



# A warning trigger: a study of the integration of Weak Signal Theory and the anticipation framework into China's policy to ban plastic waste import

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## ► To cite this version:

Xuexia Li. A warning trigger: a study of the integration of Weak Signal Theory and the anticipation framework into China's policy to ban plastic waste import. Business administration. 2020. dumas-03152204

**HAL Id: dumas-03152204**

**<https://dumas.ccsd.cnrs.fr/dumas-03152204>**

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# A warning trigger: A study of the integration of Weak Signal Theory and the Anticipation Framework into China's policy to ban plastic waste import

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Master 2 R  
Program Masters in Advanced Research in Management of  
Information Systems (ARAMIS)  
2019 - 2020

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integration of Weak Signal Theory and  
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#### Preface:

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**Université Grenoble Alpes**

Masters in Advanced Research in Management of Information Systems

(ARAMIS)

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**Xuexia LI**

**2020**

# CONTENTS

Anti plagiarism statement.....	5
CHAPTER 1.....	9
1.1 INTRODUCTION.....	9
1.2RESEARCH CONTEXT: CHINA’S IMPORT OF PLASTIC WASTE.....	10
1.3 RESEARCH OBJECTIVES.....	15
1.4 RESEARCH QUESTIONS.....	15
1.5 SIGNIFICANCE OF THE RESEARCH.....	16
1.6LIMIATTION OF STUDY.....	17
CHAPTER 2.....	18
LITERATURE REVIEW.....	18
2.1 WEAK SIGNALS THEORY.....	18
2.2COMMON CHARACTERISTICS OF WEAK SIGNAL.....	20
2.3 THE ANTICIPATION THEORY.....	23
2.4 WEAK SIGNALS FOR ANTICIPATION.....	23
2.5 THE ANTICIPATION FRAMEWORK.....	24
CHAPTER 3.....	26
METHODOLOGY.....	26
3.1 SECONDARY DATA RESEARCH.....	26
3.2DEFINING SECONDARY DATA ANALYSIS.....	26
3.3USEFULNESS OF SECONDARY DATA ANALYSIS.....	27
3.4 SOURCE OF THE DATA.....	28
3.5SHORTFALLS OF SECONDARY DATA ANALYSIS.....	30
3.6PROCESS OF SECONDARY ANALYSIS.....	30
CHAPTER 4.....	32
FINDINGS AND RESULTS.....	32
4.1CASE STUDY OF CHINA NATIONAL SWORD POLICY TO BAN PLASTIC WASTE IMPORT	32
4.2IDENTIFICATION AND ANALYSIS THROUGH ANTICIPATION FRAMEOWRK.....	33
4.2.1WEAK SIGNAL BEFORE THE BAN POLICY.....	34
a) Graphpic Photography OF Beijing Waste Area (October 2008 By Jiuliang Wang ) (Signal:	

Member of the public or lawmakers).....	34
4.2.2 ANTICIPATION OF BAN POLICY ON WASTE PLASTIC IMPORT.....	46
4.2.3 GROUP 1: CHINA.....	46
4.2.4 GROUP 2: OTHER DEVELOPING COUNTRIES' IMPORT OF PLASTIC WASTE.....	48
4.2.5 GROUP 3: DEVELOPED COUNTRIES THAT EXPORT WASTE PLASTIC.....	50
Figure 4.17 The position of developed countries (Group 3) regarding the Anticipation Framework.....	51
CHAPTER 5.....	52
CONCLUSION AND RECOMMENDATIONS.....	52
5.1 FROM WEAK SIGNS TO STRONG AND DANGEROUS SIGNAL- THE CHINESE EXPERIENCE (GROUP 1) .....	52
5.2 ADAPTING TO STRONG SIGNAL - THE DEVELOPING COUNTRIES EXPERIENCES (GROUP 2) .....	53
5.3 ADAPTING TO STRONG SIGNAL - THE DEVELOPED COUNTRIES EXPERIENCES (GROUP 3) .....	54
5.4 DISCUSSION & RECOMMENDATIONS.....	54
APPENDIX.....	66
APPENDIX 1.....	66



# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

Today, institutions and corporations are situated in a fast-growing environment with constant changes. Many studies have shown that to keep up with the changing world, corporations need to be more innovative. Many of these organization have pursued open innovation by monitoring and converging knowledge to remain competitive. Organizations that can quickly identify changes and even weak signals in their environment and react to them will gain a decisive competitive edge. The term weak signal was first introduced by Ansoff (1975) who claimed that for long-range planning or strategic-planning, and categorized information, organization should examine strong signals and weak signals. Weak signals can become clearer or might disappear over time. As a decision-support tool, weak signals are used to scan the environment and make systems more sensitive to emerging changes. Upon interpretation, the signal becomes characterized not as weak, but as an early warning signal. According to Hiltunen (2010), weak signals can help to break prevailing mental models and encourage organizations to think differently. This in turns, enables them to be more innovative about the futures (Ansoff, Kipley, Lewis, Helm-Stevens & Ansoff, 2018). Weak signal analysis, as a specific foresight methodology, can contribute to the emergence of a learning or adaptive policy-making both in private organizations and public administrations (Metcalf, 2003).

Detection of weak signals requires both sensitivity and expertise. Coffman (1997) pinpointed out that using weak signals can indicate some development path in the future. However, it is important to remember that anticipation has the potential for causing future possible events and changes. Given the importance of changing circumstances, the concept of weak signals is significant for the development of

strategies to reform (Matthews, 2016).

In weak signal research, the emphasis therefore evolves around “innovating routine” which is a routine of upsetting other routines. Weak signal research routines reduce vulnerability through learning by coping with hypothetical change and by inducing organizational practices to adapt to the requirements of radically changing environmental opportunities and threats. In doing so, they help to countervail strategic lock-in problems by opening up unconventional assumptions about the evolution of the environment and suggesting new options for strategy (Mendonça, Cardoso, & Caraça, 2008). Based on the Anticipation Framework (Lesca, 2011), when organization foresees potential threats and risks in the operational environment, it will predict the future while classifying future actions. This thereby contributes to the construction of robust business models.

In this study, the researcher examined the ban of imported plastic waste under China’s National Sword Policy as a case study to demonstrate the strength of incorporating weak signals and the anticipation to solve the economic and environmental problem. However, due to a lack of information, this issue has not been systemically analyzed before (van Beukering, 2001). As such, this research is timely and practical to understand the development of the government’s National Sword Policy from a theoretical perspective.

## **1.2 RESEARCH CONTEXT: CHINA’S IMPORT OF PLASTIC WASTE**

In recent years, the plastic and related products play significant roles in stimulating the global economy (Brooks, Wang, & Jambeck, 2018). Globally, plastic is widely used and it adds to the comfort and convenience of modern lifestyle (Alam, Billah, & Yajie, 2018; Faraca, Martinez-Sanchez, & Astrup, 2019).

In fact, plastic's portability, flexibility, durability (Europe, 2017), and cheapness make it one of the most widely used man-made materials, and in just a few decades, plastic production has skyrocketed (Dilkes-Hoffman, Pratt, Laycock, Ashworth, & Lant,

2019). This has been accompanied by an increase in solid waste, plastic waste has become an important component of solid waste (Aguado, Serrano, San Miguel, Castro & Madrid, 2007). Millions of tons of plastic waste are traded every year around the world and play an important role in replacing plastic raw materials. While recycling is a well-known solution, only 9% of the world's plastic waste has been recycled, and more than half of that is exported to hundreds of countries around the world. (Geyer, Jambeck & Law, 2017; Brooks, Wang & Jambeck, 2018).

In recent decades, China's demand for plastic has propelled the global recycling waste trade. This situation has allowed China to achieve a low-cost manufacturing advantage, which plays a crucial role in making China the world's factory (Wang, Zhao, Lim, Chen & Sutherland, 2020). According to statistics reported by Brooks, Wang, & Jambeck (2018) as depicted in Figure 1.1, China has accepted nearly half of the world's nonindustrial plastic waste imports, about 106 millions of tons of plastic waste, over the last 25 years. China's economy has partly benefited from the global recycling trade (Qu, Guo, Ma, Chen, Liu, Liu, & Xu, 2019).

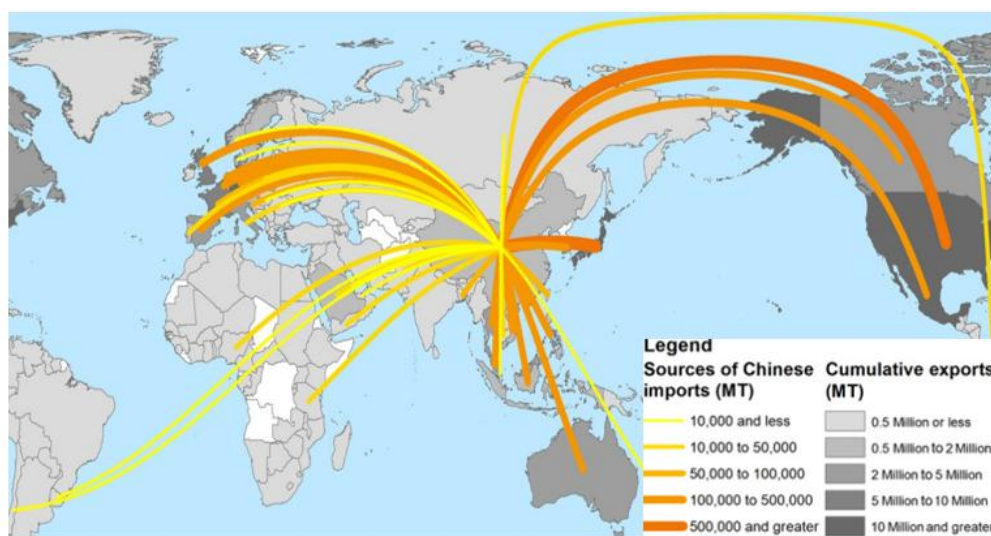


Figure 1.1: Sources of plastic waste imports into China in 2016 (adapted from Brooks, Wang, & Jambeck, 2018)

In the global plastic waste trade, the developed higher income countries attribute to the highest export level (Brooks, Wang, & Jambeck, 2018). The biggest exporters of scrap plastic are the United States, Japan, Germany, the United Kingdom, and Europe (Gourmelon, 2015). Meanwhile, Asia countries are the leading importers (Wang, Zhao, Lim, Chen, & Sutherland, 2020). Xu, Chen, Jiang, Zhang, Ma, Ren & Shi (2020) in their recent research looked into the evolution of global polyethylene waste trade system, mapped the global trade network of polyethylene waste in 1976, 1986, 1996, 2006, 2016, and 2017. The mappings are presented in Figure 1.2 as shown below.

