the last decade with the introduction of new water quality criteria regulating the quality of effluent discharged from domestic and industrial wastewater treatment plants. Similar to other industries, biochemical industry and chemical industry are faced with stringent effluent standards, and requirements to reduce contaminants discharged to the environment. Water and wastewater management in distillery industries remains a critical and practical problem. These industries exhibit a wide range of production capacities, which induces different activities in waste and water management. All industries try to keep disposal costs low whilst the legislation concerning waste disposal is becoming more and more stringent. Resource consumption is not only an economic parameter but also a tool to determine process performance. Spent grains and yeast surplus represent the most important wastes.

Wastewater treatment plant design is based on steady state assumptions and for that reason has employed large safety factors. However, plant performance is sensitive to time varying conditions that are sometimes beyond the control of the plant operators. The performance of waste treatment facilities depends on the experience of the operations staff, who develop a “feel” for the operation, allowing them to cope with changing influent conditions in operating conventional treatment technologies. Often operations staff do not have the knowledge and experience base for complex wastewater treatment facilities, with the associated inter-dependence of process operations. This can result in poor effluent quality, high operating costs and the inability of advanced treatment processes to achieve optimal levels of performance.

The better and the clearer the legal framework, the higher law is enforced appropriately. A sound legal framework is enforcement.

Table 4.1 Food & Beverages producers and processors in Yangon (2010)

Category	**Number of Units**
Alcohol & Beer	26
Confectionary	142
Coffee	7
Condensed Milk	3
Cooking Oil Mills	26
Drinking Water	34
Fish & Prawn Crackers	2
Food Flour	1
Foodstuffs	39
Soya Beans	3
Wafer	5
Ice cream	6
Ice Factory	63
Indian Curry Powder	7
Jams	16
Jelly	2
Noodles	8
Vermicelli	53
Snacks	6
Beverages	22
Wafer	5
Total	**485**

Source: Directorate of Industrial Supervision & Inspection (2012)

4.2 Survey Design

This survey also attempts to examine the importance of environmental management today. In Yangon, there exist as many as 3,500 factories under control of YCDC, and according to the data from DISI, there are 485 Food and Beverages

factories in the six target IZs in the Hlaing River basin employing about 90,000 people. Food and beverage sector are the leading sector in these IZs, followed by domestic materials, clothing, and accommodation sectors. Among these 485 factories, 26 Alcohol and Beer factories were selected for a questionnaire survey for implementation of environmental management plan. Actually, 10 factories of distillery industry were answered for their environmental management plan. Shwe Pyi Thar Industrial zone has 5 industrial zones. Among these five industrial zones, Industrial zone (1) is the foremost one it has many brewery and distillery industries which produce a lot of waste. Peace Myanmar Group Co. Ltd (PMG), SMT Co. Ltd, Shwe Ohe, Taw Win, Top One, YD, Moe Kyal Distillery, Dagon Beverages Co. Ltd, Heineken Myanmar Ltd and Myanmar Distillery Co.Ltd, all of these Alcohol and Beer factories were replied for their effluent management system.

Table 4.2 Brewery and Distillery Factories from Yangon Region

Factory No	Factory Name
1	Peace Myanmar Group Co. Ltd (PMG)
2	SMT Co. Ltd
3	Shwe Ohe
4	Taw Win
5	Top One
6	YD
7	Moe Kyal Distillery
8	Dagon Beverages Co. Ltd
9	Heineken Myanmar Ltd
10	Myanmar Distillery Co.Ltd

Source: Survey data 2019

Distillery factories surveyed sizes of factories, Environmental Impacts and capacity of factory to improve Environmental Performance are categorized as large factories according to DISI's classification, many of them are considered small to medium-scaled with respect to the number of employees and the amount of wastewater. These factories effluents do not satisfy the concentration-based requirements of NEQEG (2015), only a small fraction of factories is responsible for the large part of industrial pollution load. In Yangon, distillery factories are

responsible for 90% of BOD load discharged from IZs. Many of distilleries have been shut down and /or installed sophisticated wastewater treatment facility in 2017. Thus, the situation has probability improved significantly. This is expected to be similar in other pollutants typically associated with food and beverage industries, such as COD, T-N and T-P.

