

On Logistics Potential of Thai Industry in Identifying Gap to Logistics 4.0

¹W. Manopiniwes, ²K. Y. Tippayawong, ²J. Numkid, ²S. Santiteerakul, ²S. Ramingwong and
³P. Dallasega

¹College of Arts, Media and Technology, University of Chiang Mai, Chiang Mai, Thailand

²Center of Excellence in Logistics and Supply Chain Management,
University of Chiang Mai, Chiang Mai, Thailand

³Faculty of Science and Technology, Free University of Bozen, Bolzano, Italy

Abstract: The study investigates logistics potential of Thai industry in order to identify gap and needs of improvement if the concept of Logistics 4.0 is to be adopted. The study uses data from Thailand logistics scorecard database, comprising of 100 Thai companies, focusing on 5 logistics areas and 23 logistics potential items. The study reveals gaps of Thai industry to Logistics 4.0 as the data and information sharing is limited and information technology personnel in relation to logistics needs attentions. In addition, based on basic logistics requirement, Thai industry is weak in terms of logistics responsibility assignment, system for employee development and evaluation, logistics strategy implementation, logistics activity improvement, inventory visibility and opportunity costs, logistics cost management, logistics and supply chain IT capacity building and collaboration with partners.

Key words: Logistics potential, Thai industry, logistics scorecard, information technology, visibility, opportunity

INTRODUCTION

Thailand is an industrialized, developing country, locating in South-East Asia. Thailand is world's 21th strongest economy with GDP of 437.8 USD billion. Thailand also ranked 26th in World Bank's Ease of Doing Business Report in 2018 (Mundial, 2017). However, Thailand is ranked 45th in terms of logistics performance (Arvis *et al.*, 2016). This is preliminarily indicative that logistics system in Thailand has a big room for improvement (Limcharoen *et al.*, 2017).

The issue is addressed by Thai government in transforming Thailand into an Industry 4.0 ecosystem toward an industrial evolution and digital economy. The policy drives many initiatives both infrastructure, human resource and organizational improvement and further expanded to a bigger theme of "Thailand 4.0" (Jones and Pimdee, 2017; Languépin, 2016). However, the main focus of this study is the development of logistics system of Thai industry in Thailand toward Industry 4.0. The study investigates the logistics potential of Thai industry based on the database of Logistics Scorecard (LSC), developed by Ministry of Industry in order to assess and thus, support any needs in logistics management in Thai industry (Limcharoen *et al.*, 2017). Currently, there are 100 Thai companies in the database of LSC.

MATERIALS AND METHODS

Industry 4.0 and Logistics 4.0: Industry 4.0 is a concept of digital industrial technology, synchronizing physical and cyber system together. This enables the manufacturers to value add products fast, flexibly and efficiently. With the use of industrial Internet of Things (IoT), Cyber-Physical System integration (CPS) and Artificial Intelligence (AI) it allows industry to achieve further productivity and lower cost (Rubmann *et al.*, 2015; Bartodziej, 2016; Hofmann and Rusch, 2011; Witkowski, 2017).

Accordingly Logistics 4.0 concepts is growing. Where the products must be moved, stored, realized and supplied throughout the needs of industry 4.0 industry and supply chain (Maslaric *et al.*, 2016) it is a challenge if Logistics 4.0 can cope with the developing Industry 4.0 (Akinlar, 2014; Timm and Lorig, 2015).

Industry 4.0 and Logistics 4.0 in Thailand: Industry 4.0 and Logistics 4.0 have become common terminology for Thai industry. However, there are few companies that reached the level. Most of the companies are multi-national firms, for example, sentury tire (Thailand) company limited a 182-USD-million investment of Chinese