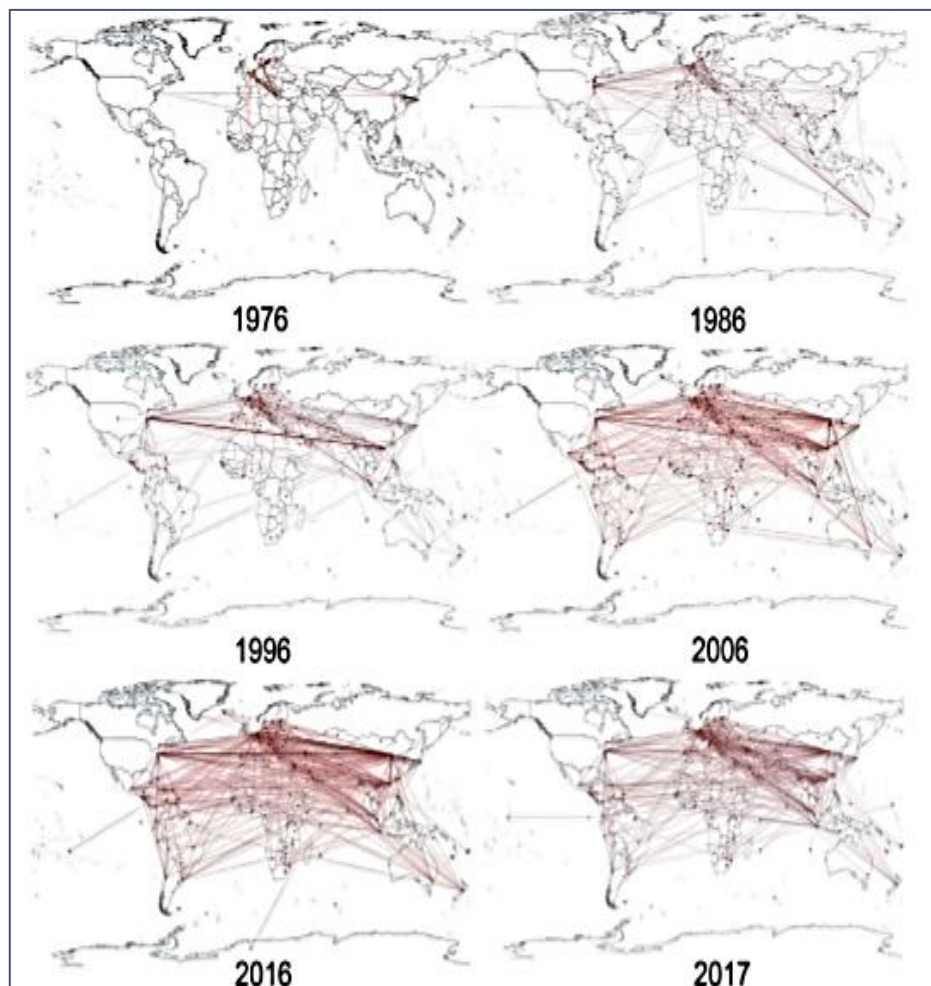


Figure 1.2: Global trade network of PE waste in 1976, 1986, 1996, 2006, 2016, & 2017  
(adapted from Xu, Chen, Jiang, Zhang, Ma, Ren & Shi 2020)

China is the largest importer of waste plastics since 1992 which accounts for 45% of the global market (Brooks, Wang, & Jambeck, 2018). The global plastic waste trade is complicated and dynamic. It is affected by various socioeconomic factors. China's environment has been damaged by a huge amount of imported plastic waste. Under mounting pressure, in July 2017, the Chinese government notified the World Trade Organization of its plan to impose bans on 24 types of waste streams, including plastics in packaging waste (World Trade Organization, 2017). Because of a desire to become a less polluted country (Wang et al., 2019), in 2017, China passed the National Sword policy (Chinese General Administration of Customs, 2017), which the import of non-industrial plastic waste has been permanently banned since January 2018. China's plastic import ban placed the global plastic waste trade into chaos.

As China's import regulation on plastic waste tighten, China's plastic imports plunged 99 percent (Katz, 2019). China still has a high demand for plastic materials and allows the import of processed plastic materials, such as recyclable materials. This has created a new plastic waste trade route (Morita & Hayashi, 2018). The plastic waste trade has been largely diverted to Southeast Asian countries as illustrated in Table 1.1. The gradual increase in plastic imports from other countries has signaled a redistribution of the burden of the global plastic waste trade (Wang, et al., 2020)

ASEAN Member States	2016	2017	2018
Malaysia	287,673	549,876	872,797
Thailand	69,487	152,244	481,381
Vietnam	347,840	659,057	492,839 <sup>10</sup>
Indonesia	120,979	128,951	320,452
Myanmar	688	1,855	71,050 <sup>11</sup>
Philippines	4,650	4,267	11,761
Singapore	3,354	6,422	9,018
Lao People's Democratic Republic	1,181	3,008	4,791
Cambodia	647	1,685	1,688
Brunei Darussalam	30	116	185
ASEAN	836,529	1,507,481	2,265,962
% Global	5.38%	11%	27%
Global	15,553,548	13,410,919	8,358,867

Table 1.1: Plastic Waste Import Trends in ASEAN countries

(Source: Trademap <https://www.trademap.org/> Import data accessed 14 June 2020)

In this study, we distinguish 3 groups of countries as depicted in Figure 1.3. The first case study, focuses on China National Sword Policy. The research focuses on the weak signals leading to the radical transformation and implementation of the new policy. In the study of case 1, the researcher uses the Anticipation framework to understand how weak signals evolved into strong signals that drive the change. With the ban of the import to China, the focus point shifted to the second category of developing Countries. Plastic waste imports to Thailand, Vietnam, and Malaysia grew significantly. According to the report of Greenpeace East Asia (2019) on Southeast Asia's struggle against the plastic waste trade, Malaysia's monthly imports of plastic waste rocketed from 20,000 tonnes in 2016 to 110,000 tonnes in 2018. The second group of countries studied in this research includes India, Vietnam, Malaysia, Taiwan, Thailand, and Indonesia. The third group comprises developed countries that are the major contributors of plastic waste. They are the United States, Japan, Germany, the United Kingdom, Europe, Canada, Australia, and Chile. The responses of these nations are studied under the Anticipation framework in this study.



Figure 1.3: The three groups of case studies in the research



### **1.3 RESEARCH OBJECTIVES**

This research uses weak signals, the Anticipation Framework, and their use in organizations as part of organizational future learning. The main objectives of the research are as follows:

- Study the types of weak signal and the key components in the Anticipation framework in analyzing different groups of countries' chain reaction after the China National Sword Policy.
- Understand how the integration of weak signals concept and the Anticipation Framework can help organization to better cope with future possible changes.

### **1.4 RESEARCH QUESTIONS**

This study seeks to enhance the understanding of how weak signals facilitates the identification of problems at an early stage. And when integrated with the Anticipation Framework, it allows organizations or institutions to formulate appropriate strategies and policies to counter the problems. As such, for this research, the researcher will examine the longitudinal data and explore trends and changes of phenomena over time to understand how effective anticipation help organizations to better adapt to the current situation. The research thus aims to answer the following research questions:

1. What are the types of weak signals and the key components in the Anticipation Framework in analyzing the chain reaction of different group of countries after the China National Sword Policy?
2. How can organizations integrate weak signals into the Anticipation Framework to cope with future possible changes after the China National Sword Policy?

## **1.5 SIGNIFICANCE OF THE RESEARCH**

All research will involve the collection of data. Unlike traditional research, this research uses secondary data as the primarily source of data. These secondary data are deliberately collected and analysed. Most of these data are created in a more informal sense as a record of people's activities. The researcher studies both raw and interpreted data to study the subject matter. Looking at the relevant data, the research covers an extended period, and analyzing development over that period.

The researcher noted that there is now a growing literature on the elaboration of the weak signals theory and the anticipation theory. Interestingly, previous studies such as Blanco and Lesca (2003), Walters, Jiang, and Klein (2003). and Choo (2001). have found positive relationship between weak signals and anticipation in the organizations' strategic management. However, there is little evidences for classifying the types of weak signals and integrating weak signals with the Anticipation Framework. Understanding the research gap, the researcher examines further using secondary data to identify weak signals and how the element of anticipation influence organization in their decision making and formation of strategies to better cope with the disruption in the industry.

This study is essential as there are not many academic studies on the application of weak signals with the Anticipation Framework. The researcher discusses in details how the integration of weak signals and the Anticipation Framework to explain and justify China National Sword Policy. This case study is also important as it provides evidence of the effectiveness of weak signals and anticipation in decision making. Importantly, the study provides recommendations into the ways to conduct substantive data collection analysis to reformulate the Anticipation Theory.



## **1.6 LIMIACTION OF STUDY**

This study has been carried out during the Covid 19 pandemic. The researcher is unable to conduct in-depth interviews or to carry out survey questionnaire. To overcome this limitation, the researcher has resolved to the use of systematic mapping (James, Randall & Haddaway, 2016) as a method to analyze the secondary data obtained for the study. Systematic mapping is developed in social sciences for several reasons. First, it is in response to a lack of empirical data when answering questions using systematic review methods. Second, there is a need for a method to describe the literature across a broad subject of interest (James, Randall, & Haddaway, 2016). Systems mapping focuses on organizing, describing, and cataloging existing evidence, as opposed to systematic reviews that attempt to answer specific questions (e.g. primary, secondary, theoretical, economic) relating to question of interest. The included studies can be used to identify evidence for policy-relevant questions, knowledge gaps (to help direct future primary research) and knowledge clusters (sub-sets of evidence that may be suitable for secondary research, for example systematic review).

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 WEAK SIGNALS THEORY**

The environment sometimes fluctuates or changes (Lesca, Caron-Fasan, & Falcy, 2012), and every change or event will react and generate weak signals (Xu, Kaye, & Duan, 2003). Weak signals are anticipative (Lesca, 2001) and by analyzing them, they can become early warning signals to anticipate certain possible events in the future (Ansoff, 1982). As the signals get stronger over time, the recovery window becomes more and more limited (Lesca, et al., 2012). Effective analysis of weak signals and corresponding actions at different stages of the Anticipation Framework can avoid or mitigate risks, or stimulate the impact of future possible events (Lesca & Lesca, 2011).

The concept of weak signal can be traced back to 1975, to solve the problems encountered in long-term planning. It was first introduced by Ansoff and the researcher was the pioneer of the weak signal analysis (Ansoff, et.al., 2018). Nowadays weak signals concept has been widely interpreted in literature reviews.

Weak signals are unusual, inconsistent, or surprising information or data that appear at the edges of cognition thought patterns, habits, stereotypes, trends, experiences, or expectations and contradict those concepts (Day & Schoemaker, 2004; 2005; 2006; Haeckel, 2004; Carton, Caron-Fasan, & Lesca, 2018). Lesca and Lesca (2014) emphasized a weak signal may be an insignificant piece of data, or submerged in the ocean of raw data that generates “noise”. This is the reason why such signal is called weak. It is a situation, a possibility, a conjecture, or a hypothesis, sometimes difficult or impossible to improve the reliability of a perceived signal (Lesca, 2011). Magruk (2010) also pointed out that weak signals are unreliable, uncertain, surprising, irrational, and hard to track. If it succeeds in attracting attention, then it has the status

of information (Lesca & Lesca, 2014). Over time, events and ideas will mature and dominate (Magruk, 2010).

