

# CORPORATE SUSTAINABILITY AND ENVIRONMENTAL DISASTERS: A CASE OF THE 2011 THAI FLOODS

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## Abstract

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Manufacturing companies suffered from the floods that happened in 2011 and left many companies in the financial fragile situation. This research examines whether the Thai floods of 2011 had differential effects among variously sized businesses, as well as among Thai, Japanese and other foreign companies. Financial records were gathered from 514 companies out of an initial 651 from seven industrial estates in Thailand affected by the floods. This research collects quantitative data to verify that disasters have differing effects on different types of companies. Comparisons were made among the various types of companies from years 2011 through 2015 on: Return on Assets (ROA), Return on Equity (ROE), Gross Profit Margins (GPM), Operating Profit Margins (OPM), and Net Profit Margins (NPM), using Kruskal-Wallis ANOVA, and Dunn's post-hoc tests. Significant differences were found among the various sizes on companies in most of the five measures in most years, especially 2011-2013. Similar, but smaller differences were found among companies of different nationalities. The study suggests ways in which companies and government agencies may work together to mitigate the effects of future disasters.

**Keywords:** Corporate Sustainability, Natural Disaster, Floods, Corporate Governance, Government Policy, Sizes, Ownership

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## 1. INTRODUCTION

The floods of late 2011 hit Thailand with devastating effects. The year 2011 is recorded as the worst year ever for Thailand's manufacturing sector. The historic floods in the fourth quarter hit seven industrial estates, which impacted 17% of total

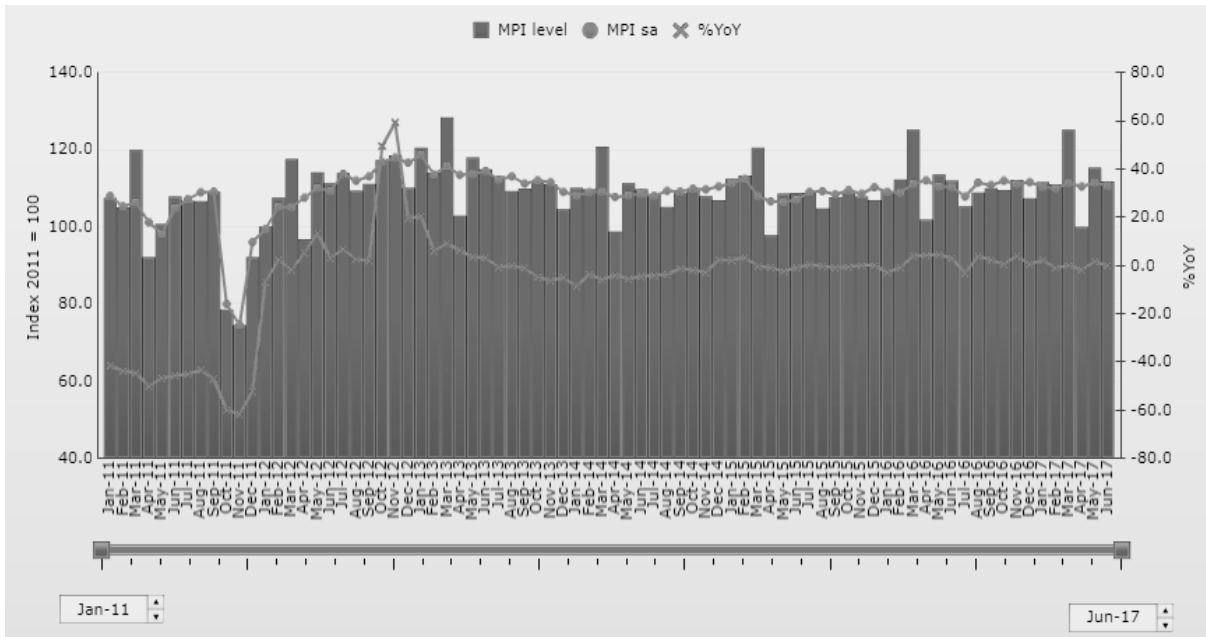
manufacturing production. The Manufacturing Production Index (MPI) during the fourth quarter fell by 21.8% (BOT, 2011) in areas where major producers and complex production networks resided, especially production in the automobile, electronics, hard disk drive, and electrical appliance industries. Due to such historic floods, damage

resulted directly from a halt in production and indirectly through disruptions to supply chains and transportation.

After the floods, manufacturing production improved gradually and finally returned to normal in the following year. The MPI started to rise after the flood (see Figure 1). The MPI in June 2017 illustrates the rise to 111.8, especially in the automobile sector as many plants still need to wait for damage assessments from the insurance

companies to be completed. The Office of Industrial Economics has changed the base year and weight from 2000 to 2012. Moreover, serious damage to critical machinery in many industrial estates forced firms to import these machines anew, thus causing further delays due to the importing and installation processes involved. The indirectly affected firms that experienced supply constraints had to seek alternative suppliers in Thailand or abroad.

Figure 1. Manufacturing production index (MPI) from January 2011 to June 2017



Source: The Office of Industrial Economics (<https://www.bot.or.th/English/Statistics/Graph/Pages/Mpi.aspx>)

In Thailand, there are 53 industrial estates; all of which are registered under the Industrial Estate Authority of Thailand. These industrial estates contain companies of all types: small, medium, and large businesses, as well as Thai-owned, Japanese-owned, and other foreign-owned companies. Overall, Thai-owned companies comprise 36%, Japanese-

owned 25%, Singaporean 6%, and American 5% of the total (see Figure 2). Manufacturing factories are the predominant type of business with 22%, while vehicles and logistics make up another 12% (see Figure 3) (Industrial Estate Authority of Thailand, 2017).