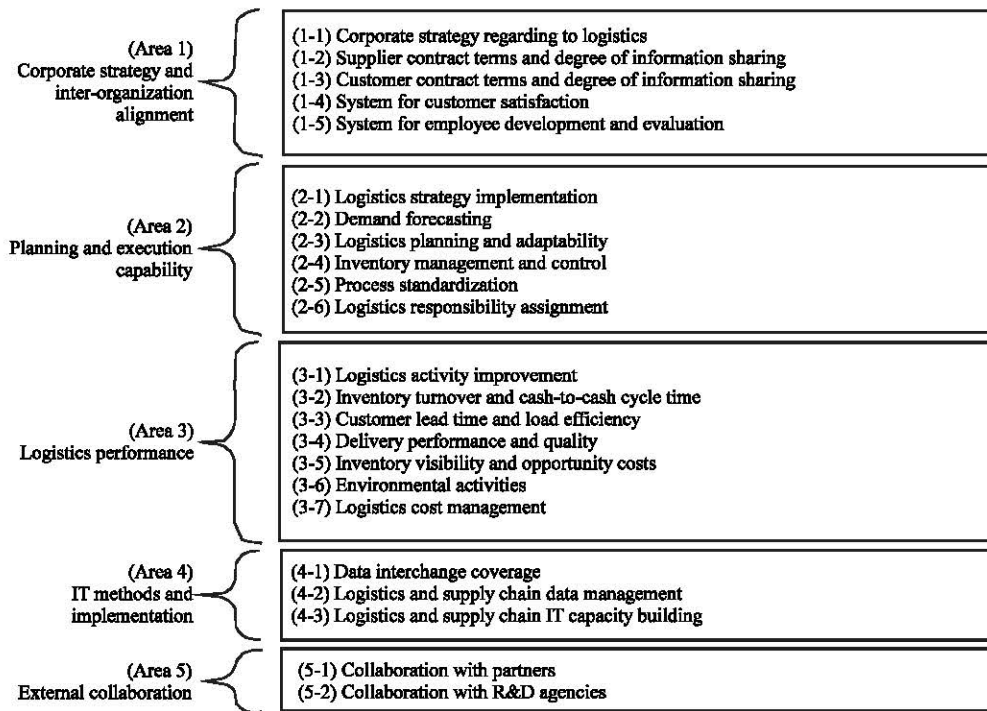


Fig. 1: Logistics scorecard: 5 areas, 23 items

tire manufacturer in Thailand in 2015. The plant is today the most advanced tire production plant in Thailand with fully automated and autonomous controlled process with the capacity of 12 million tires/year (Anonymous, 2016).

There are also Thai companies that are implementing the concept of Industry 4.0 to their production process, for example, Thai Beverage public company limited (ThaiBev) and oishi group public company limited. Both companies are in beverage sectors (Fredrickson, 2017) (Fig. 1).

However, for the rest of the industry in Thailand which are mostly small sized is it too soon to target Logistics 4.0. The study aims to identify if Thai industry is ready for Logistics 4.0. Are there gaps between current practice and the ideal Logistics 4.0. Hence, the study investigates the potential of 100 Thai companies in terms of Information Technology (IT) used in their logistics management. As it is the very basic requirement for Industry 4.0 and Logistics 4.0 that data and information is collected, processed and disseminated throughout the enterprise for necessary decision making, manned or unmanned. The study also investigates other potential in terms of logistics if Thai industry well manages their logistics. The investigation is possible due to the access of Thai logistics potential database, collected by Ministry of Industry of Thailand. The database comprises of 100 Thai companies.

Logistics potential survey of Thai industry: Ministry of industry of Thailand by division of logistics has conducted a survey of Thai industry logistics potential using a self-assessment tool called “Logistics Scorecard (LSC)”. The survey was conducted in 2017 on 100 Thai companies in order to reflect Thai industry logistics potential. The ministry will then use the information from the survey to promote and support any needs in logistics issues for Thai industry (Ramingwong *et al.*, 2015).

Logistics Scorecard (LSC): Logistics Scorecard (LSC) is a logistics potential assessment tool, based on original work by Tokyo Institute of Technology in collaboration with the Japan Institute of Logistics System (JILS). It has been widely used in Japan and Thailand in order to assess logistics potential within the company (Yaibuathet *et al.*, 2017). The self-assessment tool encompasses 23 items based on 5 fundamental logistics areas, i.e., (Area 1) corporate strategy and inter-organization alignment (Area 2) planning and execution capability (Area 3) logistics performance (Area 4) IT methods and implementation and (Area 5) external collaboration.

