CHAPTER II

LITERATURE REVIEW

This chapter will be the elaboration of the literature studies in the form of inductive and deductive study. Inductive study is the previous studies which will be the basis of research. Research obtained from journals and proceeding articles that are published periodically. While the deductive study is the theoretical basis for supporting the problem-solving in the research obtained from textbooks related to the theory

2.1 Inductive Study

The inductive study known as inductive reasoning is a literature study using previous research documented in journals, books, and proceedings. The literature review is beneficial for the researcher to get appropriate theory and methods as guidance for conducting research.

2.1.1 Theory of Constraint Previous Research

Golmohammadi (2015) implemented the theory of constraints (TOC) rules for job-shop systems to advance the state of research on constraint scheduling. Aguilar-Escobar et al. (2016) analyzed whether the Theory of Constraints (TOC) can be useful to the logistics of medical records in hospitals based on a case study conducted in the Medical Records Logistics Service. Seleem et al. (2016) introduced an integrated model combines balanced scorecard, Theory of Constraints, and DEMATEL method to be adopted by a home appliance

manufacturing firm in achieving the firm goals to support operations managers to select and manage the suitable improvement initiatives.

Akman & Özcan, (2016) performed Theory of constraints solving in a manufacturing firm in order to increase profitability, constraints emerging from production process were determined. Alsmadi et al. (2014) implemented an integrated activity-based costing (ABC) and the theory of constraints (TOC) approach to enhance decision making in a Lean company. Cox III & Boyd, (2018) conducted a theory of constraints thinking processes (TP) analysis in the health care supply chain using a primary care practice to validate both entity and causality existence. Kapustina et al. (2017) presented a concrete example of the selected Theory of Constraints (TOC) technique implementation in order to identify the leading causes of undesirable consequences in the context of supply logistics issues.

Peltokorpi et al. (2016) tested the applicability of the TOC method to improve the throughput of a forensic DNA laboratory. Badea et al. (2015) proposed using creative educational methods for implementing investment projects in renewable energy using a combination of methods of Theory of Constraints by problem diagnosing, designing the solutions plan and integrating the solutions plan through the conceptualization of adequate diagrams communication within these types of projects. Pacifici et al. (2017) provided a new approach of one of the main TOC techniques, 'drum-buffer- rope' (DBR) in the service sector healthcare.

Alves Ribeiro et al. (2017) identified research opportunities that can lead to insights and improvements in the software development process (SDP) through the application of the concepts and methodology widely used in industrial process management – the TOC. Naor & Coman, (2017) described a typical scenario occurring inside the stressful environment of a service call center working in shifts with high agent turnover, and offer ways to streamline operation through the usage of Theory of Constraints (TOC) methods. Šukalová & Ceniga, (2015) discusses the possibility of applying TOC instrument in the distribution systems elements (inventories, planning of sale, the supplier's reliability) and evaluation of significant shortcomings in the area.

Garza-Reyes et al. (2018) proposed an alternative and complementary improvement approach based on the adaptation and simultaneous deployment of lean thinking and Theory of Constraint (TOC) methods and tools for Emergency Medical Services (EMS) transport and logistics operations. Bauer et al. (2019) presented an approach based on the thinking process of the theory of constraints (TP–TOC) to support decision-makers, managers and professionals of health to diagnose and improve healthcare systems focusing on the service quality deployed to patients. Tao et al. (2016) propose a novel TOC–VLLTW methodology combined theory of constraints (TOC) policy and variable lead-lag time window (VLLTW) policy based on the machine-level predictive maintenance (PdM) method to conduct a comprehensive opportunistic maintenance scheduling methodology for series systems.

Serrano et al. (2018) used a Theory of Constraints CRT to structure the undesired effects and primary causes that limit the positive economic impacts of the south Brazilian football value chain. Okutmuş et al. (2016) provided effectively managed constraints by defining constraints that prevent their targets and thus to increase the profitability of firms using the theory of constraints practice conducted in a furniture firm. Lowalekar & Ravi, (2017) demonstrated the application of TOC Thinking Process (TP) tools in the context of large blood bank in India which is struggling with the problems like extreme shortage and wastage, low product variety, high inventory levels, high error rate, and poor financial performance.

Trojanowska & Dostatni (2017) discussed the project management method derived from the theory of constraints – CCPM. Zivaljevic, (2015) explored the use of the Theory of Constraints (TOC) approach in addressing traffic congestion as the main impediment to improve the utility of the land transportation systems, by employing exploratory design, developing tentative theory through the generation of new ideas and assumptions forming grounded picture as a base for further investigation. Below is the comparison of all previous research papers related to TOC as shown in Table 2.1:

Table 2.1 Previous study for TOC

Researcher	Objective Study	Current Reality Tree (CRT)	Evaporating Clouds (EC)	Future Reality Tree (FRT)	Activity Based Cost (ABC)	Drum-Buffer Rope	Critical Chain Project Management	Other Methods
Chang et al. (2017)	Solve the possibility of cloud storage having memory running out of space, using market information to build a rolling forecast.					v		Weighted Moving average, Exponential Smoothing
Groop et al. (2017)	Help Northern European city improve the efficiency of its home care delivery system.	v	v					Variable-Demand Inventory Replenishment
Puche et al. (2016)	Supply chain collaboration aimed at increasing its efficiency.							Beer's Viable System Model
Huang et al. (2017)	Makes a survey of user demand in summarizes which stage of product development is.							Analytic Hierarchy Process (AHP)
Sarkar et al. (2018)	Effective implementation of projects related to construction.	v	v	v			v	-
Buddas, (2014)	Building block in the humanitarian supply chain.							Process Map, Critical Path Analysis
Gupta et al. (2015)	Improve market orientation in a not-for- profit psychosocial rehabilitation Mental Health Services institute.							Market Orientation