Though often overlooked, weak signals can be found in almost any aspect of life (Robinson, 2012). People can perceive weak signals through the five senses of seeing, hearing, smelling, feeling, and even tasting (Heinone & Hiltunen, 2012). Weak signals can also be represented in a visual form such as images, photos, paintings, drawings, and video clips, and so on (Hiltunen, 2010). Lesca (2011) indicated that signals can exist in various forms, including quantity or quality, linguistic or non-linguistic, written or verbal, and even body language. In addition to people, environmental and natural changes can also present signals. Lesca (2011) also classified the types of signals and signs into four categories: Nature, Member of the public or lawmakers, Statistic, and Reflex. The classification by Lesca (2011) is presented on Figure 2.1 as shown below. For this study, the researchers adapted these classify signals and signs for the analysis in case studies in Chapter 4.

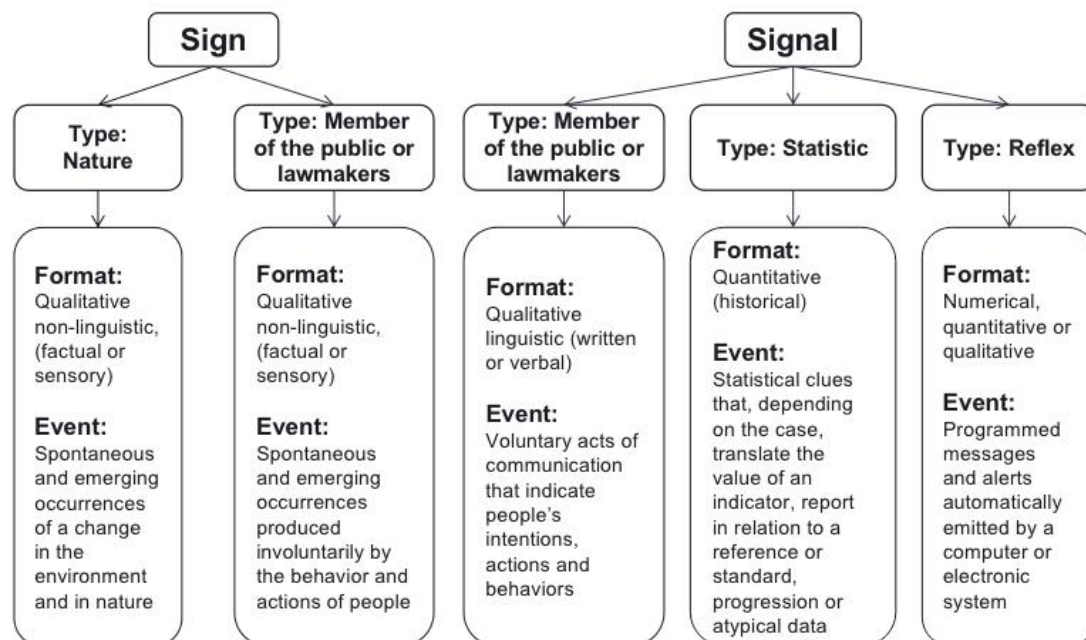


Figure 2.1. Typology of signals and signs (adapted from Lesca, 2011)

## 2.2 COMMON CHARACTERISTICS OF WEAK SIGNAL

When sorting out the literature, it is found that the authors' definitions on weak signals have the followings common characteristics of weak signals:

a) *“Weak signal is the first sign of emerging phenomena/events” (Hiltunen, 2010).*

Saritas and Smith (2011) stated that a weak signal could be an early sign of possible change but not yet proven, and that these early signs could later become important indicators of key forces of development, threat, business and technological innovation. As such, they represent the first signs of a paradigm shift or future trend, driver, or disruption. According to Ponomareva and Sokolova (2015), a weak signal is associated with high uncertain and time-lagged. Under these circumstances, information is often incomplete and there is no indication of the final consequences of the matter of interest. However, weak signals usually point to future changes and it can be major changes in today's society and economy. Based on the nature of weak signals, it can thus be the indication of future destructive events, or the witnesses of new developments and possibilities. Similarly, Magruk (2016) also cited that weak signals were early and vague signs of possible significant events and changes that affect the trajectory of future uncertain events. Saritas & Smith (2011) mentioned as well that weak signals is a hypothetical change that combines logic and imagination and is the first sign of possible change.

Meanwhile, it should also be noted that a single weak signal does not provide a lot of information about the future possible changes, but the cluster of relevant weak signals can convey more information about future changes and emerging trends (Hiltunen, 2010; Lesca, 2011). It reminds us that we should collect as many weak signals as possible that are related to each other, rather than a single weak signal, and pay attention to its tendency.

- b) After the appearance of the weak signals, they may fade away or become stronger with time. The weak signals after becoming stronger can be developed into warning signals.*

Ansoff (1982) defined weak signals as internal and or external warning signals that are either incomplete and insufficient to accurately estimate the probability of occurrence and its impact on future events. (Heinonen, Karjalainen, Ruotsalainen, & Steinmüller, 2017). Hiltunen (2006) identified weak signals as important warning signs as they are a form of information used to deal with possible changes in the system under investigation. Such information might lead to the development of unknown and uncertain direction for desired changes.

In line with this notion, Lesca (2011) suggested that weak signals and early warning signs could be precursors, incomplete information about potentially significant changes or events in the future. And these warning signals might appear very early in the possibility trajectory. As they appear weak at the initial stage, people perceive these signs to have many uncertain possibilities in the future. With the development of time, the warning signals become clearer and stronger, and result in clearer possibility of upcoming events and changes (Lesca, 2011). In the same spectrum, Robinson (2012) also defined weak signal as essentially an ambiguous observation, a warning of possible future changes, or events.

- c) In the early stages of detecting weak signals, they are often ambiguous, need analysis to make sense. After interpreting, it can become early warning signals.*

The reasons for weak signals' formation, the possibility that they may be early signs of certain events, and the effects that they may have are also uncertain and ambiguous (Daft & Huber, 1986; March & Olsen, 1976). Because their meanings are often ambiguous or neither explicit nor even implicit. It is necessary to give them meaning by interpretation (Lesca, 2011). And the key feature is that weak signals have different interpretations (Kuusi & Hiltunen, 2011). By explaining them, perhaps a

warning can be found in an obscure data item indicating that a potentially significant event has occurred whether as opportunities or threats (Lesca & Lesca, 2011). Such identification can point to some possible problems and phenomena that may strengthen or weaken over time (Smith & Dubois, 2010; Heinonen & Hiltunen, 2012).

Importantly, Hiltunen (2010) highlighted that the value of a weak signal could not be determined at the moment, only with the benefit of hindsight. In other words, weak signals in the past act as hints or warnings of future events and trends. However, some weak signals can be analyzed and may gradually weaken or even completely disappear in the future. This in turns, may lead to the losing of their value. Some weak warning signals after interpretation are able to find possible trend and avoid risks in time (Lesca & Lesca, 2011).

Lesca and Lesca (2011) propelled the idea that weak signals are useful tools to support decision making. When applied into action, weak signals could help organizations to avoid be influenced by or seize opportunities for significant changes that might occur in the future. In contrast, the absence of weak signals can have catastrophic effects according to Robinson (2012). The cost of ignoring weak signals can also make people unhappy. Hence, when weak signals are noticed, it is extremely important to analyze and interpret them correctly (Robinson, 2012).

Organizations that value weak signals will actively detect and analyze them. This reflects the vigilant and responsiveness to the changes in the environment. Having stronger stress resistance, these organizations will be likely to react and avoid possible accidents. As they will be the first to notice some important trends or signs of threat or opportunity, they gain new opportunity instead of disaster. As such, they tend to become market pioneers or guides (Tabatabaei, 2011; Robinson, 2012).

## **2.3 THE ANTICIPATION THEORY**

According to Hambrick (1981), Choo (2001), and Lesca and Lesca (2011), anticipation is the process that comprises of the following aspects:

- being sensitive to new phenomena
- assuming and imagining a series of possible consequences and influences of newly emerged events or trends right now
- influencing development trajectory by taking actions to utilize or avoid these possible consequences

An important aspect of strategic management is that managers have the abilities to anticipate potential opportunities and threats in the environment. This ultimately determines the competitiveness and sustainable development of the organization (Xu, et al., 2003). The anticipation process therefore relies heavily on interpretation, intuition and attention, managers are required to be sensitive to weak signals that can give a glimpse of future dramatic changes or events, and be able to predict in detail the potential impact, importance and urgency of possible changes through weak signals (Blanco & Lesca, 2003). To reduce uncertainty in decision making (Walters, et al. 2003), to adjust strategic objectives and strategies (Choo, 2001).

If the potential failure factors can be identified at the beginning of the development, it can help stakeholders to predict the risk and avoid it in time to increase the probability of success (Lesca & Caron-Fasan, 2008).

## **2.4 WEAK SIGNALS FOR ANTICIPATION**

A single weak signal is often overlooked as a discrete element of information and is not considered important, but when a cluster of associated weak signals is analyzed together, weak signal can be interpreted as the first sign or the early warning sign of a change or event that is likely to come. This fits into the process of anticipation: anticipation involves gathering and interpreting a certain amount of information, analyzing it to gain insight into

future events (Niculescu, 2018), the weak signal itself is inherently anticipative (Lesca, 2001).

In order to avoid the possible impact of future changes or events and better cope with them, collecting and analyzing weak signals becomes the important (Hiltunen, 2010). According to Lesca and Lesca (2014), weak signal is the core of anticipation and as a decision-support tool, it can lead to anticipated decisions (Lesca & Lesca, 2013).

## 2.5 THE ANTICIPATION FRAMEWORK

Because anticipation is not an innate mode of thinking, information may be amplified, ignored or misinterpreted in the process of anticipation, making it more difficult for the organization to execute the anticipation process. The lack of anticipative capacity can be filled with appropriate supporting methods and tools (Blanco & Lesca, 2003).

In this study, the researcher will use the Anticipation Framework built by (Lesca, 2011). Based on the literature review, the researcher has developed a theoretical model as shown in Figure 1.

