Implementation of Agile Manufacturing for Thai’s SMEs

Nantawut Sriariyawat
Department of Industrial Engineering, Facility Engineering Sriracha, Kasetsart University Sri Racha Campus, Chonburi 20230, Thailand

Abstract. This paper purposes to explore the readiness of SMEs which can adopt agile manufacturing in Thailand. It needs to improve strategies for being agile based on the Agile manufacturing. The research method includes two main parts, documentary research, was used to understand agility in theories, and the survey which includes online questionnaire and semi-structured interview, was used to carry out the results in SMEs to implement agile manufacturing regarding three propositions, including identifying agility drivers, agility providers and to improve strategies for being agile respectively. Then, this dissertation aims to discuss and criticise the similarity and the gap between theories or case studies, which are mostly exemplified by the big companies’ cases, and the results obtained by the survey, which provided in the area of SMEs. The key results for the proposition one show that external pressures, such as customer expectations and time-based competitions were driving SMEs to necessarily adopt agility, whilst less a focus for internal pressures was determined. The summary for the proposition two is SMEs tend to have innovation, high-educated people and flat structure as competitive agility providers, based on the framework, whilst technology utilisation was less important due to top management’s point of view and financial resources limitation. Finally, the third proposition was examined and found that SMEs might develop possible strategies for adopting agile manufacturing, based on the findings, that leadership and employees’ attitude of changes acceptance should be firstly brought by motivation. Then, several recommendations will be stated respectively.

1. Introduction
There are many methodologies to be chosen and to lead to succeed in business, such as lean production, flexible manufacturing and agile manufacturing. In current market trends, companies need to thrive on uncertainty and unpredictability that have become major problems in these intense competitions [1]. As a consequence, many literatures believe that agile manufacturing is the powerful strategy in competing in this century and near future when the market has experienced turbulence [2-4]. Despite the fact that there are many components and strategies for building agile manufacturing enterprise which need to be addressed, some authors found that it hardy be able to utilize all of them to carry out the best result. Iacocca Institute (1991) introduced agile manufacturing, it includes three key concepts; workforce, management skill and technology. In present days, small and medium sized enterprises are being the majority part which driving economic growth [5]. The importance and existence of SMEs have been popularly mentioned for recent decades. However, most of literatures described and classified agile manufacturing with cases in large companies, whereas there are fewer articles investigating in the area of small and medium sized enterprises. Therefore, it might have some gaps between the big and small company to achieve successful agility since they are different size and have varied characteristics.
Eventually, the analysis of agile manufacturing’s strategies is needed to carry out in order to develop and overcome the limitation of previous success of SMEs.

2. Agile Manufacturing
Since the 20th century, global business will be driven by the power of customer’s orders, so companies might face tougher conditions than in the past [6-7]. Furthermore, customers want to be treated individually [8].

A number of studies compare and contrast agile manufacturing with other previous methodologies, such as lean thinking. However, agile manufacturing aims to be a new separate philosophy which can make different and be superior to others. Its concepts are different from flexible manufacturing or lean production [9] as it tries to develop and cooperate those previous techniques to gain better performance in this age of diverse markets [10].

Lean production is one of the most powerful concepts which aims to create product’s value, whereas trying to reduce costs caused by different types of waste, such as inventory and defect [11] however lean manufacturing may not bring too much success to a business when markets start being more turbulent [12-13]. Previously, the main competition was based on price but it now has been shifted to quality, speed to market and customer order fulfillment [3]. Agile manufacturing aims to compete in the fierce markets in 21st century [6]. A company which employs agile manufacturing with clear understanding will be able to gain competitive advantages in dynamic markets where customers’ needs always change [12]. An advantage of agile company is to be able to satisfy customer requirements quickly and to be a market’s leader who can explore a new market before other competitors do [7]. The characteristics of agility also create continuous learning environment in the workplace [12].

There are four main agility providers, including innovation, people, technology and organisation [14]. Innovation; Agile enterprises need flexible structure, responsive and efficient to continuously develop over time to survive in their environment changes and to be able to catch and adapt to their new markets by taking an interest to innovative [15]. Innovator can achieve competitive advantages by creating new products to the marketplace or transforming products from the original to be more attractive to customers [16]. While the main purpose of innovator is to differentiate itself by introducing innovative products, thus, the price could be increased and the low price market may not be the target group but niche market which requires high product’s quality. In order to become agile manufacturing enterprise, two key concepts are to gain abilities to explore new opportunities in the market and quickly launch the creation of new products for catching customer’s attention. Therefore, innovation might be a competitive capability for supporting companies which need to be agile. If the agile manufacturing enterprises purpose to achieve competitive advantages in the new market, they, therefore, might need innovation strategy to respond to customer requirements. Moreover agile companies need to make it faster than other competitors by delivering new products to customers which they could be attracted in customer’s point of view [17]. To gain innovation as a competitive ability is also including innovative process development [18-19].