Researcher	Objective Study	Current Reality Tree (CRT)	Evaporating Clouds (EC)	Future Reality Tree (FRT)	Activity Based Cost (ABC)	Drum-Buffer Rope	Critical Chain Project Management	Other Methods
Kumaran et al. (2016)	Solve the constraints in achieving the objectives of business intelligence within the higher education sector.							Business Intelligence
Sommer & Mabin, (2016)	Explores decisions about care for elderly family members.		v					Boardman's Soft Systems Methodology (BSSM), EC
Costas et al. (2014)	Reduce Bullwhip Effect that cause of significant inefficiencies in Supply Chain Management (SCM).					v		KAOS Methodology
Modi et al. (2018)	Solve the constraints that existed in a lock manufacturing company.	v					v	-
Coetzee et al. (2016)	Help SALT, the Southern African Large Telescope, by provide details of the technical and operational constraints and how they were dealt with.							Process Improvement
Sinclair & Sadler, (2016)	Smelter operations decision-making.						v	-
Mohammadi et al. (2015)	Deal with soft problems in subsidized milk industry.							System Dynamics

Researcher	Objective Study	Current Reality Tree (CRT)	Evaporating Clouds (EC)	Future Reality Tree (FRT)	Activity Based Cost (ABC)	Drum-Buffer Rope	Critical Chain Project Management	Other Methods
Golmohammadi, (2015)	Advance the state of research on constraint scheduling.					v		Master Production Schedule (MPS)
Aguilar-Escobar et al. (2016)	Logistics of medical records in hospitals.							Production Management
Seleem et al. (2016)	Home appliance manufacturing firm in achieve the suitable improvement initiatives.							Balanced Scorecard (BCS), DEMATEL, Key Performance Indicators (KPI)
Akman & Özcan, (2016)	Solving in a manufacturing firm in order to increase profitability.				v			-
Alsmadi et al. (2014)	Enhance decision making in a Lean company.				v			-
Cox III & Boyd, (2018)	Health care supply chain.							Provider Appointment Scheduling System (PASS)
Kapustina et al. (2017)	Undesirable consequences in the context of supply logistics issues.	v						-

Researcher	Objective Study	Current Reality Tree (CRT)	Evaporating Clouds (EC)	Future Reality Tree (FRT)	Activity Based Cost (ABC)	Drum-Buffer Rope	Critical Chain Project Management	Other Methods
Peltokorpi et al. (2016)	Improve the throughput of a forensic DNA laboratory.	v						-
Badea et al. (2015)	Investment projects in renewable energy.					v		-
Pacifici et al. (2017)	Service sector in healthcare.					v		-
Alves Ribeiro et al. (2017)	Improvements in the software development process.							Process Optimization
Naor & Coman, (2017)	Service call center working in shifts with high agent turnover.							Root Cause Analysis (RCA)
Šukalová & Ceniga, (2015)	Distribution systems elements and evaluation of major shortcomings in the area.							Distribution System
Garza-Reyes et al. (2018)	Emergency Medical Services (EMS) transport and logistics operations.							Lean Thinking

Researcher	Objective Study	Current Reality Tree (CRT)	Evaporating Clouds (EC)	Future Reality Tree (FRT)	Activity Based Cost (ABC)	Drum-Buffer Rope	Critical Chain Project Management	Other Methods
Bauer et al. (2019)	Diagnose and improve healthcare systems focusing on the service quality deployed to patients.	v	v					-
Tao et al. (2016)	Maintenance scheduling methodology for series systems.							Variable Lead-Lag Time Window (VLLTW)
Serrano et al. (2018)	Economic impacts of the south Brazilian football value chain.	v						-
Okutmuş et al. (2016)	Practice conducted in a furniture firm.							Cost Minimization
Lowalekar & Ravi, (2017)	Blood bank in India struggling with problems.	v	v	v				-
Trojanowska & Dostatni, (2017)	Project management method.						v	-
Zivaljevic, (2015)	Improving utility of the land transportation systems.					v		-

2.1.2 Emission Efficiency Previous Study

De-xin, (2016) proposed wind energy development as a solution for cleaner, low carbon, safe, highly efficient energy resource for the future. Several constraints limiting the development of wind energy development in China as such wind power curtailment because of electricity demand are low, and wind power consumption is insufficient, weak independent, innovative ability of wind development and irrational market system mechanism slow down the development of wind power energy. This constraint could be countered by the establishment of the overall plan for energy development in China, strengthening independent, innovative capacity technology, improve the system and mechanism of wind energy development, and provision for better regulation service for wind energy development.

Roshchanka, et al. (2017) presented the assessment framework for policy-makers to facilitate the Coal Mine Methane (CMM) mitigation project. Utilization of CMM mitigation brings benefit such as reducing greenhouse gas emissions, improve energy intensity, improve mine safety, job creation, and many others. Policy framework offered by this study as such, institution frameworks as a key to reducing the transaction cost and barrier in implementing CMM project. Defining gas property right and licensing procedures of CMM, accessing natural gas and power markets, determining the price of natural gas and electricity feasibility, underlying the mine safety requirement, technical regulation and implementation, feed in traffics ad obligation for CMM based electricity market and tax intensive, environmental tax regulation for emission trading.