All of the respondents believe environmental performance of their factories is satisfactory and their products are environmentally-friendly as they are produced with low environmental impacts. The survey revealed that 80% of factory managers in Yangon Region were not aware of the newly introduced NEQEG (2015). Many of the factory managers probably did not want to give answers that could attract attention of local authorities, it seems there is a significant gap in expectation of modern environmental management, as represented by NEQEG (2015), and awareness of many factory managers.

4.3 Survey Results

In this survey, current status of wastewater management at only ten factories in Yangon have investigated for wastewater treatment facilities. Most of such facilities are rudimentary primary treatment facilities to remove large particles and solid waste, such as screens and settling basins. - Only 5% of factories or less in Yangon Region are equipped with modern secondary treatment facilities to remove biodegradable organic matter, such as activated sludge and UASB. Oil separator is available at only one factory in Yangon. Essentially none of the factories are equipped with facility specifically designed to remove nutrients (e.g., T-N and T-P). Similarly, most factories are not controlling other pollutants, such as coliform bacteria.

Perhaps a more alarming fact is that only 20% of the factories in Yangon have flow meters to monitor water usage, and only 40% of factories have flow meters to monitor wastewater flow rate. Majority of factories are using groundwater (rather than supplied water) as the sources of water, and there is little incentive to optimize water usage and wastewater discharge by monitoring.

Most of the factories are not equipped with adequate wastewater treatment facilities, it is not surprising that many of them are not meeting the effluent concentrations and requirements guideline values of NEQEG (2015), although NEQEG (2015) are not legally mandated to most existing factories at least for now. Those sectors that discharge highly concentrated organic wastewater, such as

distilleries, are expected to face serious difficulties in meeting the requirements, if the requirements are imposed.

Table 4.3 Water Conservation and Minimization of Wastewater

Parameters	Factories																			
Wastewater treatment facilities	1		2		3		4		5		6		7		8		9		10	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
flow meters to measure water usage		√		√	√			√		√	√			√	√		√		√	
flow meter to measure wastewater volume	√		√		√		√		√		√		√		√		√		√	
Recycling of water		√		√		√		√		√		√		√		√		√		√
Separation of rainwater from wastewater		√		√		√		√		√		√		√		√		√		√
Minimization of solid waste	√		√		√		√		√		√		√		√		√		√	
Separation of wastewater containing toxic substance		√		√	√			√		√	√			√	√		√		√	
Others																				
regularly wastewater quality monitoring	√		√		√		√		√		√		√		√		√		√	
submit the results		√		√	√			√		√	√			√	√		√		√	
wastewater treatment facility		√		√	√			√		√	√			√	√		√		√	
existing wastewater treatment		√		√	√			√		√	√			√	√		√		√	
Sewage from canteen		√		√		√		√		√		√		√		√		√		√
Sewage from toilet		√		√		√		√		√		√		√		√		√		√
Wastewater from production	√		√		√		√		√		√		√		√		√		√	
Storm runoff		√		√		√		√		√		√		√		√		√		√

Source: Survey data 2019

For the development of database of pollution sources, environmental authorities generally do not have detailed information about factories required for environmental management, such as production volume, water usage, pollution

prevention and control measures taken, use of toxic substances, monitoring results, environmental issues encountered, emergency plan, etc. Such information is not contained in the data set of DISI and/or IZMCs. Without such information, it is difficult to know which factories are subject to different requirements or which factories should be considered environmental priorities.

They are limited by the lack of specific guidance notes and instructions from government. There are some discharge of sludge and liquids within the wastewater effluent stream disposal activities, but existing facilities are not highly technical and their environmental performance is poor. Current practices and facilities are inadequate, and the targets for industrial growth for the region indicate that the distillery waste issues will become much more serious if no actions are taken. The current infrastructure for treatment and disposal of industrial waste is particularly limited, there is a widespread lack of awareness and there are seriously limited resources for monitoring and enforcement.

Weak monitoring and enforcement of industrial waste management practices means that companies are not properly managing their hazardous waste because of their lack of awareness on what types of waste are hazardous and how to properly segregate, store and manage the waste. Significant improvements in industrial waste management could be made if a training and awareness-raising program was planned and widely implemented, promoting segregation and reducing bad practice.