Figure 2. Nationality ownerships as of 2016

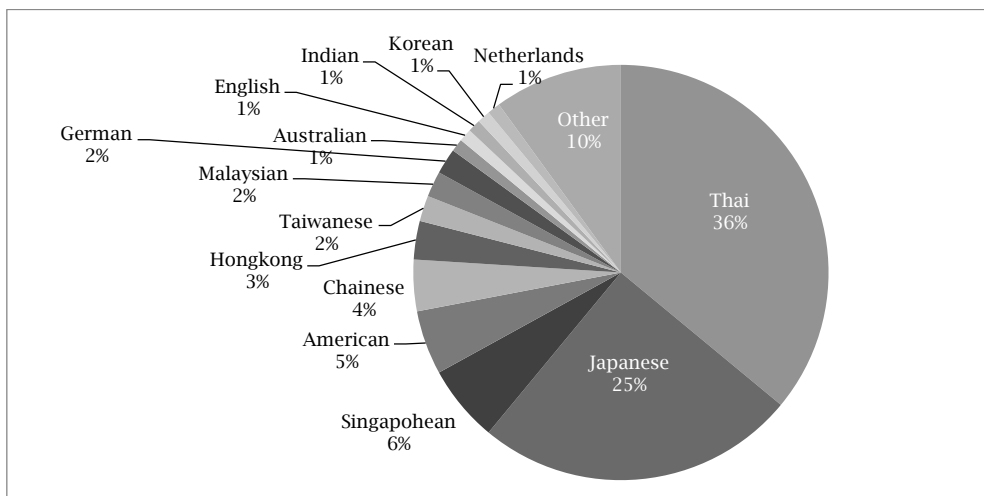
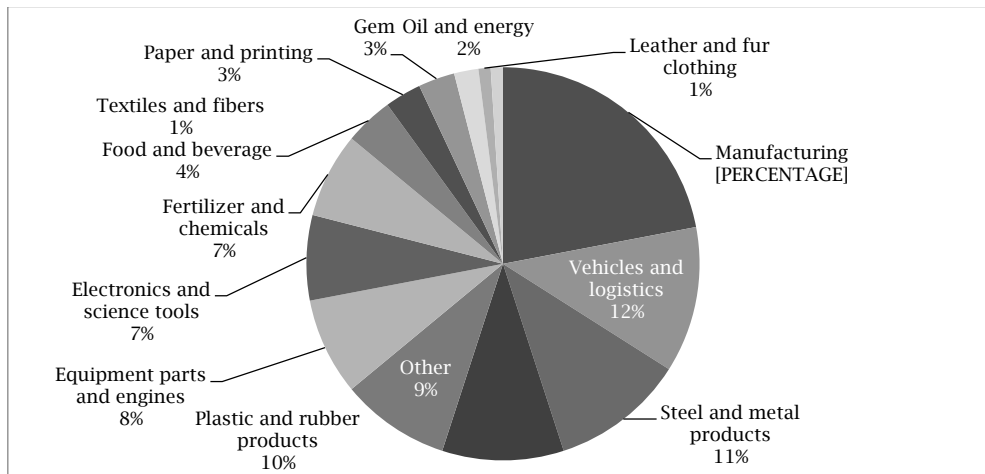


Figure 3. Business sectors as of 2016



The flood in 2011 had caused significant damage to Thai industrial estates. Especially in the central part of the country where several industrial estates located and were major manufacturing hubs of the country and the region. These manufacturing estates are vital sources of employment which directly influenced the robust of the country's economy. Therefore, the Thai government put an effort to assist the industrial estates by subsidizing two-thirds of the total budget for the construction of flood barriers surrounding 6 industrial estates<sup>16</sup> (a total length of 143 kilometres) - i.e. Bangpa-in Industrial Estate, Ban Wa (Hi-Tech) Industrial Estate, Saha Rattana Nakorn Industrial Estate, Bangkadi Industrial Park, Rojana Industrial Zone, and Nava Nakorn Industrial Zone - accounting for approximately 3 billion Baht or USD 92.07 million. This was to prevent the large scale of damage to the industrial estates. The damage still occurred despite the integration of the government and the private company's efforts.

Our research study is based on the understanding that any damages to such manufacturing will inevitably impact the national income. In those industrial estates by which Thai and Japanese are major nations among many other nations affected tremendously by the floods in 2011. Several companies located in those industrial estates went bankrupt after the national disaster (evidence from 43 companies were closed down after 2011), many presented deficit on their operating income and several had to cease their business with little to no cash inflows. It is therefore important to prevent future flood damages and at the same time to restore the confidence of both Thai and foreign investors and employees in industrial estates.

The aim of this study built on the point, and the well awareness of the authors, that at this point there are a few studies researched on the topic of the 2011 floods, for example the study by Singkran (2017) examined the 2011 flood with an emphasis on the Chao Phraya River Basin and analysed the existing plans and measure relevant to the floods risk management; the study by Haraguchi and Lass (2015) investigated investigates the impact of floods on the global economy through supply chains, and proposes measures for the related supply chain risk;

the study by Marks and Rebel (2016) investigated on how decentralization reforms and the associated power relations between government agencies at different levels affected disaster risk outcomes in Thailand, in particular, during the 2011 floods in Central Thailand; the study by Ng (2016) deeply explained on the governance approach and its responding to a reactionary flood governance regime in Ayutthaya, Thailand. However, none of them studied on the environmental impact on the individual manufacturing company's performance and none of them studied whether these companies' sustainability is influenced by their sizes or their nationality of ownership. Therefore the goals of this study are to examine corporate sustainability as the consequence of the historic floods through the financial performance of companies in those seven industrial estates with the focus on sizes and ownership.

## 2. LITERATURE REVIEW

Even though the relevant authorities have expended great efforts to deal with floods, consequences from such natural disasters still left several companies financially distressed. Most of the companies located in the industrial estates suffered financially from the floods directly. With an eye to mitigating future disasters, it is worth studying whether the floods affected the financial status of these different types of companies to different degrees. If differences are found, it is natural to discuss the reasons for the differences, and how best to make the hardest hit companies less vulnerable in the future.

A study by Terdpaopong and Manapreechadeelert (2017) initially employed the observation of various financial ratios - 28 ratios used by previous researchers. In conclusion from previous studies, a small number of financial ratios were selected as the best impacts that influence and represent companies' capability. This study examines five different measures of financial health which highly suggested being significant ratios for business performance: return on assets (ROA), return on equity (ROE), gross profit margins (GPM), operating profit margins (OPM), and net profit margins (NPM). These measures are compared across companies of different sizes and of different ownership/nationalities. If certain types of companies are found to have suffered more than

<sup>16</sup> Industrial Estate Authority of Thailand, Flood Prevention System. Source: <http://www.ieat.go.th/en/investment/why-invest-in-industrial-estate/flood-contingency-plan-for-industrial-estates>

others, one must ask what factors caused their poor performance. Once these factors have been identified, it will then be possible to suggest ways for these companies to avoid similar losses in the event of future disasters.

In certain industrial parks, where industries were clustered, hundreds of companies were severely damaged, not only in the immediate physical destruction of assets but also in loss of sales and disruption of supply chains. These industrial parks contained companies of all types: small, medium, and large businesses, as well as Thai-owned, Japanese-owned, and other foreign-owned companies.

Generally speaking, the literature is quite clear about the differential effects of flooding on large versus small businesses: large businesses are usually better prepared than small ones.

Agnello et al. (2013) studied companies in a large industrial park in Italy and found that the proximity of companies within the park area led to the pooling and sharing of information about risk management. However, a similar study by Nordloff et al. (2015) found that such risk management considerations did not always apply to the work environment. Nordloff et al. (2015) concluded that "Company size does not appear to be associated with perceptions of work environment prioritizations".

A study of large businesses in Australia by Ahmad et al. (2014) showed that "the majority of the firms involved in the survey not only extensively implement Environmental Risk Management (ERM) but also extensively embed ERM into their corporate strategic processes. Further, they have also implemented the system for more than five years.

On the other hand, many studies report on the lack of preparedness by small enterprises. Small companies are more disproportionately affected by a crisis than are larger or resource-rich enterprises (Corey & Deitch, 2011). "The impact of a crisis on small companies may be particularly great because of the personal impact on owner-managers and their lack of preparedness and resources making them more vulnerable" (Doern, 2016, p. 276).

The chief cause of this is often an attitudinal one, as summarized by Speiers (2017).

Owner managers feel they have more important matters to address than a "might happen" event at some indeterminate time in the future. Yet the preparation and testing of a plan to manage a crisis is an imperative as small companies tend to be fragile and lack the resilience of their larger counterparts and, as such, mortality rates are high.

