CHAPTER IV

DATA COLLECTION AND PROCESSING

4.1 Data Collection

A total number of 33 papers are compiled with selected preference. Paper's topic is limited to Emission efficiency, which is focusing on the topic of Industry Emission after findings from main paper. The target are Elsevier, Springer, and Google Scholar since they are few of the largest of electronic database and Google Scholar will be used to find from another source of electronic database. Papers are related with Emission Efficiency "AND" sustainable development goals "AND" SDG Goal 12. The publication of journal was compiled into percentage diagram shown in Figure 4.1 below;

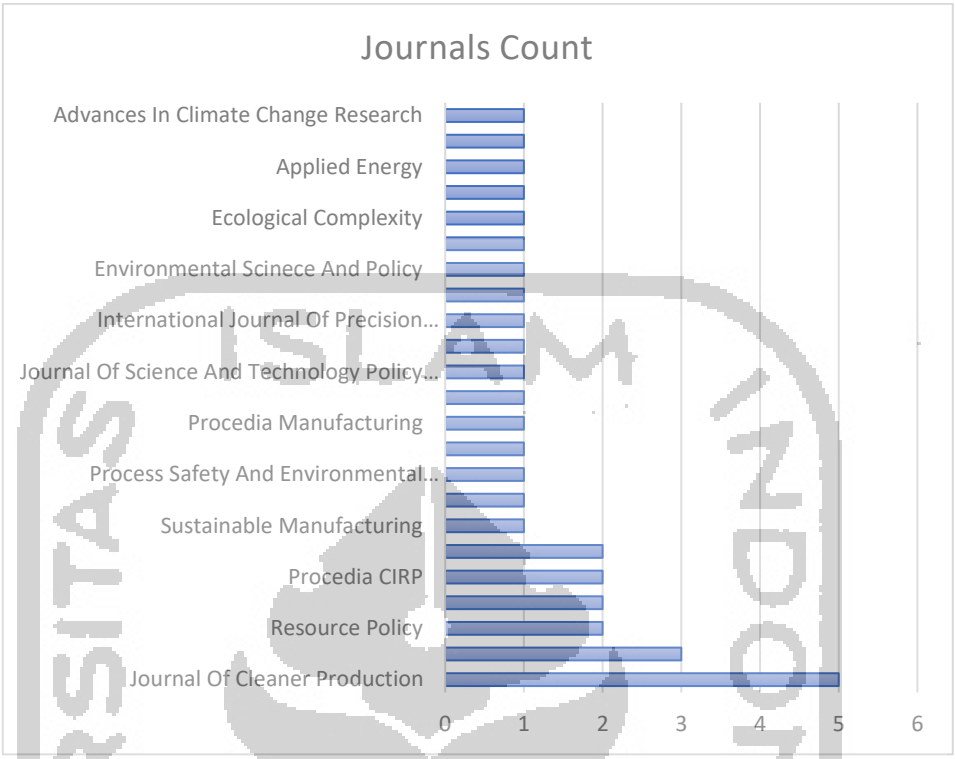

Figure 4.1 Journal counts

From the diagram above, the most significant contributor was from Journal of Cleaner Production with 15%, the second with 9% were Science of The Total Environment and while the rest was relatively equal in the range of 6% to 3%.

The author decided to select papers that published from 2010 until 2019. Figure 4.2 below shows the publication year of the papers. It is shown that the collected papers from the year 2010 until the year 2019, years 2018 have the most significant number of journals by 15 papers followed by 2017 with 7 papers and so on. It is shown that the research focused on sustainable consumption is increasing every year.