Each assessment item is allocated into a 5-level rating from 1-5. A detailed description of each level is given with the 5th level indicated as the best practice for each item. By which score are based on qualitative evaluation,

Table 1: Example of definition of item 1-1: corporate strategy regarding to logistics

Score/Level	Definition
1	Top executives have not formulated a strategy or policy regarding logistics or supply chain management. None of the department has responsibility for logistics and supply chain improvement or innovation
2	A department with responsibility for logistics system innovation exists but action is limited to that department. Logistics and supply chain strategy is not clearly defined. Top management do not actively involve
3	Under leadership of a top executive there is a program for logistics and supply chain innovation. However, the program does not extend company-wide
4	Supported by a clear corporate-level strategy a top executive (Managing Executive Director or above) leads efforts for logistics and supply chain innovation. The innovation program is making progress
5	Under the CEO's leadership and a clear corporate strategy there is a company-wide system that supports rapid adaptation of the supply chain to environmental change

scores of items are defined. The definition of score is given in Table 1. This is to minimise biasness of evaluator and allow the database to be compared forthrightly.

Of interest is current logistics potential of Thai companies. Whilst areas 1-3 mainly focus on logistics and supply chain basic competences, area 4 is the enabling factor to achieve Logistics 4.0. Area 5, on the other hand, outreaches the company to external sources, i.e., industrial partners and R&D agencies.

Logistics potential of Thai companies: A 100-company database is taken from a series of data collection by (Limcharoen *et al.*, 2017). The data collection is from industry visit, workshop and online self-assessment website. It should be noted that company size ranges from small to large and industry type varies. The database then represents overall potential of Thai industry. However, it is not statistically conclusive as the sample is rather small.

RESULTS AND DISCUSSION

The following discusses findings from the database. The inspections are in both general view as the average score of each area and item as well as the focused view as the distribution of the score or level in each item. The following discussed the results.

In general, Thai industry scores at the average of 2.93 out of 5. Figure 2 illustrate average score of each area. It can be seen that the highest score is from area 1, corporate strategy and inter-organization alignment at 3.12. The lowest score is from area 5, external collaboration at 2.70. The following discusses in detail on all 5 areas of interest.

Area 1 corporate strategy and inter-organization alignment: The area focuses on company strategies related to logistics and supply chain management strategy, including relationship with supplier, customer and employee. Figure 3 illustrates results from survey.

At discussed before, area 1 corporate strategy and inter-organization alignment yields the highest score

among 5 areas of interest. Focusing on each item it can be found that Thai companies pay considerably high attentions to customer satisfactions (item 1-4) with average score of 3.59. Moreover, more than 80% of the companies reached level 3 on this item. This is satisfactory. The degree of information sharing and contract terms with customer are also high. The score of item 1-3 is at 3.16. However, the system for employee development and evaluation (item 1-5) is among the least at score 2.81.

Area 2 planning and execution capability: The area focuses on logistics strategy, i.e., planning, assignment and implementation and logistics performance, e.g., demand forecasting, logistics planning and adaptability, inventory management and control, process standardization and logistics responsibility assignment. Figure 4 illustrates results from the survey.

The database is indicative that Thai industry lacks logistics responsibility assignment. It can be observed that more than 50% of Thai company on the database are only in level 1 and 2 in item 2-6. It yields an average score as less as 2.53. Also, item 2-1, logistics strategy implementation is also as low as 2.76. Almost half of the data also lies on level 1 and 2. On the other hand, Thai industry is doing well on process standardization. Average scores of item 2-5 is 3.25.

Area 3 logistics performance: The area focuses on logistics performance and related activities, i.e., logistics activity improvement, inventory turnover and cash-to-cash cycle time, customer lead time and load efficiency, delivery performance and quality, inventory visibility and opportunity costs, environmental activities and logistics cost management. Figure 5 illustrates results from the survey.