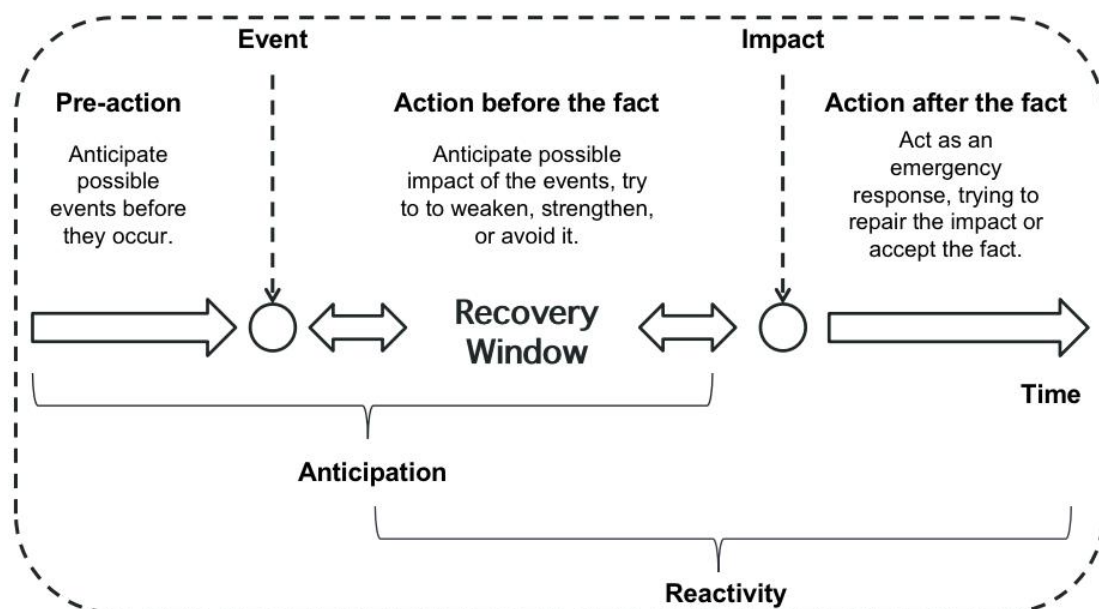


Figure 2.2. Anticipation Framework



Analyzing and anticipating through the Anticipation Framework, can help organization gains a clear visual insight into its position and situation in the overall environment, collect and interpret the signals that may be dangerous or good in the environment, and take prompt actions at the right time to make correct decisions that could beneficial to the organization (Lesca & Lesca, 2011).

By collecting and analyzing the weak signals or signals in the current environment, the organization can first determine where it is placed in the Anticipation Framework.

**Stage 1:** Before the event. After keenly detecting and analyzing the weak signals, the organization predicted the possible events in the future promptly. At this stage, nothing has happened yet, and there are many possibilities in the future. The anticipative events may or may not occur. At this point, the organization has enough time to take "pre-action" to provoke, avoid, or better meet the event.

**Stage 2:** At this point, the events have occurred but the impact of those events have not occurred yet, the organization is in the Recovery window, which has missed the opportunity to anticipate these events, but it can still anticipate the impact after events. If conditions permit, the organization can take "action before the fact" to weaken, strengthen, or avoid the possible coming impact.

Compared with stage 1, the organization can collect more weak signals or warning signals that gradually become clear. However, the stronger the signal is, the less anticipation analysis can be done, the shorter the recovery window (Lesca, N., et al. 2012) and the shorter the time for the organization to take action to deal with possible impacts will be.

In the **third stage**, when the event and its impact have already occurred, the organization has completely missed the time to anticipate and take action buffer. In this stage, the organization usually acts as an emergency response, trying to repair the impact or accept the fact.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 SECONDARY DATA RESEARCH**

In this study, the researcher used secondary data research method to gain access to data collected by other researchers, government agencies, and other unique sources by making connections with individuals accessing data from public sources or engaged in primary research. The use of secondary data is a valuable approach to find the suitable data for the research. There are various reasons why the researcher opts for secondary data analysis as a data collection technique. One of the factors for this research technique is for conceptual and substantive reason. Secondary data is the only available data for the study of weak signals on the import ban of plastic waste in China. In view of the social and political restriction, accessing to secondary data is much easier than relying on primary data (Nachmias & Nachmias, 1992). Economically, to collect primary research data collection is costly, and funding is not easy to get. Furthermore, secondary data analysis provides the opportunity of longitudinal analysis which is rare in social science due to time and costs involved, (Bryman, 2004). As such, the researcher opts for a cheaper and less time-consuming method, (Schensul, Schensul, & LeCompte, 1999). Furthermore, as this study is carried during the COVID 19 pandemic period, it is very difficult to carry out the interviews in China and online as well.

#### **3.2 DEFINING SECONDARY DATA ANALYSIS**

Technological advances enable huge amounts of data to be collected, compiled, and archived. The ease of accessing to data for research has become more prevalent and so is secondary data analysis. Secondary data analysis is a viable method to utilize in the process of inquiry when a systematic process is followed (Johnston, 2017). Hakim (1982) further described Secondary data analysis as any further analysis of an existing

dataset which presents interpretations, conclusions or knowledge additional to, or different from, those presented in the former report on the inquiry as a whole and its main results. In other words, secondary data analysis begins with an investigation to learn what is already known and what remains to be learned about a topic through reviewing secondary sources and investigations others have previously conducted in the specified area of interest. Despite the fact that researchers in a variety of disciplines are pursuing creative ways to explore complex areas of inquiry, secondary data research method is still an under-used research technique in many fields.

### **3.3 USEFULNESS OF SECONDARY DATA ANALYSIS**

Secondary data analysis has been used in many types of research designs such as comparative studies, times series and to provide background information before starting on primary data collection (Bickman & Rog, 1998). Secondary data analysis also allows the researcher to argue that a certain problem exists and that various techniques are available to solve it (Sooben, 2002).

One of the major advantages of such research is cost effectiveness and the convenience it provides (Dale, Arbor, & Procter, 1988; Smith & Smith, 2008). Additionally, in the area of information policy, utilizing existing data can allow the researcher to answer important time-sensitive policy related questions quicker (Magee, Lee, Giuliano, & Munro, 2006).

For this Master thesis and being a new researcher, the open source of information as in secondary data provides the only opportunity to examine a long terms issue or longitudinal research questions. In addition, the large publicly available data sets or aggregated existing data sets present a viable option for prospective investigations. The growing data sets used by environmental scanning comprises of information surrounding political, economic, social and technological developments (Hiltunen, 2008). As the amount of data increases it is not easy to keep pace with it and

computer-aided systems can help to extract and exploit it for creating insights and knowledge about the changing environment (Keller & Heiko, 2014).

### **3.4 SOURCE OF THE DATA**

Seale (2004) argued that, data from journals is valuable as it is accurate and reliable. The fact that, articles which are published in journals are peer reviewed gives credibility to the data (Reeve and Walberg, 1997). Other sources of secondary data analysis are reference books, trade journals, news reporting, credible websites and technical reports. As (Heinonen, Karjalainen, Ruotsalainen & Steinmüller, 2017) and (Eckhoff, Markus, Lassnig & Schön, 2015) suggest collecting weak signals from peripheral sources and social media content (such as art, science fiction, alternative media, blogs, newspaper), also recommended by (Decker, Wagner & Scholz, 2005), the Internet is a useful tool for detecting weak signals, such as customer markets, research institutions, journal articles, political policies, etc. In this study, the primary open source of data and weak signals have been collected based on the followings: scientific publications (including both journal and conference papers)

- topic-specific online communities and forums
- newspapers
- online news reports
- academic articles
- government policy documentations
- documentary films, YouTube videos, blog text, etc.
- image meta-data from Flickr

A breakdown of the sources is presented in Table 3.1 on the following page. Details of the sources are placed in Appendix (1).

<b>Category</b>	<b>Sources</b>
Newspapers (8 news agencies)	<ul style="list-style-type: none"> <li>▪ Southern Metropolis Daily</li> <li>▪ The Postandcourier</li> <li>▪ The New York Times</li> <li>▪ The Seattle Times</li> <li>▪ Taipei Times</li> <li>▪ Financial Times</li> <li>▪ The Sydney Morning Herald</li> <li>▪ Los Angeles Times</li> </ul>
Online News reports (24 news websites)	<ul style="list-style-type: none"> <li>▪ Vision</li> <li>▪ Tencent News</li> <li>▪ South China Morning Post 2</li> <li>▪ World Trade Organization</li> <li>▪ ISRI</li> <li>▪ Global News</li> <li>▪ CBC News 2</li> <li>▪ FMT News</li> <li>▪ AP News</li> <li>▪ Reuters 4</li> <li>▪ Plastics Insight</li> <li>▪ National Geographic</li> <li>▪ Recycling today</li> <li>▪ News European Parliament</li> <li>▪ Vnexpress</li> <li>▪ BRS Conversation</li> <li>▪ NBC News</li> <li>▪ World Economic Forum</li> <li>▪ The Guardian</li> </ul>
Government Policy Documentations (6 government agencies)	<ul style="list-style-type: none"> <li>▪ European Commission 2</li> <li>▪ Australia Government 3</li> <li>▪ Government of South Australia</li> </ul>
Documentary Films (2 films)	“Beijing Besieged by Waste” & “Plastic China”
Book (1 book publication)	"Junkyard planet: Travels in the billion-dollar trash trade"

Table 3.1: A list of the source of information

### **3.5 SHORTFALLS OF SECONDARY DATA ANALYSIS**

Secondary sources of data are not without problems. Some of the shortfalls of secondary research are as follows:

- Size of the data can be overwhelming to the researcher (Stewart & Kamis, 1984)
- Problem of data accuracy and the lack of control on the part of the researcher (Bickman & Rog, 1998)
- Source of the data may not be relevant to the research problem (Reeve and Walberg, 1997)

### **3.6 PROCESS OF SECONDARY ANALYSIS**

As Hiltunen (2010) pointed out that weak signals were not clear at the moment, but hindsight when the consequences occurred. The flowchart of the analysis process is presented in Figure 3.1 as presented on the following page.

First, the researchers gathered both direct and indirect information about the plastic waste trade before the National Sword Policy, in chronological order. Then, reversing analyze what information and data can be used as signals or weak signals leading to the result of the plastic waste import ban. Listing them one by one according to the timeline after determining the associated signals and weak signals.

Furthermore, the researchers also collected and integrated the policy and action data of the countries involved in the plastic waste trade before and after the ban, according to the timeline, to prepare for the analysis by substituting into the Anticipation Framework. In the last step, the researchers separately put the signals and actions by China, developing countries, and developed countries into the Anticipation Framework for discussion. A flow chart of the research process is presented in Figure 3.1 on the following page.