Technology; The implementation of agile manufacturing needs new technology to be applied as a key role [20]. Information system and technology are considered as a competitive weapon which dominate agile manufacturer from others but it has to be integrated with workforce, organisation and innovation. One capability that company has to prepare to become agile is it needs to communicate and share information within short time [2,21]. Also, the Internet provides the communication for the whole supply chain that helps suppliers to be able to contact their end customers. As a result, the suppliers will perceive changes in the market earlier by the development of technology and infrastructure.

People; Agile firms should improve workforce’s quality, including well-trained, multi-skills, high level of motivation and job-rotation skill [12,22]. Also, people in the firm are an agile driving force who can be motivated and trained by their company. Therefore, top management should encourage and motivate their employees to involve with any activities through communication as it is a key to create new culture of responsiveness to changes [2,14,23]. The level of education among workforce significantly affects to productivity of companies [24]. The high-educated employees tend to bring
productive activities into the organisations. However, the level of education and other personal characters, including gender and age, are not notable factors that can measure employees’ reaction [25]. However, higher-educated employees work with high motivation compares to low-educated workers. Normally, high-educated staff members are always in higher position in companies and get paid higher than those with a lower educational level. Hence, higher-educated employees can utilise their knowledge, ability and creativity on their jobs much more than low-educated workers, thus they are motivated by higher income as a consequence [26].

Organisation; Abilities of agile organisation are to be able to adapt to changes, adopt continuous improvement, create learning environment and be flexible for all purposes [22]. The organisation which is willing to thrive on the current market conditions by the implementation of agile manufacturing should encourage workforce in every level to be involved. Corporate culture is an effective tool for creating innovation in SMEs. The importance of corporate culture is to share point of views among people in an organisation. Moreover, this could lead to shape the coherent policies for all level of employees in a company to have the same understanding [23]. A big company tends to be familiar with planning for the long term financial flow rather than concerning short-period capital investment as in a smaller firm case [27]. In other words, large companies could have enough funds to support their business more effectively, plus gain more financial stability than SMEs. Thus, the advantage of readiness of financial resources could provide opportunities for large manufacturers comparing to smaller sized manufacturers to be able to manage easier in their investment processes. In addition, to compare firms in these different sizes, SMEs tend to be more centralised in their structure and also when they make decisions. This because of the SMEs size is small and the different sectors can cooperate closely [28-29]. As a result, SMEs might not need too many people to get involve but the owners or top management.

Family business: SMEs issue

A large number of small companies are private and limited amount of shareholders, whereas larger firms might have more people to manage and run businesses. It often found that small companies were established by only a few founders. As a consequence, power of making decisions tends to mostly rely on the owners or top-ranked managers that could lead to high degree of centralisation of family firm’s system [30]. SMEs is the transition from previous generation to new generation. Owning to family business’s nature, it is widely open for family’s member to continue handling their parents’ firm as a new management team. This gap of different generation can cause both benefits and some problems in the organization. The difference of ages might result in management system. All family businesses inevitably involve with conflict [31]. This happens because of the relationship among family’s members that it is much more complicated than other connections. Family companies sometimes suffer from informal management that might involve with emotions much more than a rational [30-31]. There are two key issues; trust and affability that they might be prevailed when the transfer of power from founders to their heirs occurs within the companies [32]. Different perceptions between founders and their heirs who come to join the businesses always cause some problems [31-32]. Although senior managers, who are parents, have already transferred responsibilities to their children since they came into the company as a new manager, the young managers often said that they do not have full authorisation to manage their company in order to make decisions. Moreover, the new generation which needs to change internal systems cannot do it efficiently due to their parents’ resistance. This is because previous generation often believe in what they have done that it might be more suitable to their company than what their children are willing to change [32]. All issues about decision processes, due to transferring responsibilities from prior generation to next generation, might be questioned if it is clear enough that which one can be a real leader who brings the firm into its goals. The effective communication can help coping with problems within firms caused by conflict and emotional exhaustion among family’s members [31]. In contrast, familial conflict does not significantly impact on family business decisions processes.