Ye et al. (2019) provided a model that balancing the Energy, Economy, and Environment (3E) for the policy-maker to consider before developing policy and regulation of carbon emission in the energy sector. From the assumption o previous study, parameters and variables are defined as such, first, determining the 3E which is improving emission efficiency for energy goal, reducing abatement cost for economic goal, and controlling total

emission for environmental goal. Second, differentiate the quota allocation for each goal's approaches.

Cardoso et al. (2019) stated that the implementation of cleaner production could be beneficial for achieving SDG's goals. The literature review correlated with industry and manufacturing specifically in the textile industry can be summarized as cleaner production application in industry and manufacturing boost the efficiency of production also affect the environment positively.

Hodgkinson & Smith (2018) suggested the roadmap of adaptation and mitigation for mining and metal industries to achieve the target of zero carbon emission by the year 2050 that initiated from the Paris Agreement within the United Nation Framework Convention on Climate Change (UNFCCC). This study aims to test the hypothesis of fulfilling low carbon economy needs, still require high demand for metals and mineral which resulted in the industry need to find a way to mitigate the potential of environmental impact of mining without limiting the demand from the market. The result shows that the demand for metal and mineral demand are still high as the technology for greener energy dependent with metal and mineral, for example, the technology of battery for energy storage, solar photovoltaic for solar energy system, wind energy technology system and nuclear power technology.

Schandl et al. (2015) constructed a model for decoupling strategy of economic and environmental aspect as a viable option to achieve SDG's target and goals. Several models were offered in this study, each model was affiliated with different scenarios. CSIRO (Commonwealth Scientific and Industrial Research Organization) is a model developed from economic scenarios. GIAM (Global Integrated Assessment Model) the coupled scenarios of climate and economics model. MEFISTO model is used to assess the speed and scale improvement of in material efficiency, related to production scenarios. Moreover, last the EORA modes, that related with for economic growth and employment scenarios. All of these models then combined and developed, which later analyzed by using the historical database from various scenarios and study case. The result of this model could be used to design policies in the reduction of carbon emission footprint.

Sarkodie & Strezov (2019) explained how pollutant haven hypothesis will bring horrendous environmental impact despite the huge direct investment for the developing country. To prove this statement, it was employed data from the World development Indicator data about top five emitters of greenhouse gas emissions in developing country and examine the pollution haven hypothesis data from these countries, using data regression with fixed effect estimator. Both mathematical models then employed the U test algorithm to test the environment Kuznets Curve (EKC) in each country. Result revealed that a positive coefficient of per capita GDP in low-income level coupled with negative coefficient in second-degree polynomial, proving the evidence that foreign direct investment inflow increases CO2 emission drastically,

Foggia (2018) promoted the energy efficiency approach as a way to achieve the goals of SDG 11 and SDG 13 and also as the way to boost the socio-economy growth. Frameworks were designed to capture the importance of drivers in supporting Energy Efficiency Measures (EEM), which was the core point of the analysis. The research process was separated into three different phases. First, the analysis of empirical study and survey carried by Energy Efficiency Financial Institution Group (EEFIG). The second phase was carried out where the data were normalized using the min-max method. Thus, the values measured using different scales could be compared easily. The third phase was data matching then clustered into analytical insight. The result will produce a list of drivers with its value. This data thus be useful for extracting necessary information evaluating the cost and benefits of EEM and also beneficial in decision making and policy making for potential areas

Stock et al. (2018) studied the assessment of value creation transition in industry 4.0 based on the dimension of SDGs, economy, social, and environment. The assessment was divided into three stages and one qualitative approach. During the first stage, potential sustainable value creation was assessed from the macro perspective. This assessment presented the expert opinion in a structured manner and underpinned by specific relevant cases. Second and third stage aimed at assessing potential sustainable value creation element of the product, process, equipment, human, and organization on the level of the smart factory. Result revealed that the value creation factors could positively contribute to the ecological

dimension of sustainability cases. Possible impact toward social dimension is expected to be better integration and inclusion of employees, enrichment of work, work effectiveness as well a better work-life balance for the worker. However, there is still lacks method-based in the quantitative investigation of the social and ecological impact of industry 4.0.

Lee et al. (2019) illustrated the current trend in industry and manufacturing move toward greener and sustainable manufacturing research. Research papers, journal, article, and citation were the indicator of evaluation of this study. Overall, the attraction and number of this indicator showed significant growth. This review journal is provided to give insight for future perspective of sustainable manufacturing, by suggesting evaluation methods and give examples included keyword analysis using artificial intelligent can provide a better degree of understanding of current and future perspective in scientific research

Beier et al. (2017) compared two major industrious countries with two different strategy approaches in facing the transformation of the industry toward digitalized and interconnected production. Germany with "*Industrie 4.0*" strategy and China with "Made in China 2025" strategy. The survey is conducted to analyze some effects of *industrie 4.0* for the future process of manufacturing companies and how these specific sustainability indicators. The survey conducted in both Germany and China. The survey question was related to digitalization of industry, future work in the industry, future of production strategy, savings, and efficiency potentials. The result showed that the digitalization of industry in both countries provides a window of opportunity for the ecological dimension of sustainability and provide a potential entry point for increased employment

Bjelle, Steen-olsen, and Wood (2018) stated that emission efficiency improvement by making emission reduction is not enough to mitigate global warming. Contribution of the developed country as a role model in mitigation example is required. Changing in consumption pattern by household could contribute significantly toward lowering Greenhouse Gases (GHG) emission. This paper investigated consumption side changes as a complementary strategy to effort to decarbonize the production side to achieve sufficient emission reductions. The result showed that several of the consumption groups with the

highest emission multipliers include fuel or passenger transport consumption. Consumption with relatively high expenditure shares has lower than expected carbon footprint.