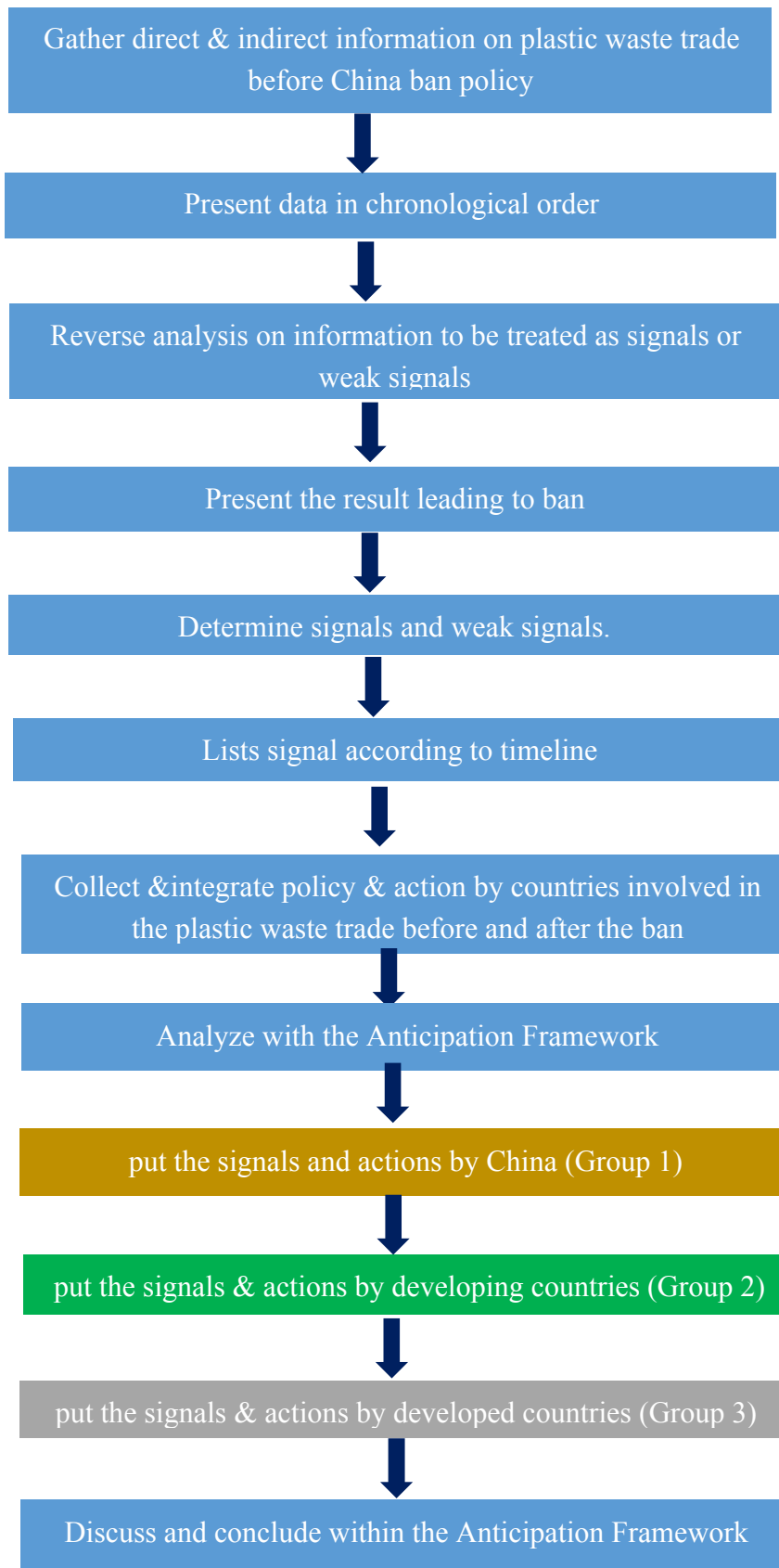


Figure 3.1: Flowchart of the research process

## **CHAPTER 4**

### **FINDINGS AND RESULTS**

#### **4.1 CASE STUDY OF CHINA NATIONAL SWORD POLICY TO BAN PLASTIC WASTE IMPORT**

To demonstrate how the Anticipation Framework work in the organization, a case study about the Chinese plastic waste import ban “National Sword” policy is considered. With the development of plastic production market, the plastic recycling industry came into being. Recycling has the strategic environmental advantages of waste management, as well as the creation of formal and informal employment opportunities (Langenhoven & Dyssel, 2007).

China is now the world's largest plastic producer (Zhang, Shi, Peng, Wang, Xiong, Wu, Lam, & Zhang, 2018; Wang, Themelis, Sun, Bourtsalas, Huang, Zhang, & Wu, 2019). China has a huge demand for plastic materials. The cost of remanufacturing plastics from plastic waste is much lower than that of virgin plastics (Yoshida, 2005). The demand for resources and cheap labor are important factors driving the world's recyclable waste into China (Yoshida, 2005). These factors drive China to lead in the importation of plastic waste in the world (Wang, Ghadimi, Lim, & Tseng, 2019). From 1988 to 2017, China has played an important role in the global plastic waste trades (Wang, Zhao, Lim, Chen, & Sutherland, 2020). And since 1992, 45 percent of the world's plastic waste has been exported to China (Brooks, Wang & Jambeck, 2018).

However, recycling is a very complex and challenging process, regarding plastic products have a wide variety of additives, mixtures, and uses (Hahladakis, Velis, Weber, Iacovidou, & Purnell, 2018). The nature of plastics also limits the number of times they can be recycled (Brooks, Wang, & Jambeck, 2018). In other words, even with the most advanced and effective recycling techniques, plastics cannot be



recycled indefinitely. In the process of plastic recycling operations, there are a lot of problems that are not conducive to the environment. Among these problems are environmental pollution and waste disposal issues (Brooks, Wang, & Jambeck, 2019).

China issued its “National Sword” policy in January 2018 banning the import of most plastics and other materials into its country (Katz, 2019). In the process of closing its door to imported plastic waste and other recyclable wastes, it has drastically affected the world plastic recycling market (South China Morning Post. April 23, 2019)

#### **4.2 IDENTIFICATION AND ANALYSIS THROUGH ANTICIPATION FRAMEOWRK**

In the global trade of plastic waste, developed countries have exported plastic waste to developing countries for decades (Brooks, Wang, & Jambeck, 2018). Developed countries and developing countries, especially China, are the main countries in the international plastic waste trade.

Thus, the researcher divided the countries impacted by the “National Sword” plastic waste ban into three groups. The first group focuses solely on China, the issuing ban policy country. The second group comprises 6 developing countries which include Indian, Vietnam, Malaysia, Taiwan, Thailand, Indonesia. And the third group, developed countries, are major exporters of plastic waste. Under this category, are included the United States, Japan, Germany, United Kingdom, Europe, Canada, Australia, and Chile. Based on the Anticipation Framework, the three groups were analyze based on the following aspects:

- a) combine weak signals or warning signals with the context of the group,
- b) analyze in detail which stage of the framework the group belongs to,
- c) what events and impacts groups had,
- d) what actions were taken to avoid events or their impacts

#### 4.2.1 WEAK SIGNAL BEFORE THE BAN POLICY

The weak signal information before the “National Sword” policy collected by the researchers as follows:

##### a) Grephic Photography OF Beijing Waste Area (October 2008 By Jiuliang Wang ) (Signal: Member of the public or lawmakers)

Mr. Jiuliang Wang attended two important exhibitions in Lanzhou International Photography Exhibition in 2009 and Song Zhuang Art Museum in 2010, which aroused people's attention (Vision Dec.06,2009).

Image	Type of Sign/ Signal	Format and Event
<p><b>王久良 《垃圾围城》</b></p> <p>Wang Jiuliang is a freelance photographer and author of the documentaries " Trash Besieged " . The documentary "Trash Besieged" was completed in June 2011.</p> <p><b>Figure 4.1</b></p>  <p><b>Figure 4.2</b></p>  <p><b>Source:</b> The Guardian (March 26, 2010)</p>	<p><b>Signal:</b> Member of the pubilc or law makers</p> <p>Figure 4.1: Plastic waste has almost completely covered a park that is still under construction</p> <p>Figure 4.2: Plastic bags of human feces collected from planes, trains and coaches are dumped here. With no convenient way to dispose of the waste, most of it ends up in landfills, along with other waste, except for a small amount that farmers use as</p>	<p>2 important exhibitions in Lanzhou:</p> <p>a. International Photography Exhibition in 2009</p> <p>b. Song Zhuang Art Museum in 2010</p>

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**b) 2011- “Beijing Besieged by Waste” -- documentary film**

From the period 2008 to 2010, Jiu Liang Wang visited more than 460 waste yard around Beijing. He traveled 15,000 kilometers to take more than 10,000 photos and over 60 hours of video footage (Wang, 2011). The immerse changes in topography of the waste yards are presented in Figure 4.2.3 to 4.2.7

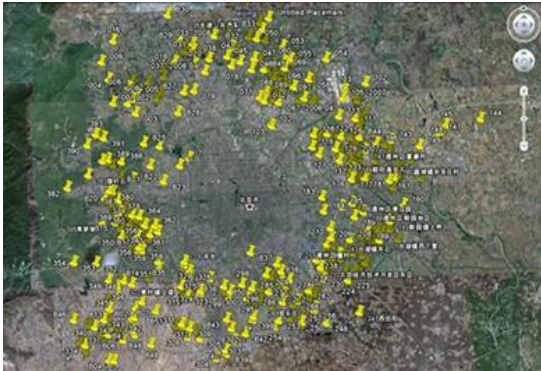





Image	Type of Sign	Format and Event
<p><b>Figure 4.3</b></p> <p><b>Source:</b></p> 	<p>From the aerial photogrammetry, a ring of waste yards were marked with yellow dots.</p> <p><b>Sign:</b> Member of the public or lawmakers</p>	<p>We can clearly see that these waste yards form a yellow circle, and Beijing was in the center of the circle.</p> <p>Beijing was surrounded by waste.</p>
<p><b>Figure 4.4</b></p> 	<p><b>Sign:</b> Nature</p>	<p>A close up aerial photograph of three large land areas designated as waste field in 2005.</p>

Image	Type of Sign	Format and Event
<p><b>Figure 4.5</b></p> 	<p><b>Sign:</b> Nature</p>	<p>Aerial photography of the same large plot of land of the same area in 2007</p>
<p><b>Figure 4.6</b></p> 		<p>Aerial photography of the same large plot of land of the same area in 2009</p>
<p><b>Figure 4.7</b></p> 		<p>Photo taken of waste fill in the area as depicted in the aerial photograph in 2010</p>

In 2005, these three puddles were still green. In 2007, the puddle on the far left was filled with white trash. Then two other puddles were also contaminated in 2009, the puddle in the middle was full of black sewage, and the one on the far right was full of red sewage. By 2010, three puddles had been filled with garbage. Figure 4.4 to Figure 4.7 are records of changes in three large waste fills taken from Google map.

**c) June 29 & July 13, 2011 The deep weekly section of Southern Metropolis Daily**

On June 29 and July 13, the deep weekly section of Southern Metropolis Daily focused on foreign garbage in North China (Southern Metropolis Daily, June 29 & July 13, 2011).

Image	Type of Sign	Format and Event
<p><b>Figure 4.8</b></p> 	<p>A flock of geese was blocked by garbage</p> <p><b>Sign:</b> Member of the public or lawmakers</p>	<p>A flock of geese is blocked by mountains of old plastic at the entrance to Changchun village. The river is polluted and the gullies are filled with rubbish, where do the poultry go for their food?</p>

Before the rise of the plastics recycling industry, drinking well can produce good water if drilled to 100 meters, now it is common to drill Wells to 300 meters, or even deeper, the deepest well has been drilled to 500 meters, or buy buckets of water to drink. For more than a decade, local young men failed the physical examination of conscription. The news point out that's not just the environment that has been destroyed, but the lives of the people themselves and the animals on the land.