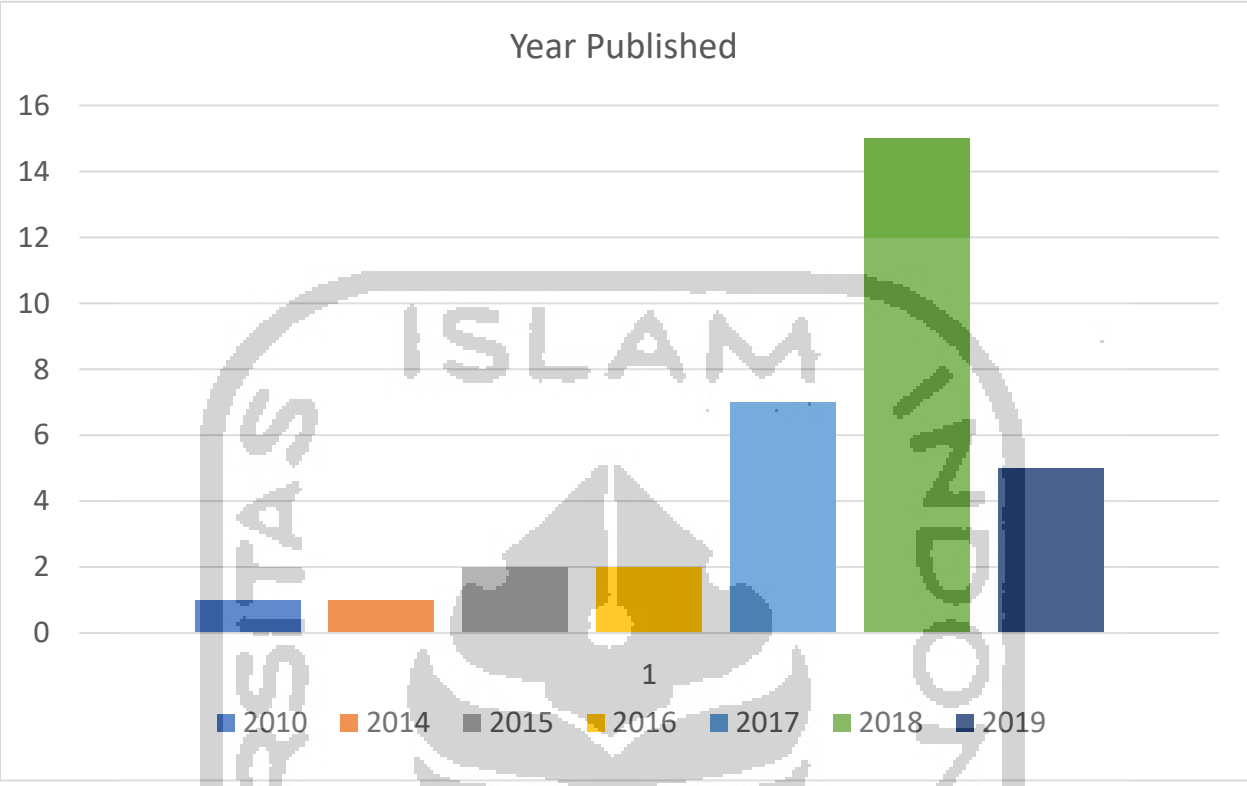

Figure 4.2 Papers year published

It can be seen in Figure 4.3 that scholars apply a set of techniques to study Emission Efficiency. Among all the methods used, the empirical study is the most frequent with 16 occurrences by collecting empirical data to build new theories or validate innovative models. Case studies are also commonly used and can be found in 12 articles, which may suggest that scholars elaborate predictive mathematical models to evaluate the cause and effect of a system in the context of process design.