Secher, Collin, and Linnet (2018) described how building materials could be the next potential project for emission reduction plan and strategy. As the starter, all industry in building material from big industry up to Small and Medium Enterprise (SME) required to assessing the environmental impact of their production. Environmental Product Declaration (EPD) and Product Environmental Footprint (PEF) are the primary methods of quantifying the environmental impact in this study. Application of both methods has direct impact relevant to SDG targets. By generating transparency of the environmental impact such as through EPD's and PEF's value can be added to the construction of industry.

Bashkar & Kumar, (2018) described how rapid development of electronic and internet not only bring advancement for humankind but also growing problem of waste electronic with its complex management. The elaboration between E-Waste management and SDG are Environmental policy perspective, macro marketing perspective, strategic management perspective, and business sustainability perspective. Integration of different perspective suggests the focus of a particular perspective on given SDG and business approach by the firms to find a synergy between the two. The result showed that E-waste management is liked with more than one SDG's.

Anna et al. (2018) specified the responsible care program as one of the voluntary reports to industries that have been supported by SDG in assessing the chemical, environmental impact. Impact of chemical industries on soil pollution was estimated by using the indicator of the amount of hazardous and non-hazardous waste deposit while impact of atmospheric pollution was estimated by considering the types of atmospheric emissions, SO2, NO, VOC, and CO. Within the entire industrial sector, the emission of atmospheric pollution nearly unchanged after 2008. There are also impact on the water system and energy consumption. The conclusion is, the environmental impact with direct visible result have been reduced significantly, while the focus of environmental impact such as GHG emissions, which not visible impact in the short term, has not been paid sufficient attention.

Molinos-senante and Sala-garrido (2018) evaluated the energy performance compared with pollutant removal efficiency in water treatment facility using Metafrontier data envelope. Metafrontier concept assumes that the input and output of each assessed treatment technology have a different functional relationship. When evaluating the energy efficiencies, it is useful to determine the percentage of treatment plants that are energy efficient. The facility is deemed to be energy efficient if its score close to that energy-frontier. As expected, energy efficient scores with the *metafrontier* as a reference, energy efficiency score relative to the *metafrontier* were lower than scores computed for any located on its group frontier. Assessment of energy efficiency scores for the *metafrontier* can be used by the water regulator to support decision making processes when selecting the most suitable technology.

Foo (2017) used pinch analysis method to perform a selection of CO2 reduction strategy and energy conservative project in order for the industry could implement the proper strategy with the condition and regulation of the different country. The graphical technique has been proposed for project selection that emphasizes on CO2 emission reduction. The technique was extended based on the recently established financial pinch analysis technique. Instead of selecting the project based on the financial criteria, the CO2 emission reduction pinch diagram emphasizes on CO2 reduction.

Pontevedra et al. (2019) simulated the new design in the drying process of electroplating manufacturing, as current technology in absorbing a lot of energy and non-value-added activity. Change in forced air movement was simulated and experimented in the model to investigate the improvement of energy consumption

Mcaloone and Pigosso (2017) explained the evolution of *Ecodesign* method in assessing environmental issue related to product development. Assessment was done by categorizing it by activity, campaign, research, industry example, and the critical result of product development separated in three-time ranges. The result of the study shows that *Ecodesign* facing almost the same challenge in each time range, but significantly increase solving the sustainability challenge

Julieth et al. (2019) introduced the concept of Landfill Mining (LM) in answering the targets of SDG. The proposed method does not only solve the problem in waste management but also offer an economic and social benefit if implemented. This method presented with the possibility of reducing GHG emission from better landfill management.

Martin (2019) suggested fire control and management as one factor that should be taken into account as SDG target. From historical data, it showed that fire has a significant impact and influence environmental globally. This study explained four main reasons why fire should be considered as SDG targets. First, fire affects the air quality and links to SDG. Second, fire effects on water quality in the context of SDG. Third, fire affects the rainfall patterns and a potential link to SDG. Fourth, fire affects soil and soil erosion. From those reasons, a broadened fire perspective will contribute to an understanding of the synergies between the SDGs and other sustainable development and climate change mitigation initiative.

Sahota et al. (2018) expressed the performance analysis of one of solar energy technologies called as solar photovoltaic (SPV) in reducing dependency toward fossil fuel. Full application of this method could increase energy efficiency development and environmental condition.

Haines et al. (2017) illustrated and explained the characteristics and effect of Short-Lived Climate Pollutant (SLCP), a substance that could be harmful to the environment and bring harm and diseases to human. Controlling and mitigating SLCP is a must, not only will contribute in fulfilling SDG 13 targets and goals but also interlinking benefit among other SDG targets.

Mancini and Sala (2018) assessed social impact in the mining sector, to what extent top and down approaches used in policy context from previous study and journal, result in a clustering of the impact in thematic areas. The result was revealing trade-offs among positive and negative impact occurring at different scales related to employment, environment, and health in the local and national level.