3. Methods
The case study technique is the preferred qualitative research method for augmenting the authenticity of the assessment, and for analysing the qualitative research findings. Case studies are utilised as an extensive qualitative research method by scholars of various disciplines [33]. However, the case study is sometimes considered as a method to supplement other experimental techniques, or it is sometimes used for developing a self-sufficient approach to studying the social world, since the term case study has different meanings for different people [34]. A case study is an essential method to attribute research investigation, in order to apply particular contemporary phenomena to a real-life context. In other words, the case study method is an important approach, particularly in a research scenario in which the empirical investigation of the phenomena lies within a real-life context [35-36]. Conversely, the case study confronts a problem of negative judgment as the downgraded academic disciplines in utilising a social research approach.

Nevertheless, this negativity can be refuted by the use of reasonable, non-biased and accurate evidential demonstration as a means of diminishing the problem of scientific generalization that might be raised [34]. Six case studies of the Agile implementation were developed. All data were collected and conducted by close and open-end questionnaires and interviews. The target SMEs manufacturers were selected and covered each SMEs sectors in Thailand; Textile, Electronics supplier, Construction, Automotive’s supplier.

4. Result
As a result, agile manufacturing strategy is confirmed, that it can be applied in SMEs to cope with changes and uncertainty in the current and future markets. These dynamic factors are called “agility drivers” based on model [15]. Then, due to those drivers approaching SMEs, agility might be appropriate to work toward opportunities in the businesses.

Innovation; To follow an agile manufacturing concept, in order to be the first in the markets or to differentiate itself out of other competitors, innovative products need to be presented. Therefore, agile manufacturer can gain competitive advantages to seek for new opportunities in the marketplace when they have creative idea which can approach to real customer’s demand. Innovation can be obtained for companies which employ high-educated workforce as their majority of the people in the organizations. In contrast, companies which need a large number of low-educated employees but less high skill staff members tend to face problems owning to their workers’ attitude. Also, technology can help providing innovative processes within manufacturing companies as well. This is because human’s ability sometimes cannot reduce time to complete tasks as fast as technologies utilisation.

People; Workforce is seen to be a competitive capability of agile SMEs from top managers’ point of view. People with efficient abilities are a crucial prerequisite to successful agile manufacturing in SMEs. They can support agile manufacturing firms to gain short lead time and flexibility. Staff members in SMEs can develop their skills with positive attitude but this may happen only in medium up to high-educated workers. Meanwhile, low-educated employees tend to lack of owner mindset that would bring them to stop improving their performance. It results in company’s ability when it cannot be fully driven by human resources to deal with intense competition in the markets that business environments force firms to be adaptive. agile manufacturing strategy requires everybody to be involved, however it also needs people who gain high ability and multi-skills on wide range of job responsibilities. This implies that SMEs do aware of power of workforce that can generate opportunities to maintain competitive capability in the intense competition.

Technology; It can be seen that SMEs in several industries do not use technology as their competitive weapons but only do remain as tools they should follow other competitors in order to survive in the business. A main reason that small companies do not employ high technologies within their company is because to purchase these high capability machines or automation often requires large financial resources. SMEs perceive huge investment as a risk that they need to seriously concern and investigate for a long term benefit. Thus, small companies which might have limited fund are always familiar with short-term investment planning that they can obviously control and manage their profit margin in return. Thus, SMEs try to adopt labor-intensive rather than increasing expenditure on advanced automatic
infrastructure. SMEs tend to perceive human resources to be worth investing with more financial security in long-term benefit, although they have to spend for wages and training costs as well.

Organisation; To create agile environment, manufacturing companies which employ many levels of employees in different sectors would encourage cooperate culture to be intensified. Relationship between SMEs and their partners or suppliers might not be considered as a competitive capability as effective as larger firms due to lower level of benefit sharing. In addition, SMEs’ characteristic in making decision mostly set as centralisation system. In other words, the owners or top rank managers try to hold responsibilities as much as they can in an effort to bring highest effective company’s performance and lead to highest profits as well. Thus, it is a factor which opposes to agile concept that although people in every level can reach to each other that it is consistent with needs of high degree cooperation to be existed in agility, decision makers might be only owners or a few of top management. In all, finding in literature22, agility capabilities can be linked among their node. In other words, if one capability is being increased, other capabilities can be improved as well. To consider the results obtained by these interviews, they can confirm that the improvement of one agility provider can link to others as well. For example, a company which can improve its employees’ abilities and attitudes to have imagination, be enthusiastic and multi-skilled might be able to create innovative processes and products innovation. This is because innovation would be enabled by agile workforce. Moreover, technology development could also bring about a company to achieve the purpose of innovative strategy and customisation. In addition, it can confirm the framework that the integration of these four agility providers is needed for the implementation and development of the agile manufacturing strategy.