If brewery and distillery factories are required to improve environmental performance and satisfy requirements of NEQEG (2015), they might face various difficulties in technical, financial and organizational aspects. To examine factory managers' view on such problems, especially on wastewater management, respondents were asked what would be the difficulties in installing a wastewater treatment plant. According to the study while respondents in Yangon Region did not select cost as the main problem, cost is undoubtedly one of the most important problems. Identify on wastewater treatment, which was implemented after the questionnaire survey, installation of a new wastewater treatment facility would cost in the order of tens to hundreds of thousands of dollars for initial investment and operation cost of several to tens of thousand dollars in the first 10 years or so; actual cost is dependent on the volume and characteristics of wastewater. Large factories might be able to absorb such cost, but for smaller factories, whose annual sales is

often less than 100 million MMK (or about 85,000 USD), it would be a significant cost.

Table 4.4 Real Wastewater Treatment Facility

Parameters	Factories																			
Wastewater treatment facilities	1		2		3		4		5		6		7		8		9		10	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
remove solid and floating waste	√		√		√		√		√		√		√		√		√		√	
Screen to remove large solid		√		√	√			√		√	√			√	√		√		√	
Equalization tank	√		√		√		√		√		√		√		√		√		√	
Settling basin	√		√		√		√		√		√		√		√		√		√	
Oil separator		√		√		√		√		√		√		√		√		√		√
Chemical coagulation	√		√			√	√		√			√	√			√		√		√
Other facility																				
biodegradable organic matter		√		√	√			√		√	√			√	√		√		√	
Basic septic tank		√		√		√		√		√		√		√		√		√		√
Activated sludge		√		√	√			√		√	√			√	√		√		√	
UASB		√		√		√		√		√		√		√		√		√		√
Other biological treatment		√		√		√		√		√		√		√		√		√		√
other type of wastewater treatment																				
Removal of toxic substance		√		√		√		√		√		√		√		√		√		√
Other treatment		√		√		√		√		√		√		√		√		√		√

Source: Survey data 2019

Limited land is another major concern for many factories in Yangon Region. The problem is especially acute in small-scaled factories whose land area is often smaller than 0.5 acre (0.2 ha). Many factories in these states pointed out lack of

expertise, both in-house and external, is a major concern. Perhaps the demand for such expertise was limited in the past because effluent was not regulated strictly. However, to improve environmental performance, advices from experts on both technical and financial matters are essential.

Some respondents commented that unrealistic environmental regulation is a concern. The requirements of NEQEG (2015) are very demanding, and many factories may not be able to satisfy the requirements, if NEQEG (2015) are mandated without adjustment. All factories have focused on installation of wastewater treatment facility as an end-of-pipe measure. However, these factories need to meet much broader environmental requirements, including air pollution control, noise control, waste management, hazardous substance management, resource conservation, emergency response, etc. To deal with such broad issues, an end-of-pipe approach is not sufficient. They have to go more strategic, adopt an environmental management system, and explore various options to improve efficiency of production and at the same time minimize pollution.

CHAPTER V
CONCLUSION

5.1 Findings

Among the 26 target distillery factories for the questionnaire survey, 10 factories were collected and analyzed for implementation of EMP. According to the results of the questionnaire survey, the average water usage per factory is about 15,000 gal/day (67 m3/day), but 70% of the factories use less than 10,000 gal/day (47 m3/day). The average wastewater discharge per factory is7,500 gal/day (34 m3/day). Only 50% of factories are equipped with flow meters to monitor water usage and wastewater, respectively. Thus, there are significant uncertainties about the water usage and wastewater discharge data. Only 50% of the factories replied that they have wastewater treatment facilities. Only several percent of factories are equipped with secondary treatment facilities to reduce level of organic matter, such as BOD and COD. Many factories believe their wastewater and solid waste management is adequate. Meanwhile, 80 % of factories were not meeting the NEQEG (2015) requirement.

In Yangon Region, opening up of the economic enhances huge FDI incomings. As employment opportunities are concentrated in Industrial Zone, population is concentrated in the urban region. This generate greater amount of waste disposal including wastewater. In Shwe Pyi Thar Industrial Zone, there is only one central wastewater treatment plant for distillery wastewater. If the pollution continues to increase, the disposal of wastewater from industries and households affect the water quality in river as well as nearly marine water resources in coastal area. Hence, efficient and effective policies for curbing disposal of wastewater are necessary for the

Industrial Zone. Comprehensive pollution control measure is necessary to control the

Environmental pollution and its negative effects. Rapid industrialization of many developing countries increased the pollution load on the existing Cities. Clean drinking water and pollution free environment is basic right of every human being. Industrialization in Myanmar is growing at steady state. Being a developing country, precautionary and compliance measures of industrialization and wastewater management is insignificant. Water pollution in Industrial Zones is higher than Special Economic Zone other except emission for Environmental Quality standard.