Martinico-perez, Schandl, and Tanikawa (2018) detected the rising trend of material use, waste, and emission mitigation by using MFA methodology. Environmental Kuznets Curve (EKC) showed that the rise of material use is correlated with the increasing growth of the economy in the Philippines, while the pressure for the environment also increases. Policies related to soil waste management, mitigation of emission is needed in the Philippines

Uddin et al. (2015) discussed the potential of effectiveness in assisting reduction in global greenhouse gas emission by using the Clean Development Mechanism (CDM). The paper started with an introduction to CDM's institutional and governance framework, CDM and GHG emission trends from the global mining industry. SDG aspect was also discussed as related context with CDM.

Müller (2018) analyzed and compared the effect of Internet of Things in Germany with "*Industrie 4.0*" strategy and China with "*Made in China 2025*" strategy for their Small and Medium Enterprise by surveying SME in both country, impact and contribution to SDG of both strategies were revealed.

Dombrowski and Ernst (2014) evaluated the effects of industrial production on global warming and aim to develop action using the rare resource more efficiently and reducing CO2 emission. Six approaches were developed as the ways to avert this. The solution is systematically developed regarding the level of risk and damage to the effect on industries. Below is the comparison of all previous research papers related to Emission Efficiency in industry as shown in Table 2.2:

Table 2.2 Previous Study of Emission Mitigation in industry

Researcher	Research Objective	Empirical Study	Case Study	Model	Literature Review	Mathematical Model	Simulation
De-xin, (2016)	Reduce dependency toward fossil and promote wind energy development	v					
Roshchanka et al. (2017)	Assess the policy frameworks to facilitate the CMM project	v	v				
Ye et al. (2019)	Proposed models that balance the energy, economy and environment factor for policymakers		v	v			
Cardoso et al. (2019)	Show the cases of implementation of cleaner production and benefits for SDG		v	v			
Hodgkinson & Smith, (2018)	Show the roadmap of adaptation and mitigation strategies in mining and metal industries	v					
Schandl et al. (2015)	Show the model of decoupling strategies to achieve targets of SDG			v			v
Sarkodie & Strezov (2019)	Explain the impact of pollutant haven hypothesis in developing country					v	
Foggia, (2018)	Promote energy efficiency approach to achieve SDG	v					
Stock et al. (2018)	Assess the value creation transition in industry 4.0 based on SDG dimension				v		

Lee et al. (2019)	Illustrate the current trend in green and sustainable industry				v	
Beier et al. (2017)	Compared two major industrious country with two different strategy approach in facing the transformation of industry toward digitalized and interconnected production.	v	v			
Bjelle, Steen-olsen, and Wood (2018)	Changing in consumption pattern and behavior by household can contribute toward GHG emission		v			v
Secher, Collin, and Linnet (2018)	Building material could be the next project for emission reduction strategy	v	v			
Bashkar & Kumar, (2018)	E-waste management could benefit both economic and environmental factor	v	v			
Anna et al. (2018)	Show the beneficial impact for environment of responsible care program in assessing chemical environment	v				v
Molinos-senante and Sala-garrido (2018)	Evaluate the energy performance of water treatment of raw water facilities using *Metafrontier*		v			v
Foo (2017)	Pinch analysis method could be used to perform selection of CO2 reduction strategy and energy conservation project in order for industry could implement proper strategy with the condition and regulation of their country		v	v		
Mcaloone and Pigosso (2017)	Explain the evolution of *ecodesign* in assessing environmental issues related with product development	v				
Hoffman et al. (2019)	Development of method in drying process of electroplating manufacturing show significant result in lowering energy consumption					v

Julieth et al. (2019)	Introduce the concept of Landfill Mining for waste management in several country		v		
Martin (2019)	Suggest fire as one separated factor for SDG targets	v			
Kumar et al. (2017)	Solar energy as one viable option for future renewable energy resource using solar photovoltaics (SPV) Technology				v
Sahota et al. (2018)	Propose bio gas as another potential renewable energy resource that can be used as vehicular fuel	v			
Haines et al. (2017)	Explain the Short-Lived Climate Pollutant (SLCP) effect on environmental and human health	v			
Mancini and Sala (2018)	Assessing the social impact in mining sectors			v	
Martinico-perez, Schandl, and Tanikawa (2018)	Rise of material used is correlated with the increase of economy but also the GHG emission to environment	v			
Uddin et al. (2015)	Clean Development mechanism has opened potential and effectiveness assisting reduction in global GHG gas emissions	v			
Müller (2018)	Internet of thing not only rise the potential but also bring risk for Small medium enterprises	v	v		
Dombrowski and Ernst (2014)	Evaluate the effects of industrial production on global warming and aim to develop action using rare resource more efficiently and reducing CO2 emission.	v			

Compilation of all journals that related with emission efficiency in industry show some interesting findings. There are two topics that frequently discussed from all journals. The topics are the discussion about policy and renewable energy.

Journal that discusses about policy tends to emphasize the importance of designing correct framework before applying environment policy. Another finding states that the framework proposed is different from each journal reviewed. Therefore, it might have correlation with the location of each journal conducted that originated from various countries. the conclusion could be withdrawn that every country will require different policy framework before implementing and applying environment policy. As for government, they cannot just imitate other country's framework that has already applied certain policy.