**d) 2011 Aug 07 - “YanZhao Metropolis Daily”**

According to the YanZhao metropolis daily on August 7, the spring drought season of Wen 'an county, a farmer used the water from the north of the village of XiaoBao river to water the wheat fields, did not expect that thousands of acres of wheat almost lost. Upstream of the river is the scrap plastic market in Yin village, the most prosperous town in wen 'an (Tencent News, Aug 17<sup>th</sup>, 2011). This piece of news shows that the water in the river can no longer water the crops because the plastic waste reprocessing has seriously polluted the river.

**e) "Junkyard planet: Travels in the billion-dollar trash trade" in 2013**

"Junkyard planet: Travels in the billion-dollar trash trade" is a book written by Adam Minter. It is about what he saw and heard when he visited deeply in wen 'an county, China, which was the center of the world plastic waste recycling industry, by chance in 2010 (Minter, 2013).

Here's how he describes wen'an in his book:

“Wen 'an was once a county of clear water and blue sky, famous for its peaches. But now “there’s nothing green. It’s a dead zone”. The wastewater after the recovery production of plastic waste is discharged at will without treatment, thus the pit becomes a smelly pond or garbage dump. The pungent smell of burning plastic fills the air.”

The air and the environment are polluted, the health of the people living here is also at stake. High blood pressure and other blood disorders are becoming more common here, and these diseases tend to be younger. Lung disease also afflicts the local population, in severe cases, patients may even become incapacitated. A variety of symptoms and environmental conditions suggest that pulmonary fibrosis and paralyzing strokes are occurring among young residents.



**f) November 2016 “Plastic China” Chinese documentary film**

This is Mr. Wang Jiuliang's second Chinese documentary on plastic pollution in 2016. The film tells the story of two families who make a living by recycling imported plastic waste in the recycling industry chain (Wang, et al., 2017). Figure 4.9 to Figure 4.14 highlight the impacts of plastic pollution in the community.




Image	Type of Sign	Format and Event
<p><b>Figure 4.9</b></p>  <p>但至少没看到废料浸在水中 But we don't see material sitting in the water.</p>	<p><b>Sign:</b> Member of the public or lawmakers</p>	<p>The plastic waste soaked in water</p>
<p><b>Figure 4.10</b></p>  <p>塑料从我们这里运达目的地后，人们在手工分拣 where people are manually sifting through it.</p>	<p><b>Sign:</b> Member of the public or lawmakers</p>	<p>A Chinese woman takes care of her baby while sorting garbage, indicating that plastic waste in China is manually sorted</p>
<p><b>Figure 4.11</b></p> 	<p><b>Sign:</b> Member of the public or lawmakers</p>	<p>The child was playing with a medical syringe</p>






Image	Type of Sign	Format and Event
<p><b>Figure 4.12</b></p> 	<p><b>Sign:</b> Member of the public or lawmakers</p>	<p>The child blew a medical glove as a balloon</p>
<p><b>Figure 4.13</b></p> 	<p><b>Sign:</b> Member of the public or lawmakers</p>	<p>The children were playing in the garbage yard</p>
<p><b>Figure 4.14</b></p> 	<p><b>Sign:</b> Member of the public or lawmakers</p>	<p>The sheep rummaged food among the rubbish</p>

Figure 4.11- 4.13 shows the status of the children's life from families involved in the plastic waste recycling industry. Toxic junkyards are their playground, discarded medical needles and gloves are their toys. Meanwhile, Figure 4.14 points out here the livestock living in a bad environment.

It also can be seen everywhere in the documentary: Waterways are polluted by sewage from the process of cleaning plastic waste, and the unrecyclable debris is either burned into the air to release toxic substances or dumped directly into riverbeds.

Director Wang Jiuliang said in an interview that China's unregulated plastic recycling industry has a huge impact on the environment and people's health (South China Morning Post, Feb.13<sup>rd</sup>, 2015). The documentary exposes China's industrial chain of recycling imported "foreign garbage".

**g) “River plastic emissions to the world’s oceans” published at June 7<sup>th</sup>, 2017**

“River plastic emissions to the world’s oceans ” is a 2017 study published in Nature, the study found that of the top 20 rivers carrying plastic into the ocean, 15 were from Asia and 6 from China. Asia's rivers are estimated to account for 86 percent of global plastic emissions (Lebreton, Van Der Zwet, Damsteeg, Slat, Andrady, & Reisser, 2017).

Combine the above information, weak signals can show possible phenomena and problems, which can be strengthened or weakened over time (Smith & Dubois, 2010; Heinonen, & Hiltunen, 2012). Over time, the weak signal above gets stronger, weak signals have anticipatory nature, put these signals together, and, by interpreting them, become warning signals (Carton, Caron-Fasan, & Lesca, 2018), warning people of what might happen.

The researchers compiled a timeline of the relevant actions of the countries involved in the plastic waste trade before and after the National Sword Policy, as shown in Table 1. on the following page. In the next section, the three types of countries will be substituted into the Anticipation Framework for further analysis.

<b>Timeline of Bans / Restrictions (Actions of Governments)</b> <b>(Signals: Member of the public or lawmakers)</b>	
July 2017	In July 18 <sup>th</sup> , 2017, China had notified to the World Trade Organization (WTO) that it would crackdown the import of plastic waste(WTO, October 3 <sup>rd</sup> , 2017).
Nov.15 <sup>th</sup> , 2017	China proposed a new 0.5 percent contamination standard in its filing to the WTO, which plans to effect in March 2018 (ISRI Nov 16 <sup>th</sup> , 2017).
Jan. 2018	The National Sword Policy of China takes effect (Katz, 2019).
Jan 1 <sup>st</sup> , 2018	On January 1 <sup>st</sup> , 2018, Montreal, the first big city in Canada to ban the use of plastic bags, officially implemented a ban on the use of plastic bags with a thickness of fewer than 50 microns (Global News Jan1 <sup>st</sup> , 2018).
Jan 11 <sup>th</sup> , 2018	The British government pointed out to put forward by various voluntary and regulatory interventions in “A Green Future: Our 25 Year Plan to Improve the Environment”, planed to "Achieving zero avoidable plastic waste by the end of 2042" (Defra, 2018).
Jan16 <sup>th</sup> , 2018	The first Europe-wide plastic strategy has been adopted, to make all plastic packaging available in the EU market by 2030 recyclable, reduce the use of single-use plastics, and limit the international use of microplastics (European Commission Jan.16 <sup>th</sup> , 2018).
April 10 <sup>th</sup> , 2018	South Carolina’s fourth-largest city approved a ban of most single-use plastic bags, foam food containers and more (The Postandcourier April 10 <sup>th</sup> , 2018).
April 2018	Australia aims to make packaging 100% recyclable, compostable or reusable by 2025 (Australia Government April 2018).
May 12 <sup>th</sup> , 2018	The state government allocated \$12.4 million to support South Australia's recycling industry, aimed at improving the recycling rate of local waste (Government of South Australia, May 12,2018).
May 16 <sup>th</sup> , 2018	Vancouver just banned the use of plastic straws, which is the first major city in Canada to do so. Vancouver would also effect the ban on distributing foam cups and takeout containers by June 1, 2019. And it aims to ban all types of solid waste by 2040 (CBC News May16, 2018).
May 28 <sup>th</sup> , 2018	The European Commission has proposed a comprehensive set of measures under the Single-Use Plastics Directive to curb single-use plastics. The plastic regulation strategy includes the ban of straws, cotton swabs with plastic, plastic plates, cutlery, plastic coffee mixers, and plastic balloon holders, while the sorting rate for other plastics, such as bottles, is set to hit 90% by 2025 (European Commission Jan 18 <sup>th</sup> , 2019).

June 1 <sup>st</sup> , 2018	Chile has become the first country in the Americas to ban retailers from using plastic bags to protect 4,000 miles of its coastline from pollution (The New York Times June 1 <sup>st</sup> , 2018).
June 5 <sup>th</sup> , 2018	The Indian prime minister has promised that all single-use plastics will be banned from India by 2022 (CBS NEWS June 5 <sup>th</sup> , 2018).
July 1 <sup>st</sup> , 2018	Seattle banned 5000 restaurants for using plastic utensils and straws, which was the first city in the United States to do so (The Seattle Times July 1 <sup>st</sup> , 2018).
July 2018	Vietnam announced it would no more issue new import waste licenses and would also crack down illegal import paper, plastic and metal into its country (Reuters July 26 <sup>th</sup> , 2018).
July 23 <sup>rd</sup> , 2018	Regarding complaints of pollution issues by residents, Malaysia withdrew 114 processing plastic waste factory import licensing (FMT News July 24 <sup>th</sup> , 2018).
July 24 <sup>th</sup> , 2018	San Francisco will effect the ban of plastic straws and containers by July 1 <sup>st</sup> , 2019 (AP News July 25 <sup>th</sup> , 2018).
Sept. 6 <sup>th</sup> , 2018	Japan has allocated 5 billion Yen to support research and production of bioplastics, to outlaw plastic products made from petroleum (Plastics Insight Sept.6 <sup>th</sup> , 2018).
Oct.1 <sup>st</sup> , 2018	Taiwan imposed strict restrictions on the types of plastic waste that can be imported, with fines of up to Nt \$10 million for violators, starting on Oct. 4 <sup>th</sup> , 2018 (Taipei Times Oct. 2 <sup>nd</sup> , 2018).
Oct.14 <sup>th</sup> , 2018	Thailand will effect the permanent ban on plastic waste imports by 2021(Financial Times Oct.14 <sup>th</sup> , 2018).
Oct.24 <sup>th</sup> , 2018	The European Parliament has passed a ban on single-use plastic, include straws, cotton swabs, disposable plastic plates, and cutler (European Commission Jan 18 <sup>th</sup> , 2019).
Oct.26 <sup>th</sup> , 2018	Malaysia will crack down the import of plastic waste seriously through phasing the permanent ban of other types of plastic waste (including "clean" plastics) import within three years (Reuters Oct.26 <sup>th</sup> , 2018).
Oct.29 <sup>th</sup> , 2018	The UK is to impose a new tax on businesses that manufacture or import plastic packaging that contains less than 30 percent recycled material (Reuters Oct.29 <sup>th</sup> , 2018).
March 6 <sup>th</sup> , 2019	India will ban all types of plastic waste imports (Recycling today March 6 <sup>th</sup> , 2019).