The database shows that Thai industry lacks inventory visibility and opportunity cost. The score of item 3-5 is at 2.57. The logistics activity improvement (item 3-1) and logistics cost management (item 3-7) are also among the weaknesses, scoring at 2.61 and 2.66, consecutively. More than 50% of Thai companies lies on

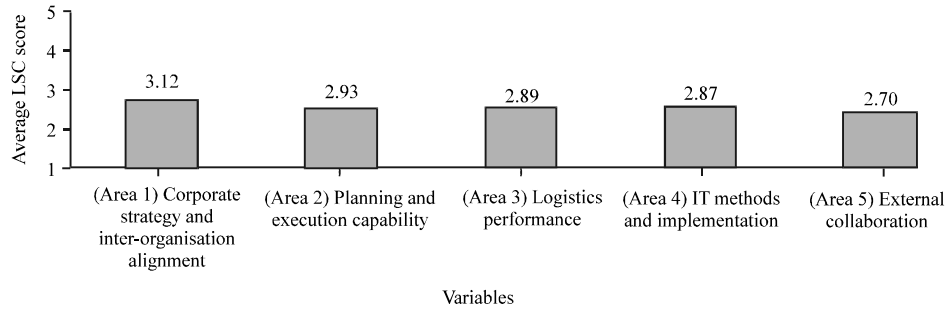


Fig. 2: Average score of Thai industry on 5 LSC areas

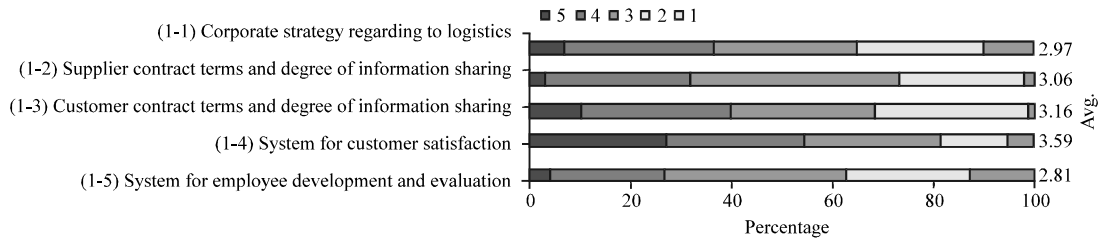


Fig. 3: Score distribution on area 1 corporate strategy and inter-organization alignment

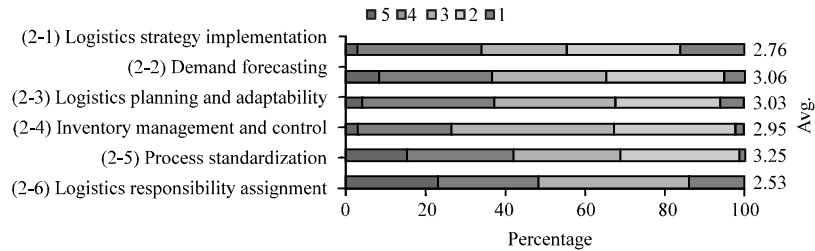


Fig. 4: Score distribution on area 2 planning and execution capability

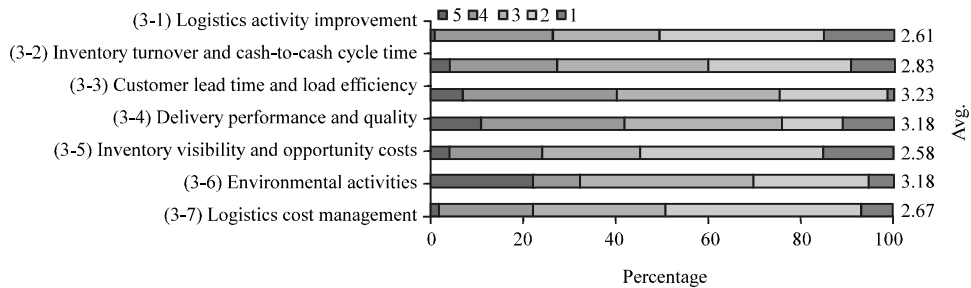


Fig. 5: Score distribution on area 3 logistics performance

level 1 and 2 on these 3 items. On the other hands, the performance is satisfactory in terms of customer lead time and load efficiency (item 3-3) as well as delivery performance and quality (item 3-4) and environmental activities (item 3-6) at the score range of 3.17-3.22.