While the journals that discuss about renewable energy, highlight the important of development of renewable energy. Some journals that conducted studies on industries that have altered to renewable energy show significant reduction in emission generation with the trade-off higher maintenance cost and the requirement of higher skilled workers. Hence, renewable energy is still hard to fully applied in most industries. As the goals of industry is to reduce cost as possible and by recruiting higher skill workers will potentially increase the wage cost to pay.

2.2 Deductive Study

Despite of its origins as a manufacturing methodology, Goldratt's Theory of Constraints (TOC) methodology can now be regarded as a system of methodology that links elements of both soft and hard systems methods. These comprise a suite of logic trees that provides a roadmap for change, guiding the user through the decision-making process of problem structuring, problem identification, solution building, identification of barriers to be overcome, and implementation of the solution.

TOC perhaps not ordinarily considered by systems modelers to be part of the systems literature, but it is a systems methodology in that it strives to ensure that any changes undertaken as part of an ongoing process of improvement will benefit the system as a whole, rather than just part of the system. At its most basic level, TOC provides managers with a set of tools that guide the user to find answers to the fundamental questions relating to change, namely:

1. "What to change?"

   This step identifies the problem. Answering this question utilizes data, feelings, and intuition to bring to the surface the root cause or constraint of the current state of the system (or current reality).

2. "What to change to?"

   This step discusses the strategy involved in a TOC solution to the problem. Once we find the constraint, we apply other TP tools that robust enough to develop an indisputable solution that avoids any unintended or undesirable consequences.

3. "How to cause the change?"

   This step discusses the tactics involved in a TOC solution to the problem. Implementing TOC allows us to determine systematically what obstacles stand between present and desired realities, explain why those obstacles exist, define the steps that will overcome the obstacles, define the order in which those steps should be taken, and recognize when the plan should be altered.

Goldratt (1990), Klein & DeBruine (1995) & Dettmer (1997) stated that TOC views an organization as a chain composed of many links, or networks of chains. Viewed as a constrained system, a chain's links all contribute to the goal, and each link is strongly dependent on the other links. The chain, however, is only as strong as its weakest link. Goldratt's TOC states that its weakest link limits the overall performance of an organization. He states that if an organization wants to improve its performance, the first step must be to identify the system's weakest link or constraint. Goldratt and Cox (1992) introduced a method called the five focusing steps for addressing system problems on a continuous improvement basis, as shown in Figure 2.1. The steps are:

1. Identify the constraint: Identify the operation that is limiting the productivity of the system. This may be a physical or policy constraint
2. Exploit the constraint: achieve the best possible output from the constraint. Remove limitations that constrain the flow, and reduce non-productive time, so that the constraint is used in the most effective way possible
3. Subordinate other activities to the constraint: link the output of other operations to suit the constraint. A smooth workflow and avoid the buildup of work-in-process inventory. Avoid making the constraint wait for work
4. Elevate the constraint: In situations where the system constraint still does not have sufficient output invest in new equipment or increases staff numbers to increase output
5. If anything has changed, go back to step one: Assess to see if another operation or policy has become the system constraint. Goldratt (1990) stated that this step is consistent with a process of ongoing improvement.

Figure 2.1 Cycle of Goldratt's TOC 5 focusing steps

2.2.1 Current Reality Tree (CRT)

Goldratt (1990) called an existing condition a reality. The tools he has designed are intended to be used to analyze and deal with a system condition, or reality, with which the TOC practitioner is unhappy. Dettmer (1997) defined a Current Reality Tree as a logical structure which has been designed to depict that state of reality as it currently exists in a given system. The CRT represents the most probable chain of cause and effect, given a specific, fixed set of circumstances (see Figure 2.2). It is constructed from top-down: from observed undesirable effects, postulating likely causes for those effects, which are then tested via the CLR. One such test is to predict (and check for) other effects that would also arise if this cause did exist - hence the term Effect-Cause-Effect. Dettmer (1997) stated that the CRT was designed to achieve the following objectives:

1. Provide the basis for understanding complex systems
2. Identify undesirable effects (UDEs) exhibited by a system
3. Relate UDEs through a logical chain of cause and effect to root causes
4. Identify, where possible, a core problem that eventually produces 70% or more of the system's UDEs.
5. Determine at what points the root causes and/or core problem lie beyond one's span of control or sphere of influence
6. Isolate those few causative factors (constraints) that must be addressed in order to realize the maximum improvement of the system
7. Identify the one simplest change to make that will have the most significant positive impact on the system.