According to the survey, the most challenges of distillery factory owners are difficulties in access to finance, lack of modern equipment, stiff foreign competition and poor technology, difficult to procure raw materials and lack of skilled labour. Wastewater from distillery factory are treated to reduce contaminants to the acceptable limit from CDC and National Environmental Quality Emission Guideline (NEQEG) from MONREC Notification before being discharged into the surface water. Finally, according to the acceptable limit from Notification of wastewater discharge standards for distillery industries, the result of final effluent liquid is discharged on land or for irrigation without dilution water.

5.2 Recommendations

The environmental management plan implemented survey provided first-cut information on current environmental status of factories in Yangon Region, but further surveys of the situation are needed. This survey was implemented to examine overall picture of environmental management in distillery factories in Yangon Region. While this goal was achieved more or less, more focused investigation is needed. For example, (i) sectoral studies to examine differences in measures and good practices in key sectors, (ii) study on implementation issues of EMPs, (iii) economic study of implementation of EMPs and pollution control measures and (iv) study of legal, administrative and financial aspects of industrial zone management. Feasibility studies of common facilities for industrial zones (especially centralized wastewater treatment and waste management facilities), are suggested. There were some difficulties in comparing effluent data against requirement of NEQEG (2015).

(An Assigment on Concept ,Types and importance of Environmental Management, 2018)In addition, short term and long-term control measure are necessary for curbing the negative externalities of industrial waste pollution. Effective Research and Development Programs, collaborative efforts with international

organizations, enhancement of corporate social responsibility, utilization of integrated waste management programs, and participation of stakeholders are necessary to control industrial waste pollution as well as reducing the potential negative impacts.

To control pollution, the environmental authorities should impose realistic regulations and support measures, based on regulation of water usage, especially groundwater usage seems necessary. In Yangon region, saltwater intrusion is a concern, and uncontrolled withdrawal of groundwater should be controlled. Aside from these government-side regulations, the industry side should also implement some studies about their management of resources and environment in order not only to control pollution, but also to improve efficiency of production and to make the workplace safe.

To estimate pollution load accurately, estimates of both wastewater flow rate and effluent concentration of pollutant should be accurate. However, there are significant variability's and uncertainties in both estimates, and further investigation is needed to follow up survey. Current status of wastewater discharge system from Shwe Pyi Thar Industrial Zone practice their waste effluent is controlled and monitored by central wastewater treatment. Even through wastewater discharge system of recent distillery factory should be systematic indicators and interrelated with EQEG parameters of Myanmar. There should be other cooperate with other environmental monitoring group from relevant sectors.

The administrative enforcement structure should be adjusted following an assessment of the needs of the legislation to ensure that enforcement mechanisms are cooperative and smooth running. Although they have challenges, previous administrative for environmental governance change idea focused on the improvement of the conservation and prevention for the Environment. On the management activities, they need to adopt a proactive approach to establish a strategic plan for environmental conservation, to prepare for a long-term goal of growth and diversity to be responsible for the implementation of environmental development policies, and to use new ideas and modern techniques to improve operational issues for better environmental quality. So, industrial effluents have to meet emission standard for the present and will be coming increased population and industries.

Environmental authorities should collect information from factories in relation to ECC and/or business licensing/registration. As MONREC has already issued an order to factories in nine priority sectors to submit EMPs, it is a good place to start.

However, basic information should be collected every year, as the situation of factories could change. Thus, submission of information should be incorporated into the reporting requirements of ECC and/or business licensing/registration. If gathering information through EMPs takes too much time, it is suggested to implement a questionnaire survey, similar to the one implemented.

The authorities should start discussing implications of the findings, current situation of factories, how to advance environmental management.