5. Conclusions
To improve strategies for adopting agile manufacturing in SMEs. It can obviously conclude that financial limitation is a significant barrier to improve agility in SMEs. It is inevitably involve with decision making for any circumstances, especially if those activity need long-term financial management, SMEs turn to be aware of investment that could be sensitive in risks. Therefore, according to information responded by participating Thai manufacturing SMEs, there are three potential strategic keys to be achieve agility to maintain competitive advantages in turbulent markets. The most important key to be agile is owners or top managers have to be enthusiastic about adapting strategies to suit to the market. Therefore, they need to except changes as the opportunity and find the way to be a winner rather than have the attitude that they can survive although they are working as the traditional style.

Innovation can be successful implementation in SMEs if they always gain high motivation for business achievement. Creativity can be more crucial factor than advanced technology to generate new opportunities in the marketplace by company’s itself. In term of “new opportunities” is not only focus on introducing new products to customers, it includes abilities of learning how to differentiate itself from other competitors and to be in dominant market position which customers easily recognise as reliable manufacturers and sellers. However, innovative ideas might be an effective component by everybody’s involvement because they need human’s imagination and inspiration to create unforeseen things. Therefore, it can help reduce pressures on financial limitation which is investigated as a small company’s disadvantage in comparison with larger companies.

The development of workforce’s skills and attitudes in every level from high level employees to low educated workers need to be simultaneously seized on by internal cooperation and outside resources. To improve human’s performance, companies have to take into account of training and learning environment implementation. The companies should try to encourage people to gain more knowledge and experience from real projects and also their colleagues who are skillful in both the same and different scope of work. Furthermore, top managers can provide their employees an opportunity to be educated from other sources which are outside the company, such as seminar.

Organisation can gain flexibility by creating corporate culture. This must require everybody to be participated and have good relationship among people in the company. This is because one of key components to adopt agile manufacturing strategy is to achieve high level of collaboration. Although
SMEs tend to face difficult problems in negotiation with their suppliers that can reflect to their relationship, it is worth beginning within their organization first.

SMEs clearly identify quick decision making as their advantages over larger companies due to flat structure. However, it could produce more flexibility in organisation if the owners or top management try to empower their people in some certain situations. In order to decentralise decision making, leaders should learn to trust their people who would be in reliable position. As a result, the top managers will not be overloaded with responsibilities and have more time to develop their company or deal with other serious problems.

Customisation can play a crucial role in current markets where customers need a variety of products’ features. Furthermore, SMEs might consider the ability to individually tailor products to meet customers’ demands that it can bring companies to access to new opportunities in the marketplace.

In short, although the framework of implementation of agile manufacturing in practices is mainly driven by external changes always call business pressures, this dissertation suggests that it should start thinking from inside company’s assets that are really existing. Then, analysis of strategies development can be adopted effectively since it is hardly possible, especially for SMEs which face various resources limitation, to take advantages from every prospect.

References

[1] Katayama, H., & Bennett, D. Agility, adaptability and leanness: a comparison of concepts and a study of practice. International Journal of Production Economics, 60,(1999) 43-51.
[2] Kidd, P.T. Agile Manufacturing: Forging New Frontiers. Great Britain: Addison-Wesley (1994)
[3] Sharifi, H. and Zhang, Z., Agile manufacturing in practice - Application of a methodology. International Journal of Operations & Production Management. 21(5-6)(2001), pp. 772-794.
[4] Naylor J.B., Naim M.M. and Berry D., Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain. International Journal of Production Economics. 62, (1999) pp.107-118.
[5] The Commission of the European Communities, Putting Small Businesses First Europe is Good for SMEs. SMEs are good for Europe, European Commission, Luxembourg.(2008).
[6] Iacocca Institute. 21st century manufacturing enterprise strategy. Lehigh University Bethlehem: PA (1991).
[7] Gunasekaran, A., Agile manufacturing: the 21st century competitive strategy. New York : Elsevier. (2001).
[8] Brian Maskell, The age of agile manufacturing, Supply Chain Management: An International Journal, Vol. 6 Issue: 1, pp.5-11 (2001).
[9] Büyükozkkan, G.; Kabraman, C. and Ruan, D. A fuzzy multicriteria decision approach for software development strategy selection. Intern. Journal of General Systems, 33: 2, (2004). pp 259-280.
[10] Gunasekaran, A., Tirtiroglu, E. and Wolstencroft, V. An investigation into the application of agile manufacturing in an aerospace company. Technovation. 22( 7)(2002), pp. 405-415.
[11] Womack, J.P. and Jones, D.T. Lean Thinking Banish Waste and Create Wealth in Your Corporation. 2nd Ed. New York: Free Press(2003).
[12] Sharp, J.M., Irani, Z. and Desai, S. Working towards agile manufacturing in the UK industry. International Journal of Production Economics. 62(1-2)(1999), pp. 155-169.
[13] Baker, J. Mastering management: less lean but considerably more agile, Financial Times, May 10(1996).
[14] Zhang, Z. and Sharifi, H. A methodology for achieving agility in manufacturing organizations. International Journal of Operations & Production Management. 20(4)(2000), pp.496 – 513.
[15] Vernadat, F.B. Research agenda for agile manufacturing. International Journal of Agile Management Systems.1(1)(1999) pp.37-40.
[16] Miller, J.G., Roth, A., A taxonomy of manufacturing strategies. Management Science
40(3)(1994), 285-304.