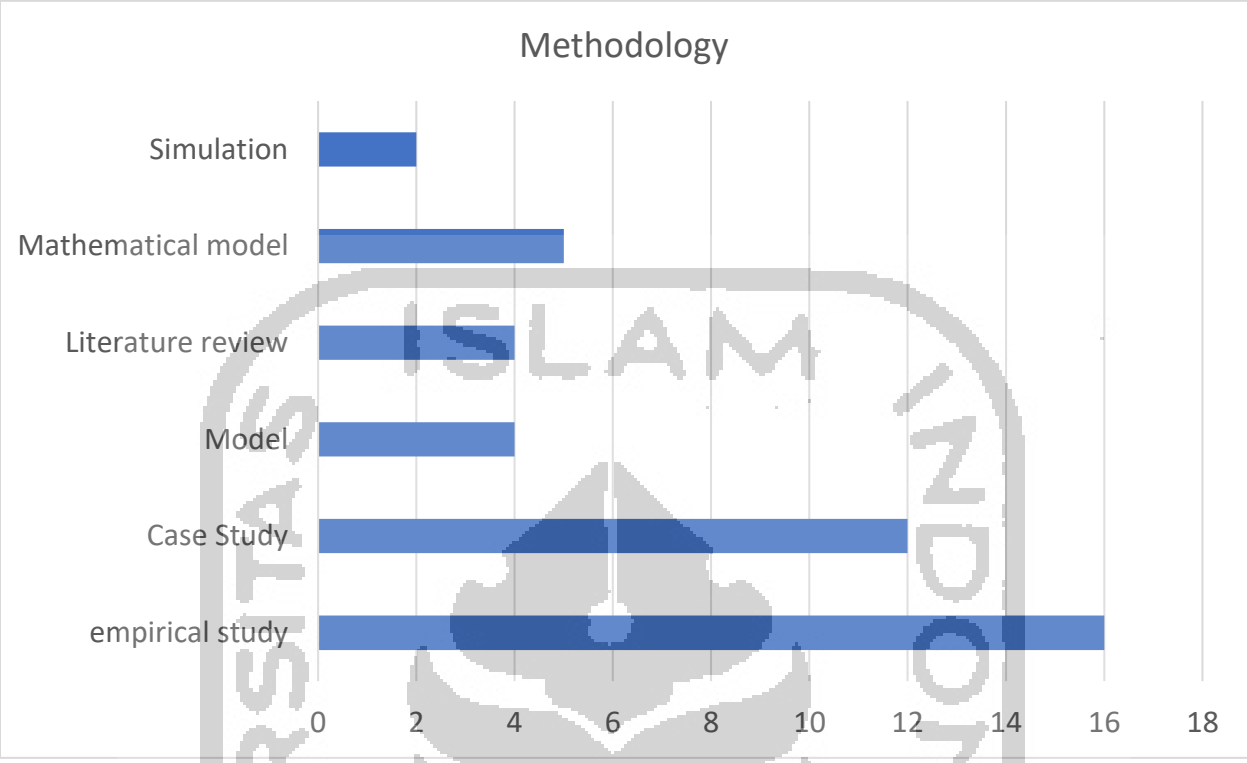

Figure 4.3 Methodology research

4.2 Data Analysis

4.2.1 Undesirable Effects

Papers collected from Elsevier, Springer and Google Scholar are put into a database. Problem analysis in this section will answer the first question in the TOC Thinking Process, which is "What to Change?" The first step is to identify the Undesirable Effect (UDE). UDEs are hindrances to get better throughput or higher performance, or obstacles to achieving the Emission Efficiency. The UDEs that are extracted from 33 papers then shown in Figure 4.4 below:

Researcher	Undesirable Effects
De-xin, (2016)	Greenhouse gas emission from energy production and consumption still the main cause of climate change
	Wind power curtailment occurred
	irrational market system in controlling wind power tariff hinder the development
	Weak independent innovative ability
Roshchanka et al. (2017)	Inaccurate application of policy slowdown the process of climate change mitigation
	developed country struggling in applying policy of CMM
	Coal mine emits methane, which is a potent GHG gas
Ye et al. (2019)	Policy makers tend to make decision that benefit environmentalist side, but have negative impact toward energy and economy sectors
	there's contradiction in applying stable 3E (environmental, economy and energy) policies
	current method in emission reduction does not reflect the goal toward 3E stabilization
Cardoso et al. (2019)	Cleaner production is not included as SDG 13 target
	textile industry responsible for high amount of toxic disposal in soil, air and water
Hodgkinson & Smith, (2018)**)**	Global CO2 gas production need to be restricted as the effect of it cause massive climate shift
Schandl et al. (2015)	many policies that increase environmental impact tend to sacrifice the aspect of economy

Researcher	Undesirable Effects
	improvement of living standard increases the amount material and natural resource used contribute to fast rising emission
Sarkodie & Strezov (2019)	pollution haven might bring external funding for developing country but it cost of increased inflow CO2 emission to the country.
Foggia, (2018)	Energy efficient building required a lot of energy, while energy generated from low carbon emission fuel is inadequate
Stock et al. (2018)	Total control of ICT or Technological system might exploit performance extortion of employee
Lee et al. (2019)	manufacturing is struggling with short time survival, while now the focus should be altered towards environmental and social aspect
Beier et al. (2017)	industry is one of major contributors to gas emission
Bjelle, Steen-olsen, and Wood (2018)	high demand from consumer side, still one reason why GHG emission still hard to tackle
Secher, Collin, and Linnet (2018)	many environmental impact assessment methods are still expensive for small medium enterprise
Bashkar & Kumar, (2018)	unmanaged E-Waste could potentially become future problem for environment
Anna et al. (2018)	the trend of GHG emission from chemical industries still increasing
Molinos-senante and Sala-garrido (2018)	processes of water treatment require a lot of energy and emit GHG gas to environment