- Introduction and enforcement of NEQEG (2015): realistic policy goal, time frame, flexible implementation uses of self-monitoring, inspection for enforcement, responsibilities of businesses and environmental authorities, administrative discretion, among others.
- Introduction and enforcement of EMP and ECC: frameworks of EMP and ECC mechanisms to ensure implementation of EMPs.
- Promotion of region, development committee, and other initiatives for environmental management: funding for environmental and development investment, development and management of industrial zones, use of sectoral cooperatives and other organizations to promote sector-specific initiatives, promoting involvement of local citizens in environmental issue.
- Demarcation of responsibilities among environmental authorities: roles of ECD, development committees, region-level environmental committee, MOI/DISI, MOH and other organizations.
- Environmental education and awareness raising: different programs to disseminate relevant information from environmental authorities to business communities, within business communities, along value-chain, within local community, etc.
- Environmental expertise: development of communities of experts to advise business communities as well as environmental authorities on different aspects of environmental management and pollution control technologies, environmental financing, environmental laws and other issues are to be discussed.

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APPENDIX A
Assessment for Survey of Brewery and Distillery Manufacturing Industries in Yangon Region

1. Basic Information

Name of Factory: _____

(1) Owner: Name (_____) Contact (_____)

(2) Address (see "Attachment 1"): _____

_____

(3) Name of Industrial Zone: _____

(4) YCDC licensing number: No._____ Date of Issue_____

(5) DISI registration number: No._____ Date of Issue_____

(6) Size of business according to DISI's classification? Large Medium Small

(7) Currently in operation? Yes No

(8) Type of business/sector:

(According to DISI's classification :)

(9) Certification of the industry : ISO 9001.....ISO 14001.....ISO 18001.....MRCC.....Others.....

(10) Type and number of products:

Name of Products	Present Amount	Possible Future Expansion
	ton or gal /year	ton or gal /year
	ton or gal /year	ton or gal /year
	ton or gal /year	ton or gal /year
	ton or gal /year	ton or gal /year

(11) Area: Total acre (Building acre)

(12) Number of employees: Total (Male: Female:)

(13) Operation hours: Total hours (From am/pm, to am/pm)

(14) GPS coordinate of main office of the factory: Latitude ° ‘ “ Longitude ° ‘ “

2. Raw Materials and Utility

(1) Main Raw Materials:

Type of Main Raw Material	Amount (Unit)
	ton or gal /day
	ton or gal /day
	ton or gal /day
	ton or gal /day
	ton or gal /day

(2) Water Usage:

Water Source	Volume of Water Usage (gal/day)
Ground Water	gal/day
Surface Water	gal/day
Waterworks	gal/day
Others ( )	gal/day
Total	gal/day

(3) Consumption of Electricity: kWh/day

(4) Fuel Usage

Type	Fuel Usage (gal/day)
Heavy oil	gal/day
Coal	ton/day
Wood, saw dust	ton/day
Others ( )	

3. Layout of Factory and Manufacturing Process

(1) Manufacturing Process Diagram

Attach general process diagram (see the example, "Attachment-3")

(2) Layout of the Factory

Attach diagram showing layout of the factory.

- Please indicate the locations of main facilities
- Please also indicate the following items:
  - locations of storm water channels
  - locations of wastewater lines
  - discharging points to nearby river, channel or soak away points
  - location of smokestacks
  - stage at which waste is generated

4. Wastewater

(1) Volume of Wastewater:

Discharge Point after treatment	Volume of Wastewater (m3/day)
Natural River (Name:)	
Channel or creek (Name:)	
Pipeline (to central wastewater treatment facility; only in Mandalay)	
Others ( )	
Total	

(2) Water Conservation and Minimization of Wastewater:

Measures	Yes or No
Installation of flow meters to measure water usage	Yes □ No □
Installation of flow meter to measure wastewater volume	Yes □ No □
Recycling of water	Yes □ No □
Separation of rainwater from wastewater	Yes □ No □
Minimization of solid waste entering wastewater stream	Yes □ No □
Separation of wastewater containing toxic substance from regular wastewater stream	Yes □ No □
Others ( )	Yes □ No □

(3) Did you know MONREC issued National Environmental Quality (Emission) Guideline in December 2015, which contains effluent guideline values for your industrial sector? Yes □ No □

(4) Monitoring of Wastewater Quality

Details	Answer
Do you regularly monitor wastewater quality?	Yes □ No □
How often do you monitor wastewater quality?	times/year
Name of laboratory that analyzes the wastewater?	Name: ( )
Do you submit your results to the following organization?	YCDC/MCDC Yes □ No □ ECD Yes □ No □ DISI Yes □ No □

(5) Breweries and Distilleries Wastewater Quality

Parameter	Unit	Value	Parameter	Unit	Value
BOD (5-day Biochemical Oxygen Demand)	mg/L		Oil and Grease	mg/L	
COD (Chemical Oxygen Demand)	mg/L		Total Coliform Bacteria	100 mL	