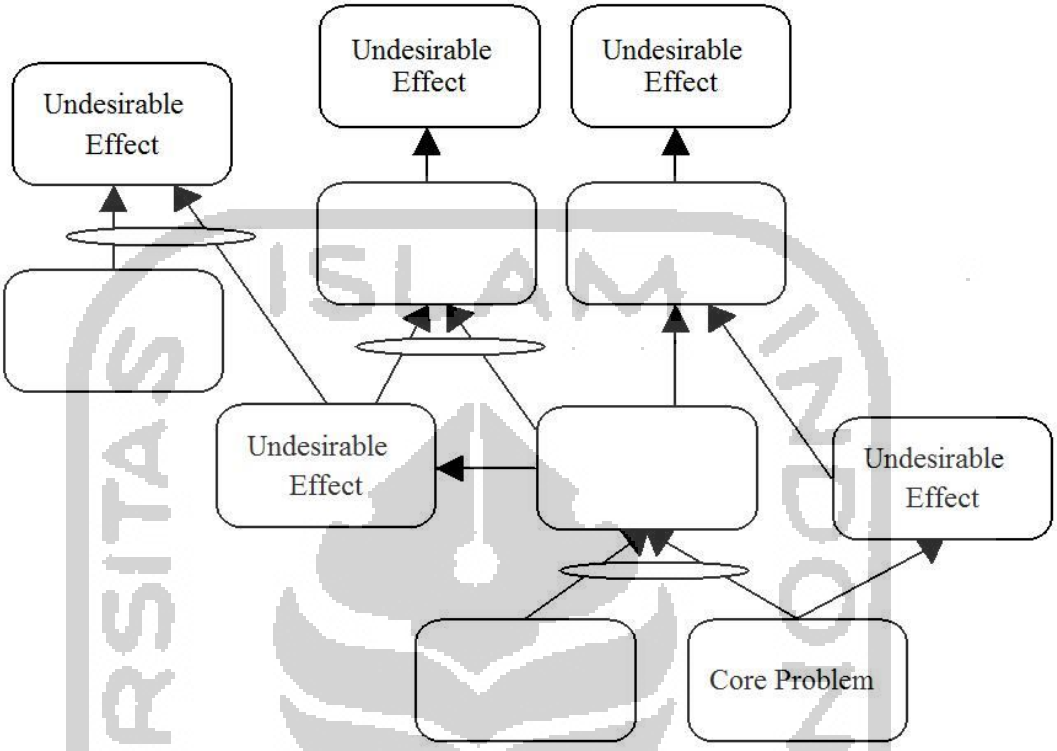

Figure 2.2 Structure of Current Reality Tree

2.2.2 Evaporating Clouds (EC)

Once TOC practitioners have identified what to change, the second step in the process deals with the search for a plausible solution to the root cause; that is, what to change to. This task is accomplished with the aid of the Evaporating Cloud (EC) and the Future Reality Tree (FRT). Unlike the trees, the EC has a set format with five boxes (see Figure 2.3). The practitioner identifies two opposing wants that represent the conflict, the need that each want is trying to satisfy, and a common objective or goal that both needs are trying to fulfill. Then the practitioner surfaces the assumptions that underlie the connections between objectives and needs, needs and wants, and in the process, uncover the reasons for the conflict that exists in their reality and prevents them from achieving the desired objective. This direct conflict is often the same as that underlying the CRT. Goldratt (1990b) stated that traditionally in

resolving these conflicts, managers have sought compromise solutions. He says that his approach ends itself most often to resolve the conflict altogether without resorting to compromise. The EC is intended to achieve the following purposes:

1. Confirm that the conflict exists
2. Identify the conflict perpetuating a major problem
3. Resolve conflict
4. Avoid compromise
5. Create solutions in which both sides win
6. Create new 'breakthrough' solutions to problems
7. Explain in depth why a problem exists
8. Identify all assumptions underlying problems and conflicting relationships

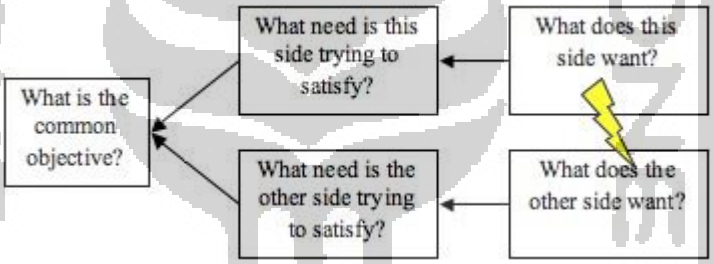

Figure 2.3 Structure of Evaporating Cloud Tree

2.2.3 Future Reality Trees (FRT)

Once a solution, called an injection, has been identified via the EC method practitioners assume for the next exercise that it has been achieved and start to build the Future Reality Tree (FRT). The tree is constructed and scrutinized to test the solution, once again using an effect-cause-effect method. The FRT identifies what to change as well as considering its impact on the future of the organization. Scrutinizing each step of the FRT as a group minimizes the probability that participants may overlook significant negative branch effects or overlooked problems. This process is referred to as trimming negative branches. The resulting tree originates in one or more injections and ends in desirable effects which really reflect the opposite of the UDEs in the CRT. Klein & DeBruine (1995) stated that the process

of synthesizing the total organization fosters and nurtures communication, understanding and acceptance. This is because one of the components of the Thinking Processes is the set of logic rules that underpin the trees. Goldratt's Categories of Legitimate Reservation (CLR) provides guidelines for communicating any reservations about the validity of the elements and connections within the trees (Dettmer, 1997). The FRT serves the following purposes:

1. Enables effectiveness testing of new ideas before committing resources to implementation
2. Determines whether proposed system changes will produce the desired effects without creating negative side effects
3. Reveals through negative branches, whether (and where) proposed changes will create new or collateral problems as they solve old problems, and what additional actions are necessary to prevent any such negative side effects from occurring
4. Provides a means of making beneficial effects self-sustaining through deliberate incorporation of positive reinforcing loops
5. Provides a means of assessing the impacts of localized decisions on the entire system
6. Provides an effective tool for persuading decision makers to support a desired course of action
7. Serves as an initial planning tool.