March 27 <sup>th</sup> , 2019	The European Parliament has voted and adopted to ban plastic straws, tableware, and other single-use plastic products and will effect by 2021(European Parliament, March 27 <sup>th</sup> , 2019).
March 2019	Vietnam will ban all plastic waste imports into the country by 2025 (Vnexpress March 27 <sup>th</sup> , 2019).
May 10 <sup>th</sup> , 2019	187 countries have agreed and signed a new agreement under the United Nations Basel Convention to regulate the international plastic waste trade and limit its contaminated plastic waste move to poor countries (BRS Conversation May 10 <sup>th</sup> , 2019).
May 28 <sup>th</sup> , 2019	Malaysia has announced it will ship 3,000 tonnes of contaminated plastic waste back to its countries of origin, including Australia, Canada, the UK, the US, and other Western countries (NBC News May 28 <sup>th</sup> , 2019).
May 2019	69 containers were shipped back to Canada from the Philippines (Reuters May 31 <sup>st</sup> , 2019).
July 2019	Indonesia was the first Southeast Asian country to send contaminated plastic waste back to Australia after it found it contains toxic substances (The Sydney Morning Herald July 2 <sup>nd</sup> , 2019).
August 9 <sup>th</sup> , 2019	The Council of Australian Government (COAG) has approved to make a detailed timetable for Australia to enforce its ban on the export of waste plastic, paper, glass, and tires while improving its domestic capacity to produce high-value recycled goods (Australia Government August 9 <sup>th</sup> , 2019).
Nov 8 <sup>th</sup> , 2019	Australia's federal and state environment ministers have released a detailed timetable for implementing the export waste ban (Australia Government Nov. 9 <sup>th</sup> , 2019).
Jan 15 <sup>th</sup> , 2020	Vietnam plans to build the country's first city of zero plastic waste, the pilot city to be announced later this year (World Economic Forum Jan15 <sup>th</sup> , 2020).
Jan 19 <sup>th</sup> , 2020	Since the third quarter of last year, Malaysia has shipped 150 boxes of plastic waste back to their countries of origin, including France, the UK, the US, Canada, Spain, Hong Kong, Japan, Singapore, Portugal, China, Bangladesh, Sri Lanka, and Lithuania (Los Angeles Times Jan 19 <sup>th</sup> , 2020).

Table 4.1 Timeline of Bans / Restrictions (Actions by Governments)

## **4.2.2 ANTICIPATION OF BAN POLICY ON WASTE PLASTIC IMPORT**

### **4.2.3 GROUP 1: CHINA**

In the beginning, the signs that the environment is being polluted by plastic waste are emitted by nature. For example, The Google map shows the change in the color of the puddle around the plastic recycling plant from the year 2005 to 2010 (figure 4.4 - 4.6). And the water in wen 'an's river can no longer water the crops (Tencent News, Aug 17th, 2011), the drinking well needs to drill from before 100 meters to now 500 meters (Southern Metropolis Daily, June 29 & July 13, 2011). But it did not arouse people's attention.

Then the three large ponds were filled in as if nothing had happened; But as the Google map clearly shows, Beijing is surrounded by hundreds of garbage dumps. It came to be noticed that the young men in the plastic waste production center had not passed the medical examination for conscription in the last decade or so. Blood diseases, lung diseases, and paralytic strokes are becoming more common and tend to be younger in that region. Residents realized that the improper processing of plastic waste would affect their health, and they switched to drinking bottled water, but plastic waste processing continued. Among the messages, the researchers collated were women taking care of babies while manually sorting through the garbage in messy, smelly environments. Medical waste that should not be in recycling centers is played by children, so on. There are the Signs that spontaneous and emerging occurrences produced involuntarily by the behavior and actions of people.

In 2017, a study of Nature sees as the Signal of statistics. The study found that of the top 20 rivers carrying plastic into the ocean, 15 were from Asia and six from China. Asia's rivers are estimated to account for 86 percent of global plastic emissions (Lebreton, Van Der Zwet, Damsteeg, Slat, Andrady, & Reisser, 2017).

Notably, it was only after the information was publicly exposed by Chinese media, documentary directors and photographers, and foreign journalists, and appeared in the form of characters in Signal Member of the public or lawmakers that people took it seriously. That's when people realized how serious the problem was.

The researchers put China into the prediction model for analysis. For China, warning to anticipate the “fact” is that China’s environment seriously polluted and Chinese people's health is also affected. And, China, as the world's largest importer of plastic waste, its environment has been badly affected.

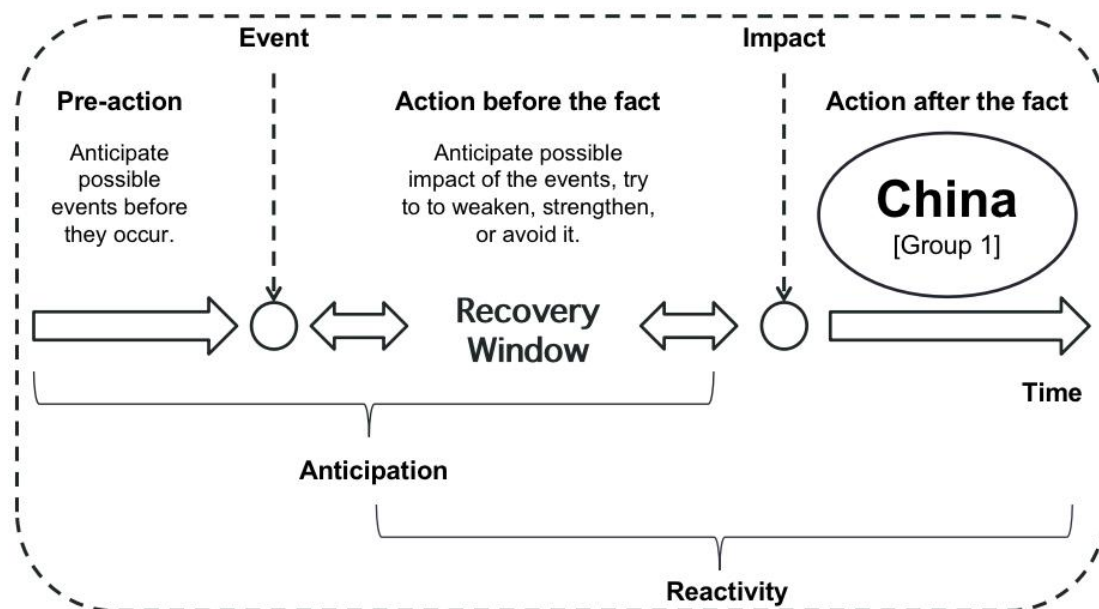


Figure 4.15 The position of China (Group 1) regarding to the Anticipation Framework

Whether it's the sheer number of garbage sites around Beijing in the “Beijing Besieged by Waste” documentary, or the severe pollution in wen 'an county, the world's recycling center, all show that China is facing environmental and health impacts. Those "impacts" have been created, and the “fact” is there. The position of China showed as Figure 4.15. Under such circumstances, what China can do and must be done in time is to take the “action after fact”. In July 18<sup>th</sup>, 2017, China had notified to the World Trade Organization (WTO) alleging that in the imported waste, there are a lot of “dirty wastes or even hazardous wastes” mixed in with solid waste that can be used as raw materials, which had seriously polluted China's environment (WTO, October 3<sup>rd</sup>, 2017). “Action after fact” of China is the National Sword Policy. As stated by Katz (2019), the plastic waste containing pollutants have overwhelmed Chinese processing facilities. China is facing a serious environmental problem, which



is not caused by China itself. China's National Sword Policy is aimed at preventing the spread of polluting materials in China. Morita and Hayashi (2018) also points out that China's regulations on the import of plastic waste and related prohibition policies are aimed at reducing environmental pollution and human health risks. At the same time the Chinese government also plans to promote the efficient use of domestic plastic waste by strengthening the country's recycling industry (Morita & Hayashi, 2018). These action after facts are China's efforts to fix this fact. At least not make it worse (Lesca & Lesca, 2011).

#### **4.2.4 GROUP 2: OTHER DEVELOPING COUNTRIES' IMPORT OF PLASTIC WASTE**

As China's import regulation on plastic waste has become tighter since 2010, in particular, in the year after the National Sword Policy, China's plastic imports plunged 99 percent (Katz, 2019). China still has a high demand for plastic materials and allows the import of processed plastic materials, such as recyclable materials. Which creates a new plastic waste trade route (Morita & Hayashi, 2018). The plastic waste trade has been largely diverted to Southeast Asian countries, and the gradual increase in plastic imports from other countries has signaled a redistribution of the burden of the global plastic waste trade (Wang, et al., 2020).

However, in Southeast Asian countries, waste management and recycling systems are underdeveloped (Wilson, Rodic, Modak, Soos, Carpintero, Velis, & Simonett, 2015). These Southeast Asian countries cannot deal with so much plastic waste. Related environmental pollution is on the rise, and the rapid growth of imported plastic waste has become a big issue (Morita & Hayashi, 2018).

China's plastic import policy has been tightened in recent years, and the recent the National Sword Policy made China's plastic imports plunged 99 percent, they are signal of Member of the lawmakers and signal of statistic from China. It is a warning signal for Group 2 that the recycling trade will be redistributed. In addition, many



owners of recycling factories have moved their recycling plants from China to Southeast Asian countries such as Malaysia to carry out illegal plastic recycling and processing into recycled materials for re-export to China (Morita & Hayashi, 2018). The migration of China's plastic processing plants become a stronger signal since this situation has accelerated pollution and other problems. Another signal (National Geographic Nov.16<sup>th</sup>, 2018) indicated that “China's ban on trash imports shifts waste crisis to Southeast Asia”.

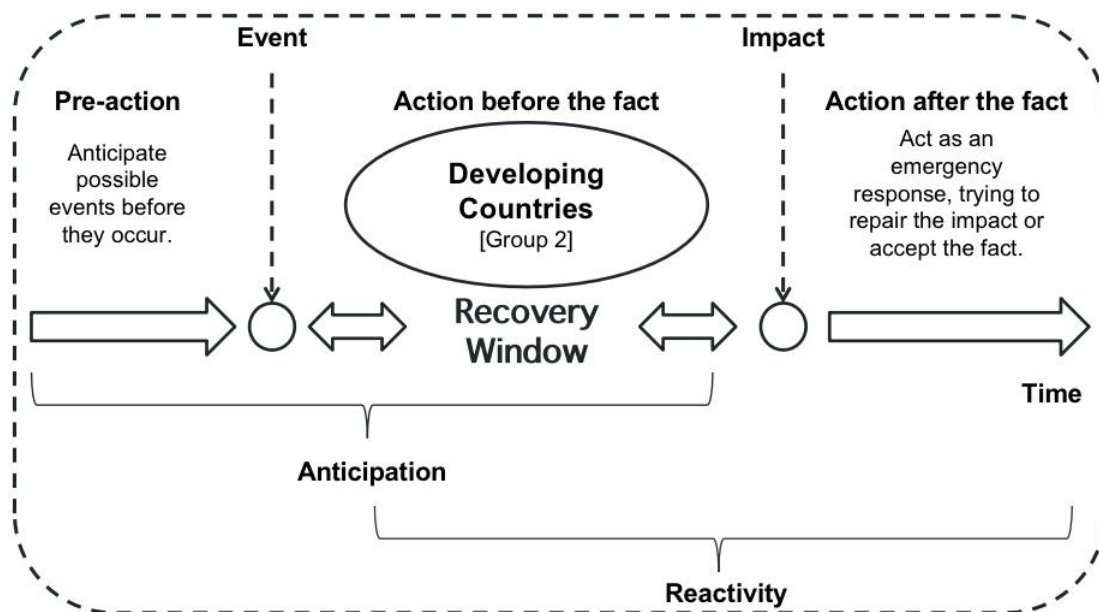


Figure 4.16 The position of developing countries (Group 2) regarding the Anticipation Framework

Following China's footsteps, a movement of ban and crackdown the plastic waste import is starting to appear in these countries (Morita & Hayashi, 2018).