TSS (Total Suspended Solid)	mg/L		Active ingredients / Antibiotics (to be determined on a case specific basis)		
TN (Total Nitrogen)	mg/L		pH	-	
TP (Total Phosphorus)	mg/L		Temperature increase	^{o}C	

(6) Existence of wastewater treatment facility*:*

Question	Source of wastewater	Answer
Do you have any wastewater treatment facility?		Yes □ No □
What type of wastewater is treated by your facility?	Sewage from canteen	Yes □ No □
	Sewage from toilet	Yes □ No □
	Wastewater from production	Yes □ No □
	Storm runoff	Yes □ No □

(7) Type and Capacity of Wastewater Treatment Facility:

Type of Wastewater Treatment Facility	Yes or No	Capacity
Do you remove solid and floating waste from your wastewater? if Yes, which of the following facilities do you have?	Yes □ No □	-
(i) Screen to remove large solid	Yes □ No □	gal/day
(ii) Equalization tank to regulate wastewater volume	Yes □ No □	gal/day
(iii) Settling basin to remove solid	Yes □ No □	gal/day
(iv) Oil separator to remove oil	Yes □ No □	gal/day
(v) Chemical coagulation	Yes □ No □	gal/day
(vi) Other facility	Yes □ No □	gal/day
Do you remove biodegradable organic matter from your wastewater? If Yes, which of the following facilities do you have?	Yes □ No □	-
(vii) Basic septic tank	Yes □ No □	gal/day
(viii) Activated sludge	Yes □ No □	gal/day
(ix) UASB	Yes □ No □	gal/day
(x) Other biological treatment	Yes □ No □	gal/day
Do you have other type of wastewater treatment? If Yes, what type of facility do you have?	Yes □ No □	-
(xi) Removal of toxic substance	Yes □ No □	gal/day
(xii) Other treatment	Yes □ No □	gal/day

(8) Layout and Process of Discharge:

Please attach the schematic diagram of your wastewater treatment facility.

(9) Layout and Process of Discharge:

Do you have any plan to improve your wastewater treatment facility within one year?

Yes□ No □

If Yes, please explain your plan ( )

5. Solid Waste

(1) Generation and disposal of solid waste

Type of Solid Waste	Amou nt	Disposal Method (check box)
General garbage from office and canteen	ton/month	Picked up by CDC for landfilling ☐ Picked up by CDC for pit burial ☐ Picked up by CDC for incineration ☐ Dumping on site/outside ☐ Incinerated on site ☐ Other ( ) ☐
Solid waste from production line (describe:)	ton/month	Picked up by CDC for landfilling ☐ Picked up by CDC for pit burial ☐ Picked up by CDC for incineration ☐ Dumping on site/outside ☐ Incinerated on site ☐ Other ( ) ☐
Solid waste from production line (describe:)	ton/month	Picked up by CDC for landfilling ☐ Picked up by CDC for pit burial ☐ Picked up by CDC for incineration ☐ Dumping on site/outside ☐ Incinerated on site ☐ Other ( ) ☐
Waste oil from production line (describe:)	ton/month	Picked up by CDC for landfilling ☐ Picked up by CDC for pit burial ☐ Picked up by CDC for incineration ☐ Dumping on site/outside ☐ Incinerated on site ☐ Other ( ) ☐
Sludge from wastewater treatment	ton/month	Picked up by CDC for landfilling ☐ Picked up by CDC for pit burial ☐ Picked up by CDC for incineration ☐ Dumping on site/outside ☐ Incinerated on site ☐ Other ( ) ☐
Other solid waste ( )	ton/month	Picked up by CDC for landfilling ☐ Picked up by CDC for pit burial ☐ Picked up by CDC for incineration ☐ Dumping on site/outside ☐ Incinerated on site ☐ Other ( ) ☐

(2) Possible Organic and Inorganic constituents in wastes

Type of Solid Waste	Possible Organic Constituents	Possible Inorganic Constituents
General garbage from office and canteen		
Solid waste from production line (describe:)		
Solid waste from production line (describe:)		
Waste oil from production line (describe:)		
Sludge from wastewater treatment		
Other solid waste ( )		