Area 4 IT methods and implementation: The area focuses on data interchange coverage, logistics and supply chain data management and logistics and supply chain IT capacity building.

From Fig. 6, it can be seen that Thai industry is weak on both personnel and system of management. The data

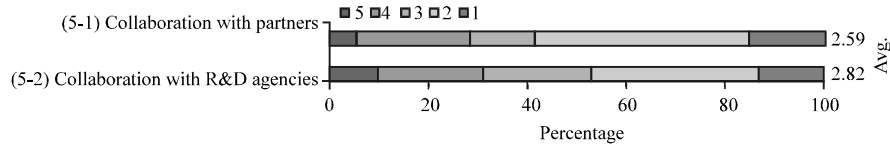


Fig. 6: Score distribution on area 4 IT methods and implementation

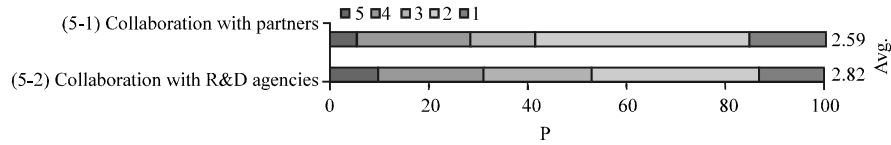


Fig. 7: Score distribution on area 5 external collaboration

shows limitation of logistics and supply chain IT capacity building in Thai industry. Item 4-3 scores at 2.74. Almost 50% of the data lies under level 1 and 2. Moreover, there is none of Thai companies that reach level 5 of data interchange coverage (item 4-1). This means Electronic Data Interchange (EDI) is yet to be fully integrated within Thai industry supply chain. Such open standards for EDI are far to be adopted.

Noted that the study focusing on Industry 4.0 where data and information technology are key driver it is suggestive that Thai industry has big room of improvement. Most of the company today utilizes manpower, data and information only on some logistics activities and not expand to the enterprise and supply chain level. Therefore, they should focus more on vertical and horizontal data exchange and alignment. Thus, it can synchronise the physical and information flow to support the development of the Industry 4.0 concept.

Area 5 external collaboration: The area focuses on collaboration of the industry to partners and R&D agencies (Fig. 7). As discussed above, the area is the weakest and the collaboration with partners, item 5-1, is scored as low as 2.59. Almost 60% of Thai Company lacks collaboration with partners. Here, partner is defined as company with the same business. Score 2 of this item means that there might be some collaboration between partners, however in an informal, unconstructive form. Also, the collaboration with R&D agencies are low. Almost 50% of the data lies under score 2.

CONCLUSION

The study presents results of logistics potential assessment of Thai industry from the database comprises of 100 companies. Of interest are the potential of Thai industry and gaps if the concept of Industry 4.0 is targeted. From result presentation it can be seen that data

and information sharing and information technology utilization in Thai industry is very limited. IT personnels related to logistics and supply chain are also in high need to support this information-based development. These issues are among the obstacle of the evolution path to Industry 4.0 environment.

Furthermore, among 23 items of 5 area of Logistics Scorecard (LSC) it is suggestive that Thai industry still need improvement in many logistics and supply chain perspectives. The issues are logistics responsibility assignment, system for employee development and evaluation, logistics strategy implementation, logistics activity improvement, inventory visibility and opportunity costs, logistics cost management, logistics and supply chain IT capacity building and collaboration with partners. Therefore, the findings can be indicative to both policy and organization level if the improvement is needed.