The introduction of the relevant ban policy in Group 2 countries and even some of them return the plastic waste to the original country, these actions can also be defined as warning signals for Group 2. But these policies and actions have no direct impact between Group 2 countries themselves. Those warning signals are not strong enough and require countries in Group 2 to be sensitive to detect those signals and well analysis.

Group 2 countries are stated in the recovery window position of the Anticipation Framework (see as Figure 4.16), here, after what “events” have happened are the international plastic trade route change to their countries after China National Sword Policy goes into effect; Chinese recycling factories move to Group 2 countries, Plastic waste are also pouring into these countries. Weak signals here turn into warning signals, the “fact” that the anticipation of Group 2 is that if Group 2 does nothing and allows things to go forward, the countries in Group 2 will be the next country overtime after China to suffer badly polluted by plastic waste that will strongly affect the environment and people's health. The advantage of the Recovery window is that Group 2 countries still have time to take "action before the fact" to avoid the “ fact” come true. Table 4.1 shows that Group 2 countries try to take active actions to avoid the “fact”: become another China with serious environmental pollution.

#### **4.2.5 GROUP 3: DEVELOPED COUNTRIES THAT EXPORT WASTE PLASTIC**

Groups 3 has long been dependent on the plastic waste exported to other countries, whether it's China's policy tightening or the National Sword Policy for Group 3 are strong warning signals. After China restricted the import of plastic waste, group 3 start to shift their plastic waste to Group 2. From the analysis in the previous paragraph and the timeline of bans/restrictions by plastic waste trade relevant countries in recent years ( Table 4.1), it is not difficult to see that Group 2 is also tightening the import policy. Each time Group 2 issued a new policy restricting the import of plastic, which is a strong signal for Group 3.

The third group of countries is also in the recovery window position (show in Figure 4.17). “Event” such as China's plastic ban, other developing countries are tightening their import policies of plastic and even closed their import doors. The third group of countries is faced with the” fact” that plastic waste has no place to go and has to be disposed of in their own countries, or even accumulated and produced pollution.

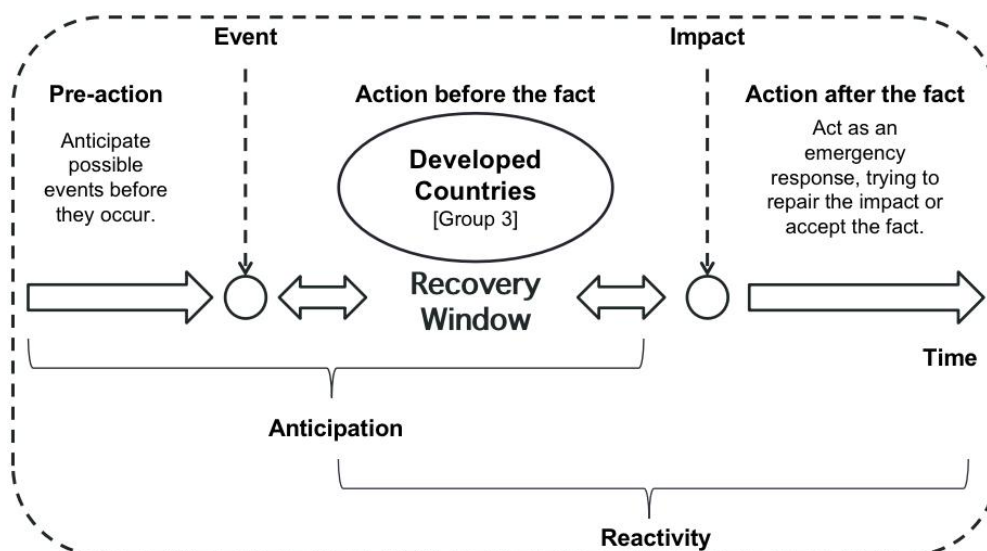


Figure 4.17 The position of developed countries (Group 3) regarding the Anticipation Framework

In fact, they are beginning to face those problems: Based on an example from Katz (2019), in 2018 alone, UK burned more than 500,000 tones of plastic waste along with other household waste because it could not be recycled effectively. Australia's recycling industry is in trouble because it cannot handle the 1.3m tones of waste that was sent to China previously. Recycling costs are soaring in the United States, and many communities have reduced or stopped recycling programs altogether.

These are warning signs, and the stronger the warning, the smaller the recovery window that can be fixed (Lesca, et. al., 2012). Hence, Group 3 countries are actively moving, in the short term, to move the plastic waste ship to other developing countries. But Asia has a serious plastic pollution problem. Shipping plastic waste to Asia will only make things worse (National Geographic Nov.16<sup>th</sup>, 2018).

As the second group of countries tightens their policies on importing plastic waste, it will become harder and harder to export it in the future. According to Table 1, they are continuously investing in the construction of their national system of plastic waste recycling stations to improve their recycling rate of plastic waste and impose stricter restrictions on the use of plastic products.

## **CHAPTER 5**

### **CONCLUSION AND RECOMMENDATIONS**

#### **5.1 FROM WEAK SIGNS TO STRONG AND DANGEROUS SIGNAL- THE CHINESE EXPERIENCE (GROUP 1)**

By the time, China has recognized and acknowledged the signals, there was a greater sense of urgency to take actions to rectify the situation. Nevertheless, the change was considered late and it had missed the opportunity for recovery and to be in a better position to handle future possible changes. The researchers collated a series of information before the Chinese ban and found that when plastic wastes caused environmental pollution, the signs from nature would appear. For example, the fishes died, and the river became muddy. It was almost impossible for the river water to be used for irrigation and not mentioning for drinking.

The weak signal prior to the ban policy was considered weak. This could be seen from the provided examples in Chapter 4, the changes of satellite images about the puddles near the main waste treatment plants around Beijing in Figure 4.4 to Figure 4.7 With the mass media acting as the information dissemination channel, shows that the environment and people's health in the areas where plastic waste is mainly recycled and processed are seriously affected. This is an evidence of how weak signals were no longer weak, and became strong warning signals.

The situation deteriorated further when local population showed signs of illnesses and the emergency of greater health issues and problems. In fact, there were already stronger signals that showed the serious damages incurred in the natural ecological system. This became a crisis point when younger people in the vast polluted areas failed their physical examination for the military conscription. This is the outcome of not dealing with the problem for over a decade and the long terms impact prevailed.

The extensive impact on the plastic pollution was also a strong signal of the collapse of the ecological environment.

## **5.2 ADAPTING TO STRONG SIGNAL - THE DEVELOPING COUNTRIES EXPERIENCES (GROUP 2)**

By contrast, developing countries (Group 2) take China as an example, and what has happened to China could easily serve as warning signs, giving group 2 countries more time to avoid becoming another major plastic waste polluter in the future.

In view of the fact that Group 2 countries are taking precautionary steps with various environment protection measures, they are in a better position to tackle plastic waste pollution in the future. In addition to the signals from China, some statistical analyses of developing countries (Group 2) plastic waste imports after China's ban can also be used as statistical signals to make intuitive anticipations for Group 2.

In response to the strong signal by the Chinese government, policy-makers in the developing countries are now taking a more proactive strategy towards the strong signal to change. Group 2 countries successively adopted "Action before the fact", and such policies and actions can be perceived as a kind of signal. As countries in Group 2 are not directly affected by these policies, the signals may not be strong. But paying attention to them is a better anticipate of future changes. For example, most of the plastic waste importing countries have adopted policies to restrict imports. Will the rest of the countries in Group 2 that have not received the signal to act in time worry about the plastic waste all ship into their countries? Therefore, to avoid the possible risks in the future, Group 2 should have the sensitive identification of signals.

### **5.3 ADAPTING TO STRONG SIGNAL - THE DEVELOPED COUNTRIES EXPERIENCES (GROUP 3)**

Most of the plastic waste in Group 3 was shipped to Group 1 and Group 2. These exporting countries have long relied on China to recycle their unwanted waste. The Chinese ban was a strong signal to Group 3. However, the stronger the signal, the smaller is the recovery window. Group 3, could have actually felt some signals and geared up in preparation before the import ban came in place. Such as get signals from the Plastic China documentary, or "Junkyard planet: Travels in the pull - dollar trash trade" the published book. Books and documentaries here are the early warning signals, could remind of this group of three, China has loaded to acceptance of plastic waste, should seek a plastic solution as soon as possible.

### **5.4 DISCUSSION & RECOMMENDATIONS**

In the Anticipation Framework, important components include weak signals, signals, and early warning signals. These require organizations to analyze and anticipate possible events and their impacts in each group of countries by identifying and collecting them sensitively. Some of the events themselves may be strong warning signs. For example, a large number of plastic waste and plastic waste processing plants have relocate to their countries after China's plastic ban. This was a strong warning sign. Under the Anticipation framework, these countries in Group 3 will assess the situation based on these determining factors are listed as below:

- a) whether the events have occurred
- b) whether the impact has been caused
- c) what stage the organizations are at in the Anticipation Framework
- d) what further decisions and actions can be made

It is worth noting that the weaker the signals, the larger the recovery window for the organizations, and the greater the likelihood of taking action to avoid future possible events and changes. Conversely, the smaller the recovery window, the more passive

the organization. As Niculescu (2018) has emphasized, to promote the anticipative ability of organizations, anticipative management plays a key role. In anticipative management, it should focus on the Anticipation Framework, methods, organizational solutions, and so on. Through the analysis of the same event of China's plastic ban, it can be found that different groups of countries have different understandings of the same signal. After the signal analysis, some countries consider it a strong signal, while some countries consider it a weak signal, which has different meanings for different countries.

To better respond to future changes, organizations need to develop their anticipative management capabilities, important aspects of which are the identification and analysis of different types of weak signals and signals, and also the use of the Anticipation Framework. A single weak signal may be ambiguous, but overtime, a series of weak signals can point to signs of future changes and trends in likelihood and play a key role in anticipating and risk assessment. But what condition makes organizations consider and believe that signals are strong enough to pay attention and change?

Further research should conduct a new case in another field and continue to analyze the same event through multiple groups to see whether the understanding of signals has different meanings for them and how they combine signals and anticipation model.

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## **APPENDIX**

### **APPENDIX 1**

#### **The list of open sources used in this research**

##### **Websites:**

Australia Government (April 2018) “Australian Packaging Covenant”

<https://www.environment.gov.au/protection/waste-resource-recovery/plastics-and-packaging/packaging-covenant> Accessed on April 24,2020

AP News (July 25,2018) “San Francisco moves to ban plastic straws, containers”

<https://apnews.com/2589c9ac201f46bc9f6d255c1a891f6b/San-Francisco-moves-to-ban-plastic-straws,---containers> Accessed on April 26,2020

Australia Government (August 9, 2019) “COAG waste export ban consultation”

<https://www.environment.gov.au/protection/waste-resource-recovery/coag-waste-export-ban-consultation> Accessed on April 28, 2020

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