(3) Recycling

If you recycle or reuse waste material, please describe briefly

Name of recycled/reused material	Method of recycle/reuse	Amount recycled (in ton)

(4) Hazardous Materials

If there are any hazardous materials that are dangerous to workers, animals and other living things, such as toxic substances (e.g., pesticides to control pest, heavy metals used in production line, chlorinated solvents to clean metal surface, PCBs in transformer, etc.), corrosive/reactive materials (e.g., strong acid, strong base, organic peroxides, etc.), ignitable/flammable materials (e.g., some degreaser, spent organic solvent that have low flash point, etc.), infectious materials (medical wastes), and sharp objects (e.g., glass, needles, etc.) in raw materials, products or waste, please input in the below table.

Type (Toxic, Corrosive / reactive, ignitable/ flammable, infectious, sharp)	Name of Hazardous Material	Amount	Disposal Method (check appropriate box)	
		ton or gal/day	Picked up by CDC for landfilling Picked up by CDC for pit burial Picked up by CDC for incineration Dumping on site/outside Incinerated on site Other ( )	☐ ☐ ☐ ☐ ☐ ☐
		ton or gal/day	Picked up by CDC for landfilling Picked up by CDC for pit burial Picked up by CDC for incineration Dumping on site/outside Incinerated on site Other ( )	☐ ☐ ☐ ☐ ☐ ☐
		ton or gal/day	Picked up by CDC for landfilling Picked up by CDC for pit burial Picked up by CDC for incineration Dumping on site/outside Incinerated on site Other ( )	☐ ☐ ☐ ☐ ☐ ☐
		ton or gal/day	Picked up by CDC for landfilling Picked up by CDC for pit burial Picked up by CDC for incineration Dumping on site/outside Incinerated on site Other ( )	☐ ☐ ☐ ☐ ☐ ☐
		ton or gal/day	Picked up by CDC for landfilling Picked up by CDC for pit burial Picked up by CDC for incineration Dumping on site/outside Incinerated on site Other ( )	☐ ☐ ☐ ☐ ☐ ☐

6. Environmental Management

(5) Do you have Environmental Management Plan (EMP) required under Environmental Conservation Law? Yes □ No □

(If Yes, submission date of EMP to ECD: _____)

(6) Do you have any environmental management system, such as ISO14001?

Yes□ No □

(If Yes, briefly explain: _____)

(7) Do you have any plans for emergency (e.g. fire, accidental release of chemicals, explosion, etc.)?

Yes □ No □

(8) Do you have any Corporate Social Responsibility (CSR) program?

Yes □ No□

(If Yes, briefly explain: _____)

(9) Have you had any environmental accident, such as spill of hazardous substance, accidental discharge of highly contaminated wastewater, etc., in the last 3 years?

Yes □ No □

(10) Have you received any environmental complain from local residents in the last 3 years? Yes □ No □

(If Yes, briefly explain: _____)

(11) When was the last time YCDC/ECD/DISI/other organization visited your factory for environmental inspection, and what was the result?

Organization	Date	Results
YCDC		
ECD		
DISI		
Others		

(12) Do you think your wastewater management is adequate? Yes □ No □

(13) Do you think your waste management is adequate? Yes □ No □

(14) Please tell us the difficulties you are facing regarding environmental management.

Question	Please rate on scale of 1 to 5 (1: not true to 5: very much so)
- We don't know how to deal with pollution problem because there are no environmental experts in the factory.	1 2 3 4 5
- We don't know how to deal with pollution problem because we don't know any external expert.	1 2 3 4 5
- Most industries in the same sector are not meeting the requirements of the regulations.	1 2 3 4 5
- The cost for controlling pollution is too high compared with the benefit.	1 2 3 4 5
- We are having difficulty in obtaining funding (e.g., bank loan) to install wastewater treatment facility and other pollution control facility.	1 2 3 4 5
- We have limited land to install pollution control facility.	1 2 3 4 5
- Regulatory requirements (e.g., effluent guideline values, other technical requirements on pollution control, reporting requirements are not clear	1 2 3 4 5
- Current environmental regulations are not realistic considering the financial, technical and other conditions of my factory.	1 2 3 4 5
- Other (please specify:)	1 2 3 4 5

(15) Possible Environmental Impacts to Air, Water and Soil because of improper waste water and waste management- qualitative assessment

To Soil	To Water	To Air

(16) Do you think your products are more environmentally-friendly compared with the products of your competitors in Myanmar? Yes □ No □

(If Yes, briefly explain why: _____)

(17) If you have any comments, please describe below:

.....