Risk management is naturally related to corporate governance, especially in the area of longer-term planning and strategic management. Smaller, owner-managed companies tend to take a short-sighted approach based on day-to-day survival (Clarke & Klettner, 2009). Crossan et al. (2015) emphasise "A lack of governance within small companies that is a contributory factor in business failure.... Many of these failures can be mitigated by the introduction of robust governance structures that would potential[ly] provide better planning and management structures".

These short-term attitudes also affect the recovery of owner-managed businesses after a disaster, according to a UK Government report (2006). "Around half of all companies experiencing a disaster and which have no effective plans for

recovery fail within the following 12 months". The report proposes that appropriate elements of corporate governance such as enterprise risk management would mitigate the impact and effects of a crisis.

Indeed, Pedone (1997) states that 90% of companies without a plan for recovery will fail within two years post-crisis. Budge, Irvine, & Smith (2008) view this attitude of small business managers as a "reactionary posture" They attribute these attitudes to a combination of consequences:

- resource scarcity, (Aleksić et al., 2013);
- ineffectual planning (Corey & Deitch, 2011);
- limited business skills (Minichilli & Hansen, 2007);
- flimsy corporate governance (Faghfour, 2015);
- denial: "Finally, when considering risk and the possibility of a crisis event, it is a posture of denial and 'head in the sand' that prevails" (Spillan, 2001).

Still, these attitudes have serious consequences that can be avoided with better foresight "Yet, when managers take a pro-active approach to crisis management planning, both crisis prevention, and post-crisis survival rates are improved" (Runyan, 2006).

More closely related to the Thai floods of 2011, Do et al. (2016) studied the effects of the same flooding in neighbouring Can Tho, Vietnam. The authors emphasised that the closure of businesses and the resulting supply chain damage was financially even more deleterious than the initial structural damage. "Only 25 percent of small businesses had repaired their establishments by February 2012. A lack of financial resources was an important reason why ... small businesses had not yet carried out these repairs".

The second consideration in Vietnam was that government and NGO assistance in the recovery process tended to focus on larger companies, while "low-income households are rather left alone with their adaptation costs" (Garschagen, 2013).

Due to the literature review, the first hypothesis is drawn regarding the size differences between small, medium and large companies that even though all of them were severely affected by the 2011 floods, their financial ratios are to be statistically different.

*H<sub>1</sub>: During the years 2011-2015, the financial ratios of flood-affected companies are different statistically among the companies of different sizes.*

The study also examines whether floods affect local companies any differently from foreign companies, of which Japanese companies are numerous. There is evidence from the literature that local companies in various countries are not well prepared for natural disasters. In Nigeria, for example, Iroegbu (2005) found that Nigerian construction companies "have failed to place more emphasis on risks during the construction project and such risks when not properly managed have added to project failure". In Saudi Arabia, local companies used outmoded or conventional methods of risk management that were not appropriate (Algahtany, 2016).

Adeleke et al. (2017) studied variables that affected risk management in Nigeria. They singled out Organisational External Factors that could negatively impact response to disasters. These include political factors, such as, according to Jabnoun et al. (2005): discriminatory legislation,

covering tax regimes, riots, strikes, civil unrest, wars, terrorism, invasions, and religious turmoil.

Such political factors could have more harmful effects on locally owned companies, especially if they include factors such as mentioned by Israelsson and Hansson (2009):

[A] Political decision also positively influences construction risk management within the organization, by which some companies are politically connected to one another. ... Those who are connected to the ruling party tend to receive more capital, support, and huge projects with experts, compared with those who are not.

In Thailand itself, Maier-Knapp (2015) pointed out political factors that could have affected the 2011 flood response. In particular, local government and national government do not always share the same perspectives of a problem, and hence their proposed solutions may differ and even conflict. "The illustration of the flood crisis highlighted the delicate relationship between the central authorities and the authorities on the subnational level".

Flood-related institutions were created to raise the confidence levels of foreign investors to harness various areas of expertise of the many state agencies; their efficacy is ultimately contingent on the cooperative attitudes of the established bureaucracies, which are also increasingly developing along expertise-driven and participatory lines.

The Adeleke study (op. cit.) also identified technological factors that could affect risk management. Multinationals, along with larger companies, might be able to take advantage of economies of scale to purchase technology to prevent or mitigate flood damage, while small or local companies might find the installation of a single piece of equipment too expensive.

In addition to examining external organisational factors, Adeleke also studied the effects of rules and regulations. The study concluded clearly that companies that follow the rules on risk avoidance and mitigation are most likely to escape major damage. An earlier longitudinal study by Aniekwu (1995) "affirmed that organizations that duly follow the prescribed rules and regulations by the government either while procuring materials, drawing plans, or performing other activities involved in construction will record less occurrence of risk in the project".

This statement sounds obvious, but in light of his citation of previous studies showing that in many countries, companies are not following guidelines and prescribed risk management practices, it should be clear that in spite of regulations, companies are still failing to prepare for disasters. More emphasis must be placed on the enforcement of those rules.

One may also surmise that it is the small, local businesses who are failing to follow the rules. Large multinationals are probably more strictly regulated, either by their home country or by local officials. Thus, it may be the small, local companies who suffer most when disaster strikes. Still, the above-cited studies do not offer any direct quantitative comparison between local companies and foreign-owned companies.

Our second hypothesis regarding the companies' nationality shareholders would be that the financial ratios of the flood-affected companies will illustrate some differences among different

nationality. In other words, the companies with one nationality would perform differently when compared to companies with another nationality. Thus, the hypothesis is stated as follows.

*H<sub>2</sub>: During the years 2011-2015, the financial ratios of flood-affected companies are different statistically among the companies of different nationality shareholders.*

### 3. METHODOLOGY

#### 3.1. Indicators

In the present research, the main objective is to investigate financial changes of the flood-affected companies. A preliminary study (Terdpaoong & Manapreechadeelert, 2017) initially employed the observation of various financial ratios - 28 ratios used by previous researchers. For this study selected 5 ratios which might be most affected by the floods - Return on Assets (ROA)<sup>17</sup>, Return on Equity (ROE)<sup>18</sup>, Gross Profit Margin (GPM)<sup>19</sup>, Operating Profit Margin (OPM)<sup>20</sup>, and Net Profit Margin (NPM)<sup>21</sup>. The financial records of industrial companies from 2011 to 2015 were used.

#### 3.2. Population and sample selection

This study uses seven Thai industrial estates namely 1) Rojana<sup>22</sup> 2) Navanakorn<sup>23</sup>, 3) Hi-Tech<sup>24</sup>, 4) Bangpa-in<sup>25</sup>, 5) Factory Land<sup>26</sup>, 6) Saharattananakhon<sup>27</sup>, and 7) Bangkadi<sup>28</sup>. Total of these 7 industrial estates comprises of 651 companies as samples. The sample selected for this study is 514 companies (78.96% of the population), which omits companies that missed reporting their financial statements (75 companies), companies out of business or closed down after the floods (43 companies), and newly registered businesses after 2011 (19 companies). The Rojana Industrial Estate was the largest industrial estate

<sup>17</sup> Return on Assets (ROA) indicator of how profitable a company is relative to its total assets, calculated by taking Net Income / Total Assets.