Researcher	Undesirable Effects
Mcaloone and Pigosso (2017)	the increase of environment crisis, make the development of sustainable assessment inevitable
Hoffman et al. (2019)	as non-value added activity, drying process of electroplating manufacturing is consume a lot of energy
Martin (2019)	Fire as a substance that highly affect environment globally, is not classified as one of SDG Target
Kumar et al. (2017)	dependency of industry toward fossil fuel is still one of the major causes of high GHG gas emission
Sahota et al. (2018)	in spite the potential, bio gas has some limitation that make it less favorable
Haines et al. (2017)	SLCP is pollutant that contribute to major illness globally and harm the environment
Mancini and Sala (2018)	Mining sector bring social and environmental impact affecting human and human right
Martinico-perez, Schandl, and Tanikawa (2018)	lack implementation of green growth and sustainability development policies
Uddin et al. (2015)	mining is one sector that received little attention in Clean development mechanism project
Müller (2018)	Internet of things not only bring potential, but also might bringing risk for SME
Dombrowski and Ernst (2014)	Industry and manufacturing are susceptible to the effect of climate change

Researcher	Undesirable Effects
Hertwich et al. (2019)	Production of major materials, is accounted for over one quarter of global energy usage
	Remanufacture and Reuse practice not commonly used by most industry/ manufacturing
	there's major trade off in applying Material efficiency strategies
	Need more integrated policy model to assess the 3E dimension of Material Efficient strategies
Worrel et al. (2016)	Material production produces large volumes of waste both in production and at end of disposal
	material efficiency is not realized in practice to its full potential
	massive increase in the use of materials, has led to growing impact on environment
Liu et al. (2010)	sustainable development could not be achieved if policy makers continuously emphasize the control of polluting industries.
	The ‘problems of consumption’ comes both from consumers and producers.
	Consumer demand are becoming a more important contributor for the generation of CO2 due to the indirect impact for products and services.

Table 4.1 Undesirable Effects extracted from journals

4.3 Data Processing

In data processing, the author will visualize each UDEs using TOC logic thinking diagram to find the root cause of Industry Emission in Current Reality Tree, solve the conflicted problem using Evaporating Cloud, and give Injection based on Islamic value into Future Reality Tree. The diagrams will describe in detail in the next Current Reality Tree sub-content of data processing below.

4.3.1 Current Reality Tree

In order to answer "What to Change?" in Industry Emission Contribution, the collected UDEs are then interpret into Current Reality Tree as shown in the Figure 4.5 below;