.....

(_____)

APPENDIX B

Brewery and distillery Factories in Myanmar

No	Distillery	Location	Region/State
1	Taw Win Distillery	No -42/ 170, Industrial Zone(1), Shwe Pyi Thar Township	Yangon Region
2	Moe Kyal Distillery	Tataru Village, Htantabin Township	
3	Top one Distillery	No -42/ 47-48, Ingyin Myaine Street, Industrial Zone(1), Shwe Pyi Thar Township	
4	YD Distillery	Tharkayta Industrial Zone	
5	Shwe Ohe Distillery	Industrial Zone(1), Shwe Pyi Thar Township	
6	Heineken Myanmar Ltd	No. 5601, Leik Poke Village, No-4 Main Road, Mawbi Township	
7	Myanmar Distillery Co.,Ltd	Near by Leik Poke Village, Above Thae Khone Village Group, Mawbi Township	
8	Peace Myanmar Group (PMG) Co., Ltd	North District, Shwe Pyi Thar Township	
9	Dagon Beverages Co.Ltd	No.4 Highway Road, Kyaung Kone Ward, Shwe Pyi Thar Township	
10	SMT Co.Ltd	Industrial Zone (1), Shwe Pyi Thar Township	
11	Shwe Myin Pyan Distillery Co., Ltd	Pyi Gyi Takon Towship	Mandalay Region
12	Shwe Myanmar Co., Ltd	No A-5, Industrial park street, Pyi Gyi Takon Towship	
13	Kyar Min Gyi	No .14,Kna Ngal Quarter, Pyi Gyi Takon Towship	
14	Kyar Min Gyi, Yaung Ni Distillery	No .8, Mar lar Kone Village , Myit Kyo Village Group, Myan Aung Township	Ayarwaddy Region
15	SML Distillery	Sar Malaut Village, Nyaung Tone Township, Maoopin District	
16	UKT Distillery	Boe Byor Yate Thar Street, Pyi Thayar Quarter, Pyi Township	Bago Region
17	Shwe Hintha Distillery	Aye Thuka Village, Maoopin Tan Village Group, Dite Oo Township, Bago District	
18	Two Tigers Distillery	Pyi Taw Thar Quarter, Pyi Township	
19	Zayawaddy Distillery	Myo Ma (4) Quarter, Zayawaddy, Pyuu Township	

Brewery and distillery Factories in Myanmar (Continued)

20	D1 Distillery	No (1), Min Kwat Quarter, Nan Oo Street, Paung Tal Township, Pyi District	
21	Myanmar Carlsberg Co., Ltd	No (3-13), Nyaung Inn Industrial Zone, Bago	
22	Sein Toe Distillery	No (20/644), Myo Gyi Street, Taungoo District	
23	Gyo Phyu Distillery	East Yay Phyu Kin Village,Kyaung Chit Sal Village Group, Oak Twin Township, Taungoo District	
24	Lewe Distillery and bottling Plant	No (108), Pattar Village, Lewe Township, Dakina District	Nay Pyi Taw Council
25	U Htwe Lwin Distillery and bottling Plant	Lalway Township	
26	777 Distillery	Bal Yann Village Group, Mudone Township	Mon State
27	Ruby Dragon companies Red Mountain Production Co.,Ltd	Shwe La Phone Village, Taung Chay Myin Sakont Village Group, Nyaung Shwe Township	Shan State
28	Shwe Thamin Toe Nayar Distillery	No (2/106), Khwar Nyo Street, Aye Thar Yar Industrial Zone, Taungyi Township	
29	Myanmar Vineyard Estate Co.ltd	Htone Bo Agicultural Field, Naung Inn Village Group, Aye Thar , Taungyi Township	
30	Nan Taw Distillery and bottling plant	No (38), Ywar Ngan Su Quarter, Pin Taya-Aung Pan Street, Aung Pan Township	
31	Aung Myat Distillery and bottling plant	No (2/104), Aye Thar Yar Industrial Zone, Taungyi Ma Township	
32	Myin Pyan Distillery	Loilin Township, Mine Poyn Township	
33	Kyar Min Gyi Co.Ltd and Kyar Min Gyi Kanbawza Distillery	Taung Lay Lone Village,Nyaung Shwe Township	