<sup>18</sup> Return on Equity (ROE) measures a corporation's profitability by revealing how much profit a company generates with the money shareholders have invested, calculated by taking Net Income/Shareholder's Equity.

<sup>19</sup> Gross Profit Margin (GPM) is a company's financial health and business model by revealing the proportion of money left over from revenues after accounting for the cost of goods sold (COGS), calculated by taking Revenue less Cost of Goods Sold and divided by Revenue.

<sup>20</sup> Operating Profit Margin (OPM) is a measurement of what proportion of a company's revenue is left over after paying for variable costs of production such as wages, raw materials, etc., calculated by taking Operating Income divided by Net Sales.

<sup>21</sup> Net Profit Margin (NPM) is the ratio of net profits to revenues for a company or business segment. Typically this ratio will be expressed as a percentage. net profit margins show how much of each dollar collected by a company as revenue translates into profit. The equation to calculate net profit margin is taking Net Profit divided by Revenue.

<sup>22</sup> Rojana Industrial Park Public Co., Ltd. was established in 1988 by a joint venture between Japanese (Nippon Steel & Sumikin Bussan Corporation) and Thai (Vinichburi's Group) companies for the purpose of development and operation of industrial parks in Ayutthaya province, Rong province and Prachinburi province. Source: <http://www.rojana.com/index.html>

<sup>23</sup> Since the establishment in 1971, Nava Nakorn Industrial Zone remains one of the most trusted industrial estate developers in Thailand. Source: [https://www.navanakorn.co.th/ewt\\_news.php?nid=238&filename=indexFN](https://www.navanakorn.co.th/ewt_news.php?nid=238&filename=indexFN)

<sup>24</sup> Hi-Tech Industrial Estate is one of the projects under Thai Industrial Estate Corp. Ltd. The company was established on January 11 1986 with the main purpose of developing an industrial estate in Ayutthaya catering to high technology but less polluting industries. Source: [http://www.industrialpark-th.com/about\\_us/profile.php](http://www.industrialpark-th.com/about_us/profile.php)

<sup>25</sup> Bangpa-in Industrial Estate established in 1989, located at Ayutthaya. Source: [http://www.bldc.co.th/about\\_us.php?id=6](http://www.bldc.co.th/about_us.php?id=6)

<sup>26</sup> Factory Land - Wangnoi is a small industrial estate consisting of 65 SMEs, located in Ayutthaya. Source: [http://www.diw.go.th/liz/fac\\_list.asp?zone=000014](http://www.diw.go.th/liz/fac_list.asp?zone=000014)

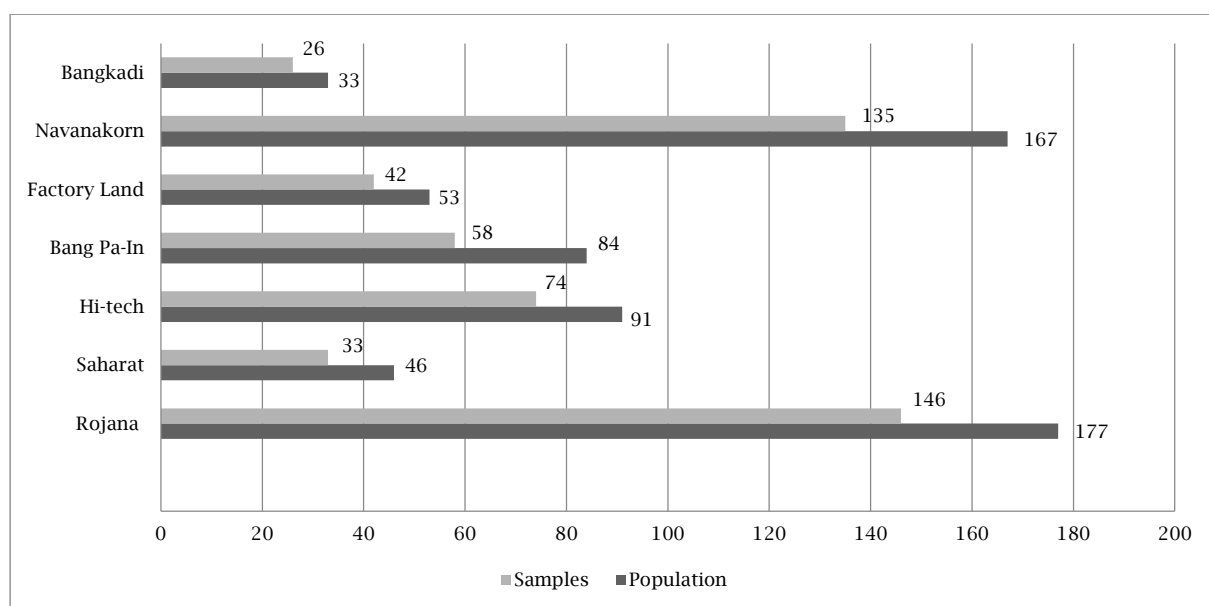
<sup>27</sup> Saha Rattana Nakorn Industrial Estate established in 1994 located in Ayutthaya. Source: <http://thailandindustry.blogspot.com/2012/09/blog-post-8789.html>

<sup>28</sup> In 1987, Bangkadi Industrial Park Co., Ltd. was founded on 483 acres of land on Tivanon Road, Pathumthani province through a joint venture between Thai Toshiba and Mitsui Group with the goal of attracting foreign investment into Thailand with cooperation from Board of Investment of Thailand (BOI). Source: <http://www.bangkadi.co.th/philosophy.html>

among all with 177 companies and Navanakorn was the second largest with 167 companies residing in the park. The samples selected for this study come

from Rojana (28.40%), Navanakorn (26.26%), Hi-Tech (14.40%), Bangpa-in (11.28%), Factory Land (8.17%), Saharattananakhon (6.42%) and Bangkadi (5.06%).

Figure 4. Population and sample size



### 3.3. Sizes and nationalities

Companies can be classified into different categories according to their sizes; for this purpose different criteria may be used (e.g. number of persons employed, employees, total balance sheet (total assets), total capital investment (total equity), but the one most common in a statistical context is number of persons employed which includes employees but also working proprietors, partners working regularly in the enterprise and unpaid family workers. Small and Medium-sized Enterprises (abbreviated as SMEs) are further subdivided into:

- micro enterprises: fewer than 10 persons employed;
- small enterprises: 10 to 49 persons employed;
- medium-sized enterprises: 50 to 249 persons employed;
- large enterprises: 250 or more persons employed.

The OECD estimates that SMEs account for 90% of firms and employ 63% of the workforce in the world (Munro, 2013). These figures can also be implied for Thai SMEs. In Thailand, SMEs are divided into 3 different sectors - production, service and trading firms. The companies in Thailand are classified either as micro, small, medium or large enterprises based on both the number of employees and the amount of fixed assets, excluding land (Institute for Small and Medium Enterprises Development, 2006). Businesses in the production and service sectors are classified as small enterprises if their assets are not more than THB 50 million and employ no more than fifty people; while medium enterprises are those with assets between THB 50 to 200 million and employ between fifty and two hundred people. On the other hand, businesses in the wholesale trading sector are classified as

small enterprises if their assets are less than THB 50 million and employ no more than twenty-five people and as medium enterprises, if their assets are between THB 50 to 100 million and employ between twenty-six and fifty people. When a situation where the number of employees and the value of fixed assets places the firm in both categories, that is either small or medium, the lower of the two determines how the enterprise will be classified.