[17] Subrahmanya, M.H.B. Pattern of technological innovations in small enterprises: a comparative perspective of Bangalore (India) and Northeast England (UK). Technovation. 25(2005), pp.269280.

[18] Pett, Tim and Wolff, James. SME opportunity for growth or profit: What is the role of product and process improvement? International Journal of Entrepreneurial Venturing.(2009).

[19] Edwards JD, Wadley VG, Vance DE, Roenker DL, Ball KK. The impact of speed of processing training on cognitive and everyday performance. Aging Ment Health.(9)(2005). 262–271.

[20] Cheng K., Harrison, D.K. and Pan, P.Y. Implementation of agile manufacturing—an AI and Internet based approach. Journal of Materials Processing Technology. 76 (1-3)(1998). 96-101

[21] Sharifi, H. and Zhang, Z. A methodology for achieving agility in manufacturing organisations: An introduction. International Journal of Production Economics. 62(1-2)(1999). 7-22.

[22] Yusuf, Y.Y., Sarhadi, M. and Gunasekaran, A. Agile manufacturing: The drivers, concepts and attributes. Int. J. Production Economics. 62(1-2)(1999), 33-43.

[23] Yaw A. Owusu. Importance of employee involvement in worldclass agile management systems, International Journal of Agile Management Systems, Vol. 1 Issue: 2(1999). 107-115.

[24] Haltiwanger, J.C., Lane, J.I. and Spletzer J.R. Productivity differences across employers: The roles of employer size, age, and human capital. The American Economic Review. 89(2)(1999). 94-98.

[25] Tsui, A.S., Egan T.D and O'Reilly III, C.A. Being different: Relational demography and organizational attachment. Administrative Science Quarterly.37(4)(1992). 549-579.

[26] Yang, W. Work, motivation and personal characteristics: An indepth study of six organizations in Ningbo. Chinese Management Studies. 5(3)(2011). 272-297.

[27] Welsh, J.A. and J.F. White. A Small Business Is Not a Little Big Business. Harvard Business Review (July-August)(1981). 18-32.

[28] Blii, S., and Raymond, L. Information technology: Threats and opportunities for small and medium-sized enterprises. International Journal of Information Management. 13(6)(1993). 439-448.

[29] Gupta, M. and G. Cawthorn. Managerial Implications of Flexible Manufacturing for SMEs, Elsevier Advanced Technology, Technovation 16(20)(1996), 77–83.

[30] Morris, M., Williams, R., Allen, J., & Avila, R. Correlates of success in family business transitions. Journal of Business Venturing, 12(5)(1997). 385–401.

[31] Astrachan, J.H., and McMillan, K.S. Conflict and Communication in the Family Business, Marietta. GA: Family Enterprise (2003).

[32] Barnes, L. B., and Hershorn, S. A. “Transferring Power in the Family Business.”Harvard ... Family Business Review, 2(1)(1989). 17–29.

[33] Yin, R. K. Case Study Research: Design and Methods. Sage Publications (2009).

[34] Gomm, R., Hammersley, M. and Foster, P. Case Study Method. Sage: London (2000).

[35] Robson, C. Real World Research: A Resource for Social Scientists and Practitioner. Blackwell Publishing (2002).

[36] Gill, J. and Johnson, P. Methods for Managers. Paul Chapman: London (1997).