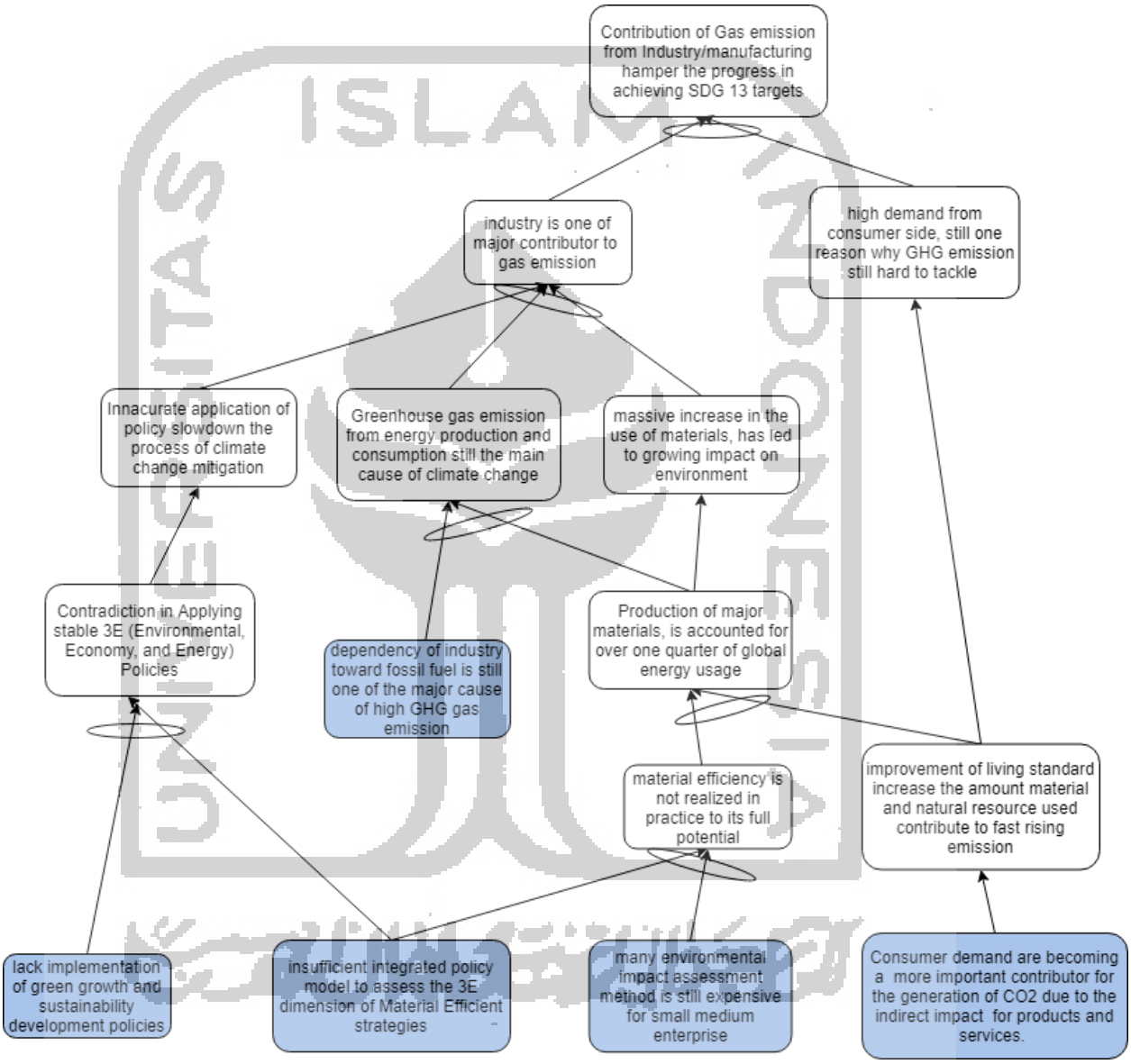

Figure 4.5 Current Reality Tree of Industry Emission

The negative effects listed above are the main idea of what current state has over emission in industry, and there are five core problems that identified as the causes of the

undesirable results. The core stakeholders that responsible in the process related to industry emission are:

1.Lack of implementation of green growth and sustainable development policies

2.The dependency of the industry still one of the primary causes of high GHG gas emission

3.Insufficiently integrated policy model to assess the 3E dimensions of the material efficiency strategy

4.Many environmental impact assessment methods are still expensive for small and medium enterprise

5.Consumer demand becomes more critical contributor of CO2 due to the indirect impact for product and services

4.3.2 Conflict Resolution Diagram / Evaporating Clouds

Evaporating Clouds mainly challenges the assumption by using positive injection to solve the conflicting sides found in the main objectives of each core problem. These main objectives are the opposition to negative effects that are going to help attaining Emission Efficiency in stakeholders. Now the seven core problems are projected into Evaporating Clouds to solve the dilemma in achieving Emission Efficiency. The first EC from the Government side will be shown in Figure 4.6 below;