2.2.4 Prerequisite Trees (PRT)

The PRT uses a different logic from the previous trees, both of which use sufficiency logic (which basically asks “Is this enough?”) to establish cause and effect relationships. The PRT uses necessity logic, as does the Evaporating Cloud. In the case of the PRT, it is to identify the critical elements, or obstacles, standing in the TOC practitioner's way of reaching the objective (see Figure 2.4). Dettmer (1997) advised asking the following two questions to check whether a PRT is needed:

1. Is the objective a complex condition? If so, a PRT may be needed to sequence the intermediate steps to achieve it.

2. Do I already know exactly how to achieve it? If not, then a PRT will help to map out the possible obstacles, the steps involved in overcoming them, and the appropriate sequence.

Dettmer (1997) states that the PRT is used to achieve the following objectives:

1. To identify obstacles preventing achievement of a desired course of action, objective, or injection (solution idea arising from the Evaporating Cloud).
2. To identify the remedies or conditions necessary to overcome or otherwise neutralize obstacles to a desired course of action, objective or injection.
3. To identify the required sequence of actions needed to realize a desired course of action.
4. To identify and depict unknown steps to a desired end when one does not know precisely how to achieve them.

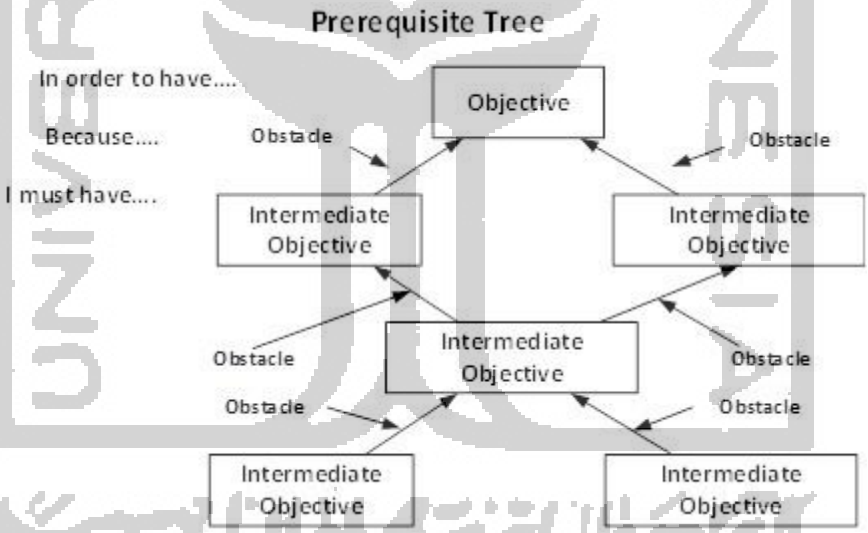

Figure 2.4 Structure of Prerequisite Tree

2.2.5 Transition Trees

The last tool in the TOC thinking process is the Transition Tree, which Klein & DeBruine (1995) stated to allow practitioners in determining the actions necessary to implement the

solution. Practitioners use the effect-cause-effect method to construct and scrutinize the details of the action plan, called the Transition Tree. As in construction of the FRT, each step is scrutinized using CLRs for negative branches.

Dettmer (1997) stated that the purpose of a Transition Tree is to implement change. He said that the Transition Tree structure started off as a four-element tree, with a fifth element being added later. Dettmer assumed that the use of the four or five element tree was situational. He stated that the five-element tree is the preferred methodology when constructing step by step procedures and there is a need to explain to others exactly why each step is required (see Figure 2.5). Dettmer (1997) outlined the original four elements of the Transition Tree as:

1. A condition of existing reality,
2. An unfulfilled need,
3. A specific action to be taken, and,
4. An expected effect of the integration of the preceding three.
5. The rationale for a need at the next higher level of the tree.

This change was devised to better assist buy-in from those from whom the TOC practitioner requires assistance. People are often inclined to resist change without a good explanation for the background to it. Also, frequently the implementation of major change falls outside the span of control of the person designing the change initiative, so that it is important to obtain the commitment of those who have the required power to ensure implementation. The fifth element that Goldratt has added appears to address these issues. Dettmer (1997) stated that the Transition Tree has nine basic purposes, these are:

1. Provide a step by step method for action implementation
2. Enable effective navigation through a change process
3. Detect deviation in progress toward a limited objective
4. Adapt or redirect effort, should plans change
5. Communicate the reasons for action to others
6. Execute the injections developed in the EC or FRT
7. Attain the intermediate objectives identified in a PRT

8. Develop tactical action plans for conceptual or strategic plans
9. Preclude undesirable effects from arising out of implementation.

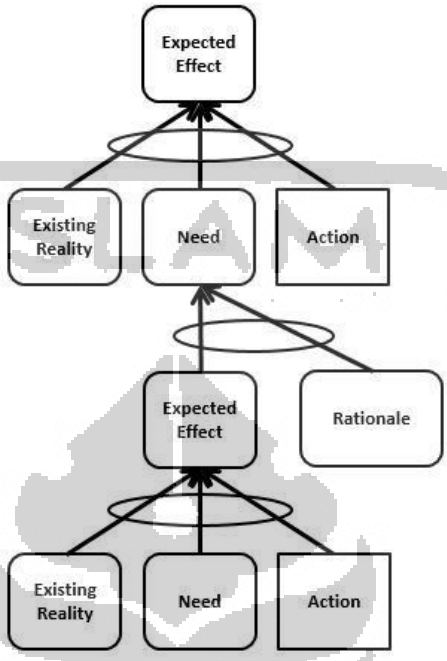

Figure 2.5 Structure of Transition Tree