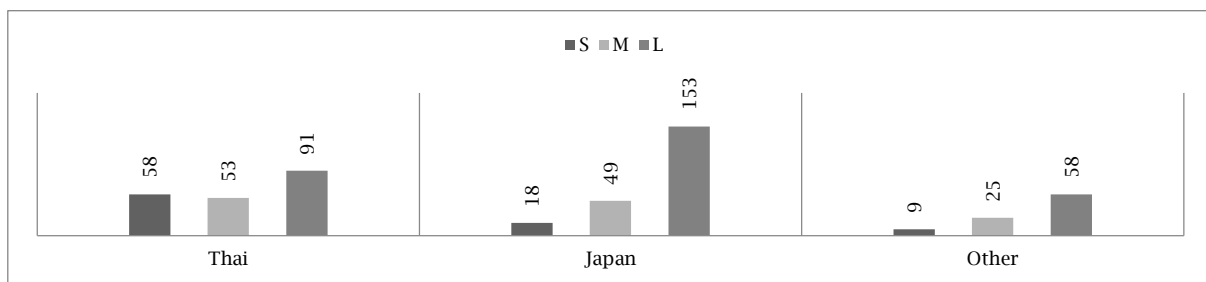
In this study, however, finding such information on the number of employees of the companies in the industrial estates is difficult. The second best the study can find is values of assets. After careful consideration, the value of the company assets (total assets) at the end of the year was used to categorize the companies' sizes. The study divided companies into three different sizes.

- Small (S) - Total assets < THB 50 million (USD<sup>29</sup> 1.60 million)
- Medium (M) - Total assets < THB 200 million (< USD 6.41million)
- Large (L) - Total assets > THB 200 million (> USD 6.41million)

Due to the national majority of the companies in the industrial estates are Japanese, Thai and other. The data taken into accounts for the nationalities are to consider these three main nationalities (see Figure 5).

<sup>29</sup> Exchange rate 1 USD = 31.203 THB. Source: <https://www.bloomberg.com/quote/USDTHB:CUR>

Figure 5. Firm size by nationality graph



The companies in 7 industrial estates classified in Table 1. by sized and nationalities are presented below

Table 1. Information as of December 2011 (small changes after this are of minor relevance)

Size and nationality			Industrial Estates						Total	
			Rojana	Saharat	Hitech	Bang pa-in	Factory land	Nava nakorn		Bang kadi
L	Nationality	Thai	25	3	15	10	3	27	8	91
		Japanese	62	10	25	10	4	30	12	153
		Other	17	2	16	7	0	15	1	58
	Total	104	15	56	27	7	72	21	302	
M	Nationality	Thai	12	4	4	6	5	20	2	53
		Japanese	15	8	6	6	1	12	1	49
		Other	7	2	4	4	4	4	0	25
	Total	34	14	14	16	10	36	3	127	
S	Nationality	Thai	3	2	1	8	18	24	2	58
		Japanese	4	2	3	4	2	3	0	18
		Other	1	0	0	3	5	0	0	9
	Total	8	4	4	15	25	27	2	85	
Total	Nationality	Thai	40	9	20	24	26	71	12	202
		Japanese	81	20	34	20	7	45	13	220
		Other	25	4	20	14	9	19	1	92
	Total	146	33	74	58	42	135	26	514	

Note: L: Large, M: Medium, S: Small

### 3.4. Statistical methods

Before the actual analysis, various assumptions of multicollinearity, linearity, and normality were ascertained. The data were analysed for normality using Kolmogorov-Smirnov tests, which show the data were highly non-normal. As the result, the non-parametric Kruskal-Wallis tests were applied to small, medium and large companies, as well as the

Thai, Japanese and other major nationality shareholders (Singapore, America, China and etc.).

### 4. FINDINGS

The floods of October 2011 had serious effects on the financial status of 514 companies in the economic zones studied. The following losses (all in percentages) were recorded for the year 2011, 2012 and the bounce-back 2012-2011.

Table 2. Means of the five variables - entire sample

		2011	2012	Bounce-back 2012-2011
Return on Assets	(ROA)	-5.21	6.94	12.15
Return on Equity	(ROE)	-8.47	19.02	27.48
Gross Profit Margin	(GPM)	13.43	8.38	-5.41
Operating Profit Margin	(OPM)	-4.47	3.41	7.88
Net Profit Margin	(NPM)	-5.43	3.64	9.06

It should be noted that the gross profit margin, as calculated by subtracting production costs from revenues, was positive for the year 2011 since the cost of repairs and replacements from the flood were not counted in the GPM. Rather, those disaster costs were taken into account in calculating the OPM and the NPM, which were indeed negative for the year.

The only measure to drop was GPM, which fell 5.41% from 13.48% to 8.38%. This drop could be due to several possible factors, either from loss of

revenue or from increased costs. It is probably that supply chains were disrupted so that products could not reach sales outlets, and therefore sales fell. It is also possible that customers who could not be serviced during the flood turned to other businesses outside the flood zones and possibly remained with those new outlets.

The effects reported above were not uniform among businesses. It was the purpose of this study to examine the differential effects of the flooding on

large, medium, and small businesses, as well as on Thai, Japanese, and other foreign companies.

**4.1. Return on assets and equity (ROA and ROE)**

The following table shows the mean percentage ROA and ROE for small, medium, and large companies in years 2011 through 2015.

**Table 3.** Means of ROA and ROE by size

	2011	2012	2013	2014	2015	Bounce 2011-2012
ROA:						
Small	-7.82	3.21	2.21	2.94	2.92	11.03
Medium	-8.7	5.69	4.17	3.14	2.7	14.39
Large	-3.01	8.51	8.66	4.36	4.47	11.52
ROE:						
Small	-10.44	13.63	7.78	28.16	8.44	24.06
Medium	-16.08	21.63	15.73	21.12	5.97	37.71
Large	-4.72	19.43	16.56	11.77	8.47	24.15

**Table 4.** Means of ROA and ROE nationalities

	2011	2012	2013	2014	2015	Bounce 2011-2012
ROA:						
Thai	-5.8	5.72	5.17	3.9	4.37	11.51
Japanese	-5.1	7.69	6.97	2.96	3.34	12.79
Other	-4.19	7.83	8.21	5.73	3.56	12.02
ROE:						
Thai	-8.97	15.37	11.12	19.42	7.72	24.34
Japanese	-7.38	19.15	16.36	11.72	7.79	26.53
Other	-9.97	26.69	19.7	23.13	9.15	36.66

In order to compare the data among sizes and among nationalities, it was necessary to avoid parametric statistical methods. Kolmogorov-Smirnov tests revealed highly non-normal distributions in all cases. As a result, the non-parametric Kruskal-Wallis ANOVA test statistic was used. The following significances were recorded.