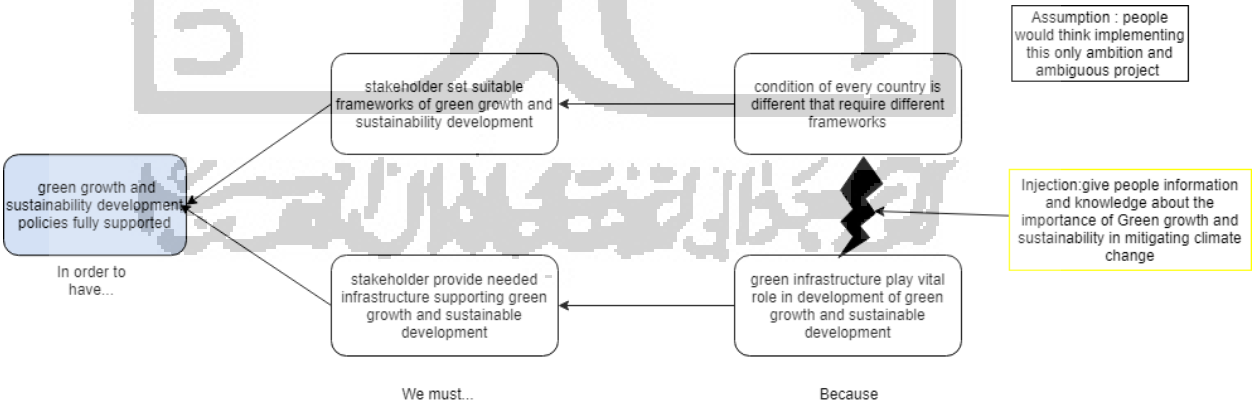

Figure 4.6 Evaporating Clouds of Green growth and sustainability policy

The second EC from Energy Efficiency, will be shown in the Figure 4.7 below:

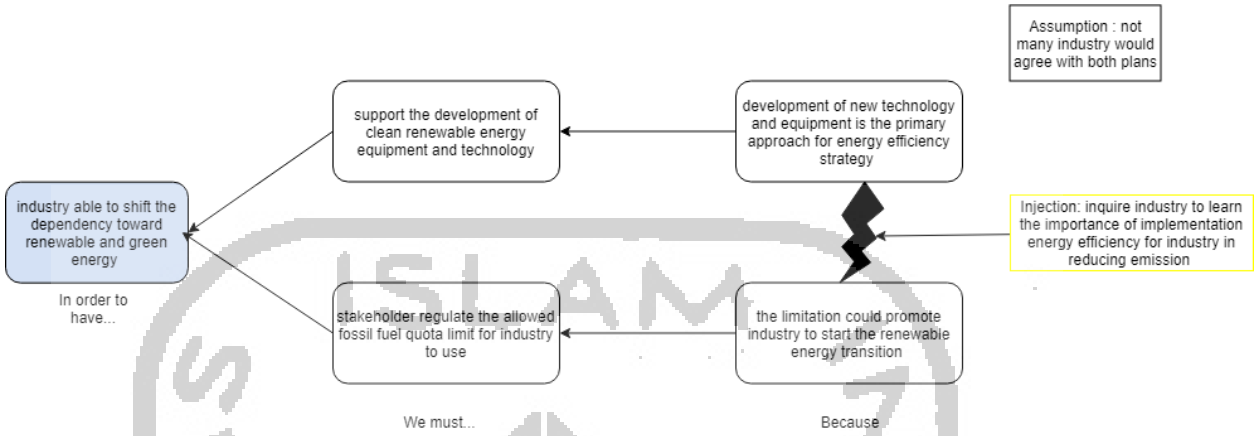

Figure 4.7 Evaporating Clouds of Energy Efficiency

The third EC from Material Efficiency, will be shown in the Figure 4.8 below:

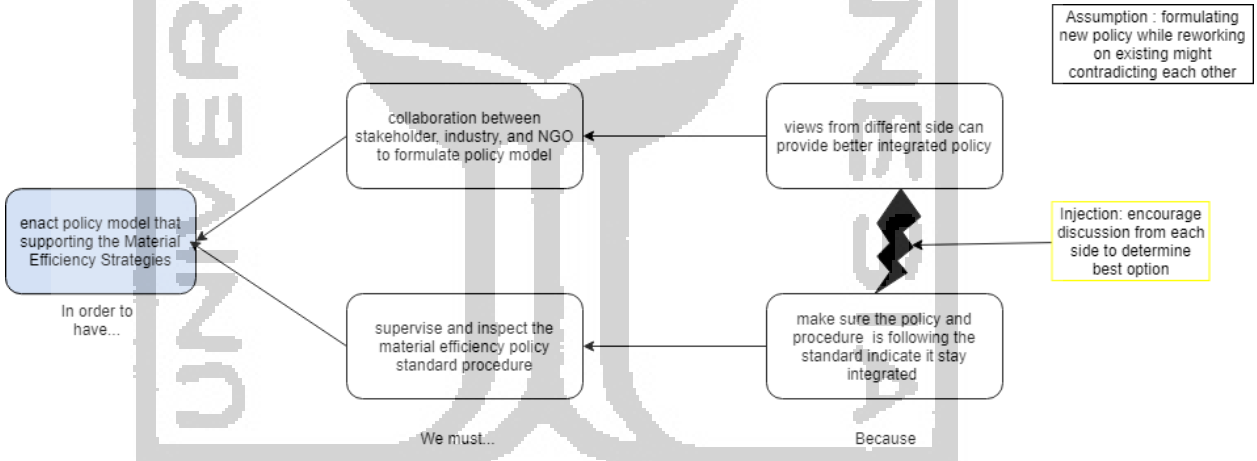

Figure 4.8 Evaporating Clouds of Material Efficiency

The fourth EC from Small Medium Enterprise side will be shown in the Figure 4.9 below:

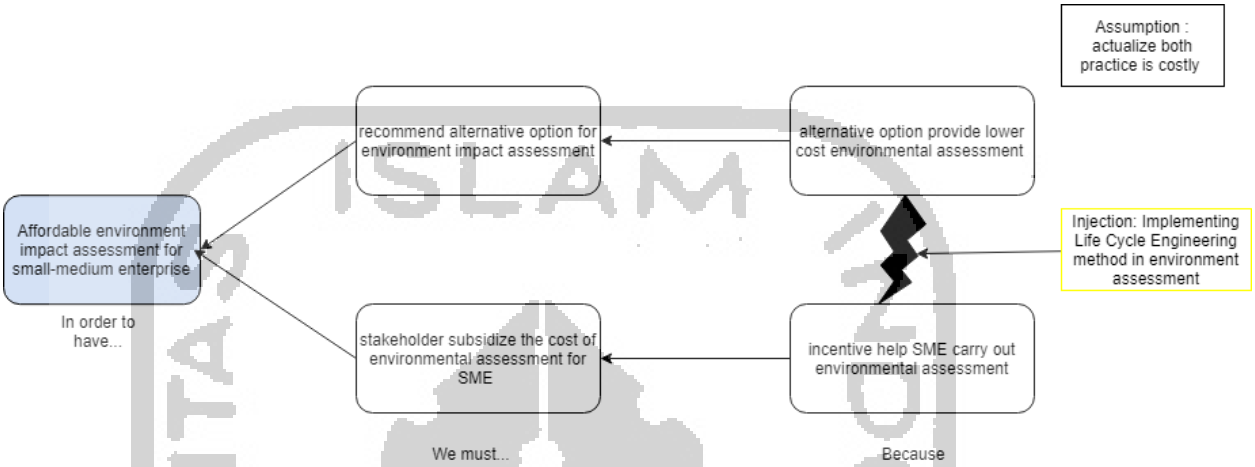

Figure 4.9 Evaporating Clouds of Small Medium Enterprise

The fifth EC from Consumer demand side will be shown in the Figure 4.11 below:

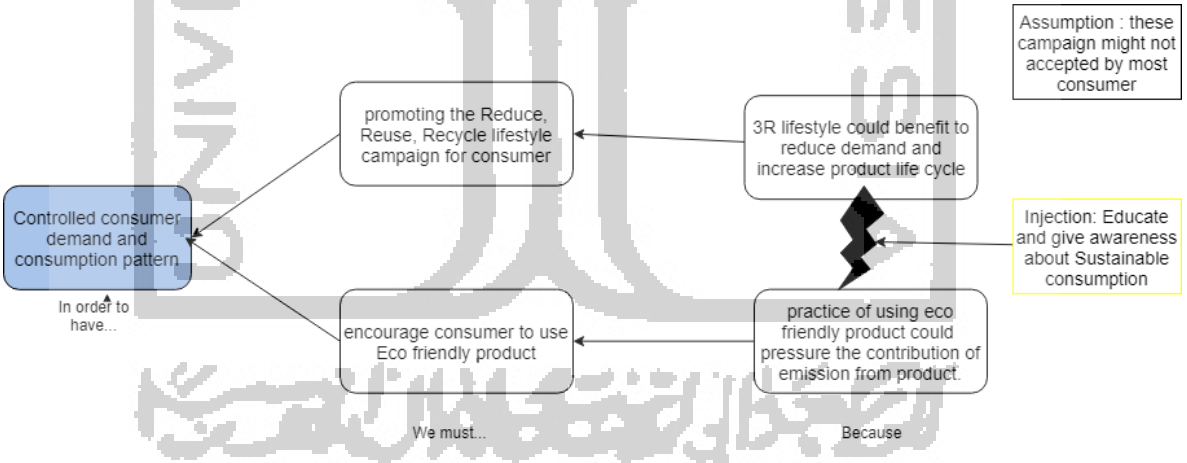

Figure 4.10 Evaporating Clouds of Consumer demand

4.3.3 Future Reality Tree

As an opposing objective from Current Reality Tree, Future Reality Tree will include the Desirable Effects to achieve Emission Efficiency. The ultimate result is a reverse of the

negative effects in the Current Reality Tree to see the effects of making the core problems into positive actions. The FRT will be shown in Figure 4.11 below;