ACKNOWLEDGEMENTS

This research is part of the project “Industry 4.0 for SMEs” from the European Union’s Horizon 2020 research and innovation program under the Marie Skłodowska-curie Grant Agreement No. 734713.

The researchers also would like to thank Division of Logistics, Ministry of Industry of Thailand for fruitful support for many years of collaborative work.

The study is a part of research work of Center of Excellence in Logistics and Supply Chain Management, Chiang Mai University, Thailand.

REFERENCES

Akinlar, S., 2014. Logistics 4.0 and challenges for the supply chain planning and it. Fraunhofer IM, Istanbul. https://www.iis.fraunhofer.de/content/dam/iis/tr/Session%203_5_Logistics_Fraunhofer%20IML_Akinlar.pdf.

- Anonymous, 2016. Century tire in Thailand: Establishing a world class tire brand. Thailand. http://shandong.chinadaily.com.cn/e/2016-01/21/content_23199938.htm
- Arvis, J.F., D. Saslavsky, L. Ojala, B. Shepherd and C. Busch *et al.*, 2016. Connecting to compete 2016-Trade logistics in the global economy: The logistics performance index and its indicators. The World Bank, USA. <http://www.worldbank.org/en/news/feature/2016/06/28/connecting-to-compete-2016-trade-logistics-in-the-global-economy>
- Bartodziej, C.J., 2016. The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics. Springer, Berlin, Germany, ISBN:978-3-658-16501-7, Pages: 123.
- Fredrickson, T., 2017. Push for robots in Thailand 4.0 planning. Bangkok, Thailand. <https://www.bangkokpost.com/learning/advanced/1249871/push-for-robots-in-thailand-4-0-planning>
- Hofmann, E. and M. Rusch, 2017. Industry 4.0 and the current status as well as future prospects on logistics. *Comput. Ind.*, 89: 23-34.
- Jones, C. and P. Pimdee, 2017. Innovative ideas: Thailand 4.0 and the fourth industrial revolution. *Asian Intl. J. Soc. Sci.*, 17: 4-35.
- Languepin, O., 2016. Thailand 4.0, what do you need to know. Thailand Business News, Hong Kong. <https://www.thailand-business-news.com/economics/54286-thailand-4-0-need-know.html>
- Limcharoen, A., V. Jangkrajarn, W. Wisittipanich and S. Ramingwong, 2017. Thailand logistics trend: Logistics performance index. *Intl. J. Appl. Eng. Res.*, 12: 4882-4885.
- Maslaric, M., S. Nikolicic and D. Mircetic, 2016. Logistics response to the industry 4.0: The physical internet. *Open Eng.*, 6: 511-517.
- Mundial, B., 2017. Doing business 2018: Reforming to create jobs. Master Thesis, The World Bank, Washington, D.C., USA.
- Ramingwong, S., A. Sopadang and K.Y. Tippayawong, 2015. Factory Logistics Improvement Projects: Case Northern Thailand. In: *Industrial Engineering, Management Science and Applications*, Gen, M., K.J. Kim, X. Huang and Y. Hiroshi (Eds.). Springer, Berlin, Heidelberg, ISBN:978-3-662-47199-9, pp: 357-362.
- Rubmann, M., M. Lorenz, P. Gerbert, M. Waldner and J. Justus *et al.*, 2015. Industry 4.0: The future of productivity and growth in manufacturing industries. Boston Consulting Group, 9: 1-14.
- Timm, I.J. and F. Lorig, 2015. Logistics 4.0: A challenge for simulation. *Proceedings of the 2015 Conference on Winter Simulation*, December 6-9, 2015, IEEE Press, New York, USA., ISBN:978-1-4673-9741-4, pp: 3118-3119.
- Witkowski, K., 2017. Internet of things, big data, industry 4.0-innovative solutions in logistics and supply chains management. *Proc. Eng.*, 182: 763-769.
- Yaibuathet, K., T. Enkawa and S. Suzuki, 2017. Supply chain operational performance and its influential factors: Cross national analysis (global supply chain management). *J. Jap. Ind. Manage. Assoc.*, 57: 473-482.