**Table 5.** Kruskal-Wallis test

Significance levels for Kruskal-Wallis tests for sizes and nationalities		
Between S, M and L		
	ROA	ROE
2011	0.001**	0.034*
2012	0.004**	0.186
2013	0.005**	0.276
2014	0.735	0.007
2015	0.171	0.6
2012-2011	0.239	0.312
Between Nationalities		
	ROA	ROE
2011	0.259	0.765
2012	0.462	0.106
2013	0.54	0.092
2014	0.044*	0.001**
2015	0.477	0.923
2012-2011	0.604	0.984

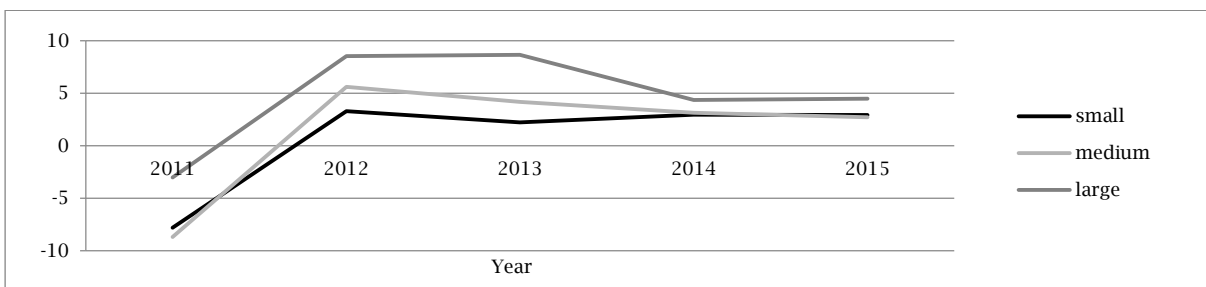
Note: \*\*p < .01  
\*p < .05

Thus, highly significant differences were found, especially among the various sizes of companies. In the cases where significances were found, post-hoc comparisons were made using the Dunn's test for non-parametric statistics. In the tests for company size, all significant differences yielded post-hoc significance involving the large companies, in most cases large versus small. There were no significant differences between small and medium companies, suggesting that small and medium companies can be grouped together as one statistical entity.

In the two cases of significant differences among nationalities, the Dunn's test showed a paired significance between Japanese and other companies of .042 for ROA in 2014, while the ROE in 2014 found a Japan-Thai difference (p<.010) as well as a Japan-Other difference (p<.002).

In order to visualize the nature of these significances, one can turn to a graphic representation, for example, that of the ROA means over the course of the period 2011-2015:

**Figure 6.** ROA graph by size



One observes that large companies' ROAs were hurt less than small and medium companies in 2011 and that this advantage to large companies continued through 2013. No significant differences were observed for 2014 and 2015 when the ROAs of the three sizes became roughly equal. Note also that the bounce-back from 2011 to 2012 was roughly the same for all sizes, as evidenced by the similar positive slopes of all three parallel graphs between 2011 and 2012.

**4.2. Gross profit margins (GPM), operating profit margin (OPM), and net profit margin (NPM)**

**4.2.1. Gross profit margins (GPM)**

Overall means for the gross profit margins (GPM) of all 514 companies in 5 different years were as follows:

**Table 6.** GPM 2011-2015

	2011	2012	2013	2014	2015	Bounce 2011-2012
GPM all 514 companies (%)	13.43	8.38	11.31	14.14	16.5	-5.05



Thus, profit margins fell in 2012 but recovered by 2013 and continued to rise thereafter. The following table shows the mean percentage GPM for small, medium, and large companies in years 2011 through 2015.

**Table 7.** GPM classified by sizes 2011-2015

	2011	2012	2013	2014	2015	Bounce 2011-2012
Small GPM	13.89	11.5	15.29	16.42	18.03	2.42
Medium GPM	12.87	9.2	12.25	15.73	17.54	3.17
Large GPM	13.75	7.16	9.79	12.82	15.54	-6.59

**Table 8.** GPM classified by nationalities 2011-2015

	2011	2012	2013	2014	2015	Bounce 2011-2012
Thai GPM	14.5	12.2	14.99	16.88	18.45	-2.3
Japanese GPM	13.08	5.59	8.84	12.56	15.11	-7.48
Other GPM	11.94	6.64	9.13	11.88	15.25	-5.3

**Table 9.** GPM significance levels for Kruskal-Wallis tests by sizes and nationalities

<i>Between S, M and L</i>	
	GPM
2011	0.568
2012	0**
2013	0**
2014	0.012*
2015	0.028*
2012-2011	0.003**
<i>Between Nationalities</i>	
	GPM
2011	0.297
2012	0**
2013	0**
2014	0**
2015	0.006**

Note: \*\* $p < .01$   
\* $p < .05$

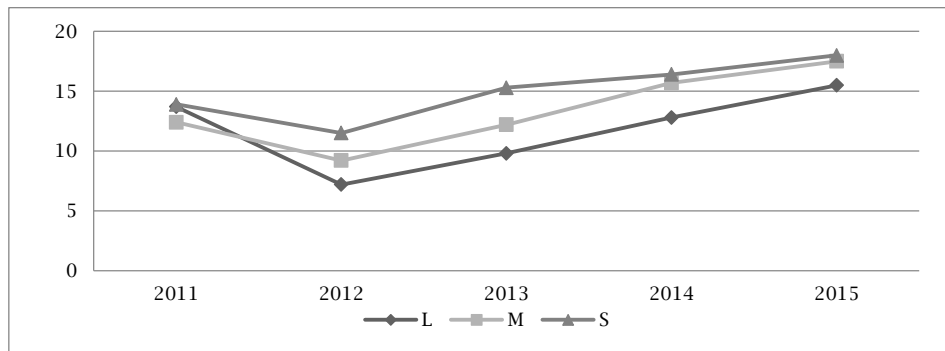
As in the case of S-M-L comparisons, Dunn's tests revealed that all significant paired differences involved large companies, while there were no significant paired differences between medium and small companies.

Significant paired differences among nationalities, according to the Dunn's post-hoc test, were a mixed bag, with Japan figuring in results of all four significant years. The results were

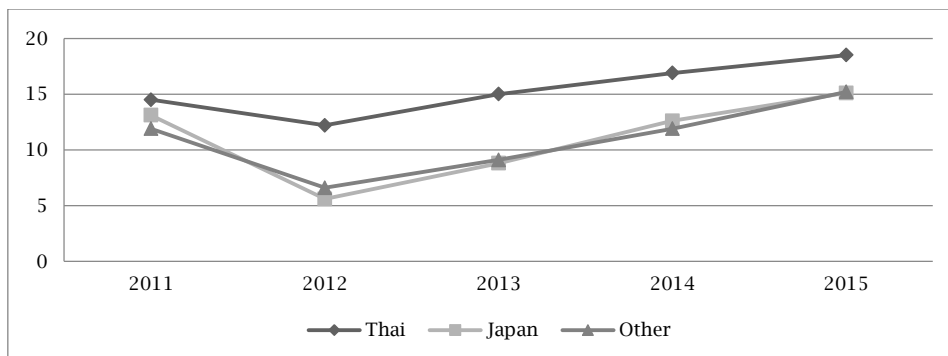
- 2012: Japanese-Thai ( $p < .001$ ) and Japan-Other ( $p < .003$ );
- 2013: Japanese-Thai ( $p < .001$ ) and Other-Thai ( $p < .001$ );
- 2014: Japanese-Thai ( $p < .001$ ) and Other-Thai ( $p < .005$ );
- 2015: Japanese-Thai ( $p < .009$ ).