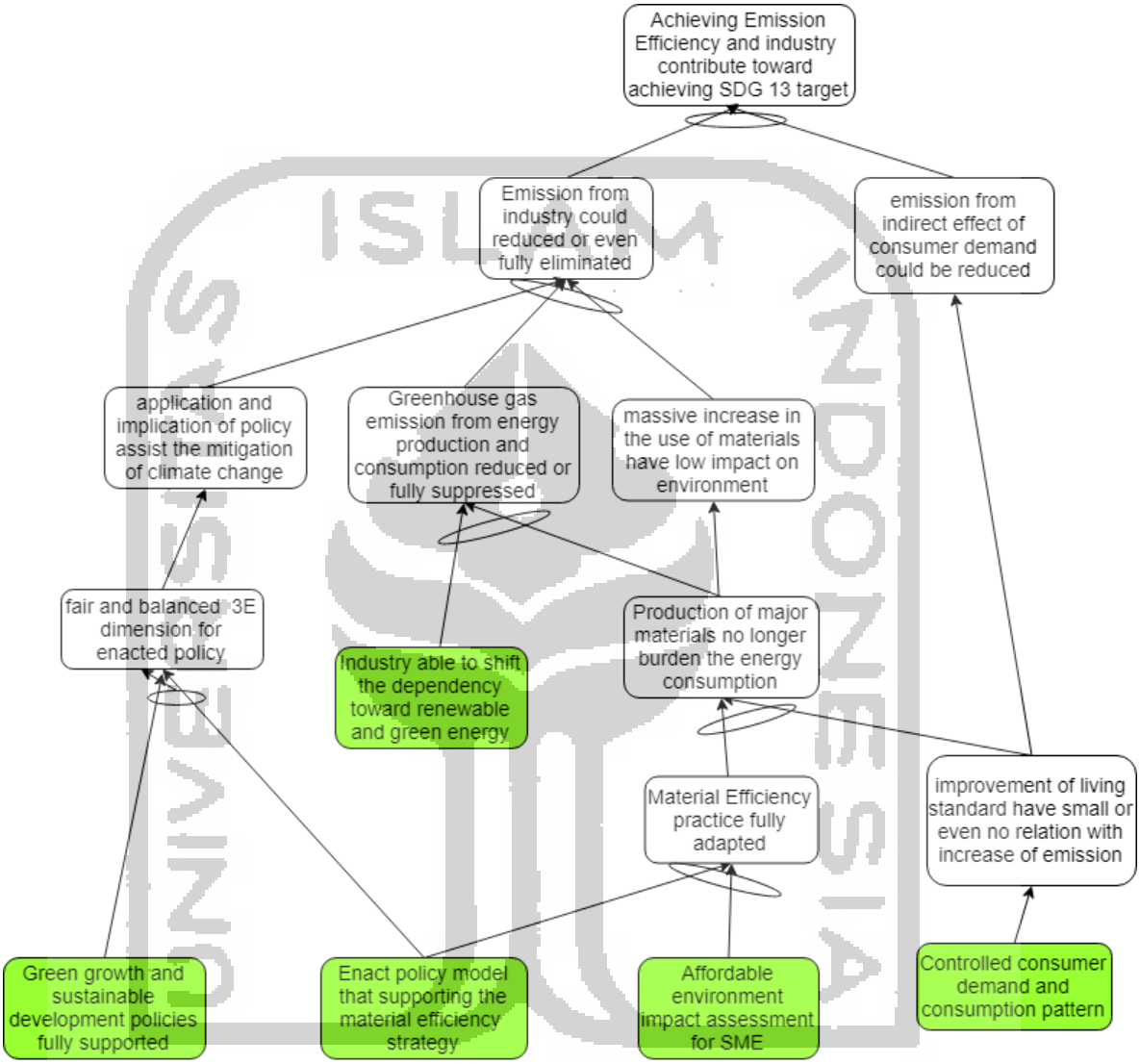

Figure 4.11 Future Reality Tree of industry emission efficiency