Note that all sizes and nationalities had approximately equal GPMs in 2011, but those figures diverged in 2012. Small companies had consistently higher GPMs than medium and large companies, and Thai companies had consistently higher GPMs than foreign companies. This can perhaps be explained by the differing effects of supply chain disruptions: small companies were disrupted less than larger companies, and Thai companies were disrupted less than foreign companies. It is likely that larger, foreign companies had more overseas export supply chains, and so they suffered more than did smaller Thai companies. These data are illustrated in the two graphs shown below.

**Figure 7.** GPM graph by size



**Figure 8.** GPM graph by nationalities



It is interesting that by 2014, the smaller companies had lost their GPM advantage so that there were no significant differences in 2014 and 2015. On the other hand, Thai companies retained their advantage over foreign companies throughout the period 2012-2015.

#### 4.2.2. Operating profit margin (OPM)

The following table explains the operating profit margin of the companies in the industrial estates classified by their sized and their nationalities. Data was illustrated in 2 different periods; on the flood year and after the flood years. The comparisons between the 2 different periods were presented as a bounce back in each category.

**Table 10.** OPM classified by sizes and nationalities

	2011	2012-2015	Bounce
<i>Size:</i>			
Small	-7.6960	0.3686	8.0650
Medium	-8.5334	1.6034	10.1370
Large	-1.8533	5.0856	6.9390
<i>Nationalities:</i>			
Thai	-4.4793	3.8087	8.288
Japanese	-4.9146	2.8612	7.776
Others	-3.3867	4.0399	7.427

The study found that the medium-sized companies are the one with the highest bounce back; 10.1371, while small companies possessed the bounce back of 8.0650 (second highest) and large companies 6.9390 (the least bounce bank). When considering the nationalities, the bounce back records are quite similar, Thai nationality is the highest bounce back of 8.288 (see Table 10).

The p-value from the Kruskal-Wallis Tests from the year 2011 to 2015 are statistically different among 3 different sizes of the manufacturing companies. In some years such as 2014, p-value equals 0.054, 2015 p-value 0.003 which present lower than .05, while in 2011 p-value 0.001, 2.12 and 2.13 p-value 0.00 which present lower than .01, can be interpreted that those are statistically different at significant levels .01 and .05. While there is no statistical difference on nationalities, the p-value is greater than .05. These can be interpreted that companies of different sizes illustrate statistically significant operating incomes (see Table 11).

**Table 11.** OPM significance levels for Kruskal-Wallis tests by sizes and nationalities

<i>Between S, M and L</i>	
	<i>OPM</i>
2011	0.001**
2012	0**
2013	0**
2014	0.054*
2015	0.003**
2012-2011	0.188
<i>Between Nationalities</i>	
	<i>OPM</i>
2011	0.322
2012	0.723
2013	0.655
2014	0.067
2015	0.323

Note: \*\* $p < .01$   
\* $p < .05$

#### 4.2.3. Net profit margin (NPM)

Gross profit takes into account only production costs, not administrative costs, repairs, renovations, taxes, etc. When these costs are subtracted off to obtain Net Profit Margins (NPM), a different picture emerges. Thus, these additional costs dragged a GPM of 13.43 in 2011 down to an NPM of -5.43 and sprung back to positive figures in 2012 and after 2012 onwards (see Table 12).

**Table 12.** NPM 2011-2015

	2011	2012	2013	2014	2015	Bounce 2011-2012
NPM all 514 companies (%)	-5.43	3.64	5.29	2.47	2.84	9.07

When the sizes and nationalities are considered, the study found that medium companies are the highest bounce back from 2011 with the bounce back of 11.211 which mean the medium-sized companies enable to recover the most among other sizes, and followed by small companies and large companies, while companies with different nationalities have a similar bounce back (see Table 13 below).

**Table 13.** NPM classified by sizes and nationalities

	2011	2012-2015	Bounce
<i>Size:</i>			
Small	-9.3286	0.1086	9.437
Medium	-9.3180	1.8933	11.211
Large	-2.6911	5.2328	7.924
<i>Nationalities:</i>			
Thai	-5.8177	3.8055	9.623
Japanese	-5.6315	2.9837	8.615
Others	-4.0753	4.3859	8.434

When considering the p-value from the Kruskal-Wallis Tests from the year 2011 to 2015 (Table 14), the study found that there are statistically different among 3 different sizes of the manufacturing companies. This picture is the same direction with the Kruskal-Wallis Test of OPM. Thus, the interpretation is that companies of different sizes illustrate statistically significant net operating incomes, while nationalities illustrate no significant difference.

**Table 14.** NPM significance levels for Kruskal-Wallis tests by sizes and nationalities

<i>Between S, M and L</i>	
	<i>NPM</i>
2011	0**
2012	0.001**
2013	0**
2014	0.003**
2015	0.005**
2012-2011	0.304
<i>Between Nationalities</i>	
	<i>NPM</i>
2011	0.144
2012	0.752
2013	0.626
2014	0.07
2015	0.492

Note: \*\* $p < .01$   
\* $p < .05$

For companies of different sizes, the significant differences in GPM carried over into differences in operating profit margins (OPM) and in net profit margins (NPM) as well.

On the other hand, no significant differences in OPM or NPM were observed between companies of different nationalities, despite differences having been found between GPMs. Net profit margins were negative in 2011 where NPM ratio was -5.43 in 2011 but rose in 2012 to 3.64 (see Tables 2 and 12). The advantage to Thai companies in GPM was erased when costs were subtracted to calculate OPM and NPM. This probably means that Thai companies had relatively high repair and renovation costs compared with foreign companies.

One other possible explanation for the rise in non-production costs is that insurance premiums might have increased for local Thai companies more than for foreign companies. This is because foreign-owned companies may have foreign or international insurance policies, which might not have raised premiums for a single event in Thailand, while Thai insurance companies might have raised rates significantly. This possibility would help to explain the fact that the significance levels recorded for GPM were erased not only for the following year, 2012, but for subsequent years as well, since Thai insurance premiums would have remained high and dragged down the profit margins of Thai-owned companies.

Finally, it must be stated that foreign-owned companies are highly diverse. Some may have foreign management while others have Thai management; some may import parts and raw materials from abroad, while others use local parts and materials. These differences may contribute to differences in flood-related profit margins among the many types of foreign-owned companies.

Although small companies were initially hit the hardest by the floods, they were able to recover just as well as the larger companies. This result suggests that the smaller companies were ill-prepared in the area of risk management, especially in risks to assets. The rebound suggests that longer-term effects such as sustained loss of business to competitors or supply chain disruption were not that serious.

While significant differences in ROA and other variables were observed between large and small companies, many of those differences vanished when comparing Thai-owned with foreign companies. In fact, the gross profit margins of Thai companies were consistently higher than those of foreign companies. Thus, it appears that it was the smaller companies, rather than just the Thai-owned companies, who were least prepared to deal with the floods.

What were the causes of this lack of preparedness? This is an area for further research, possibly through in-depth interviews with those companies who lost the most. We can guess from reading the extensive literature on risk management by small countries around the world, that the problem is an attitudinal one (Speiers, 2017). Owner-managers tend to think in the short term and do not have a strategic plan for avoiding and coping with disaster.

It might also be useful to contact representatives of those 43 companies that actually closed because of the floods. Information on those companies is largely unavailable at present; it is difficult to know whether they were mostly large or small, local or foreign-owned. But it is precisely those failed companies who suffered most from the floods, and they could provide insights into just where they went wrong.

The literature suggests several ways of improving the situation, especially through various ways of improving corporate governance and strategic management. The situation of the industrial parks in Thailand suggests that the type of solution advocated by Agnello (2015), in the area of factory safety may be fruitful if applied in those parks. This is because the proximity of dozens if not hundreds of companies of all sizes and ownership within a single area could make it easier for risk management information and strategies to be shared or 'pooled' among the companies. Agnello goes on to state the positive results of such a pooling process among companies in a large industrial park in Italy:

Pieces of knowledge previously fragmented among plant operators and contractors, have to be pooled.... The selection is also a good chance to break the contractors' isolation and involve them in safety objectives. Thus by pooling experience and practical knowledge, the common understanding of safety issues has been strengthened.

More importantly, if many companies interacted in the area of risk management, owner-managers might come to have a more proactive, far-sighted, and strategic attitude. Perhaps risk management committees could be established among the companies within the park, on which managers from all sorts of companies would be represented.

The second area for improvement appears to be better coordination between local and national governments. The Maier-Knapp study (2015) reported above showed that local government and national government do not always share the same perspectives. These differences may lead to confusion and even conflict. Various levels of Government in Thailand, as well as in other countries, need to develop clear and consistent risk management strategies which determine precisely which agencies are to deal with which problems.

## 5. CONCLUSIONS AND SUGGESTIONS

Thailand's 2011 flood crisis caused significant damage to industrial estates, industrial parks, and industrial zones, especially those in 7 industrial estates. Being major manufacturing hubs and key sources of employment in Thailand, these industrial estates are important to the country's economy. Therefore, any damage to them impacts national income significantly and inevitably. The Thai floods of 2011 had differential effects on companies of different sizes, with smaller but measurable differences among Thai, Japanese, and other foreign companies.

From our study, the businesses of medium-sized suffered the most financially, followed by

small and large-sized, especially in their return on assets (ROA) and return on equity (ROE), and their gross profit margins (GPM) in 2011 and 2012. However, all types of companies recovered by approximately the same margins by 2013. For operating profit margin (OPM) and net profit margin (OPM), the medium-sized companies again suffered from the historic floods and followed by small and large companies respectively. Even though medium-sized companies suffered the most, they were also the group that can recover quickly and illustrated the high bounce back when compared to small and large companies. This finding is interesting to the point that one would have expected large companies had recovered quickly and strongly. However, this is not the case for the Thai manufacturing in those seven industrial estates. Due to the floods that equally happened to all companies in these areas, we found that the medium-sized companies presented the recovery highest among other. The explanation for this could be that for small companies to recover, they highly require new investment, and a decision to make recovery or to regain the situation may not be professional like medium-sized or large-sized company. The literature suggests that small owner-managed businesses often do not take a long-term, strategic view, and simply hope for the best. They are therefore inadequately prepared for natural disasters like floods. While the large-sized companies to reconcile the situation may require longer process and may need executive management to make a big move to resolve the problem. These could prolong the recovery stage of the large companies. The setbacks for those small and large-sized companies, however, may not be a big issue for medium-sized companies. Our study rejects the null hypothesis 1 and accepts the alternative hypothesis stated that the financial ratios of flood-affected companies are different statistically among the companies of different sizes.

Interestingly, the result from this study also finds that ownership or nationalities did not influence in the companies' performance. The Kruskal-Wallis Tests did not pick up the significance from different nationalities. The explanation for this non-significance on nationalities could come from the fact that those companies were located in the same areas and were hit by floods at a similar level, and then the effect could occur similarly. We accept the second null hypothesis stated that the financial ratios of flood-affected companies are statistically similar among the companies of different nationality shareholders.

When many companies of all sorts are located in a single industrial park, as is the case with companies in this study, it makes sense for the companies to work together on their risk management strategies. In this way, the strategic attitudes of the larger companies may rub off on the smaller ones.

A government may play a role in the preparation of risk management strategies, especially flood prevention system. From the historic floods in 2011, the Industrial Estate Authority of Thailand had made quick-install flood barriers - a preparation in accordance with I-EA-T's Flood Contingency Plan among other strategic

prevention plans<sup>30</sup>. This is to prevent future flood damage and to restore the confidence of Thai investors and foreign and other stakeholders. This is especially true if local and national government agencies can agree on a strategy and coordinate their efforts. The literature has shown that rules and regulations are important factors in risk avoidance and mitigation, but only if these regulations are actually followed. A government must enforce regulations so that all companies strictly adhere to policies.

## 6. LIMITATION AND FUTURE RESEARCH

Although this research was carefully prepared, there are still limitations and shortcomings. First of all, the research was conducted based on the data available of 514 companies in those 7 industrial parks where the entire population for these 7 industrial estates was 651 companies. The study omitted 75 companies, of which 43 of them were closed down after the floods and 19 are newly registered after the floods, while 13 of them were considered as outliers with extreme financial ratios and were dropped from the study. There could be a nonresponse bias in our study, since the 43 of them that went out of business after the floods were actually the most flood-affected. Had their information been included, the results could have been different, in fact, more extremely negative. However, obtaining their information after they closed down is difficult and takes great effort.

Secondly, this study, the paper takes 5 financial ratios into account. This is under cautious consideration that these 5 ratios are the most significant among many found in the literature, and illustrate statistical differences. For future research, one may look wider to cover more financial ratios, plus including interviews with the business owners of the flood-affected companies of different sizes and nationality. This approach would acquire more qualitative information, such as insights as to why some companies suffered more than others. A further recommendation is that for future research, one might look at the ways to reduce and mitigate risks from natural disasters. This is not just to find ways to prevent such natural disasters, but also to reduce the potential damage that could result from the natural disasters, how to use community networks to benefit each other, to diversify risks that could occur. Further, a business continuity plan should be in place - one that is reviewed regularly to maintain the relevance and workability. Businesses should develop foresight based on what should have been done if something had happened, in order to prepare for strategic planning. Such pro-active planning will sustain the survival of the businesses and the economy as a whole; whether or not the businesses will be unavoidably hit by natural disasters, the sustainability of the business should occupy the top priority in strategic planning.

<sup>30</sup> I-EA-T's Flood Contingency Plan where I-EA-T stands for Industrial Estate Authority of Thailand. Source: <http://ieat.go.th/en/investment/why-invest-in-industrial-es-tate/flood-contingency-plan-for-industrial-estates>

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