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Evaluating Learning Agility of Malaysian Engineers in Small and Medium Enterprises

Sakeshraj Narajah[a,b*], Abd Rahman N.F[a,c], Ashmimi M.A[a,c] & Ketang Wiyono[d]

[a]*Clean Energy Xpeditions Sdn Bhd.*

[b]*Centre for Engineering Education, Universiti Teknologi Malaysia*

[c]*Faculty of Educational Sciences and Technology, Universit Teknologi Malaysia*

[d]*Department Physics Education, Faculty Teacher of Training and Education, Sriwijaya University.*

[*]*Corresponding author: nfwahidah@utm.my*

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ABSTRACT

The Fourth Industrial Revolution (IR4.0) is driving significant technological transformations across industries, requiring engineers to adapt quickly. In Malaysia, policies such as Industry4WRD and the Malaysia Productivity Blueprint aim to facilitate industrial transformation at a macro level. However, their implementation at the micro level, particularly in Small and Medium Enterprises (SMEs), remains limited. Engineers in SMEs often struggle to keep pace with rapid changes due to limited exposure, training opportunities, and financial constraints. This study examines learning agility as a key factor influencing engineers' adaptability, focusing on four dimensions: people agility, change agility, result agility, and mental agility. A quantitative survey conducted among 207 engineers across Malaysia revealed that 55.56 percent exhibited high learning agility, while 44.44 percent fell into the moderate category. Among the four dimensions, people agility scored the highest, indicating strong teamwork, collaboration, and communication skills. Conversely, mental agility scored the lowest, highlighting challenges in critical thinking, problem-solving, and learning from mistakes. These findings suggest that while Malaysian engineers excel in interpersonal adaptability, they may require additional support in developing cognitive flexibility and analytical skills. To enhance engineers' adaptability in SMEs, targeted interventions such as specialized training programs, mentorship initiatives, and continuous learning opportunities should be prioritized. Strengthening learning agility, particularly mental agility, will be crucial for ensuring engineers are well-equipped to navigate the complexities of IR4.0. This study provides valuable insights for policymakers, industry leaders, and educators in fostering a resilient and agile engineering workforce in Malaysia.

Keywords: Industrial Revolution 4.0 (IR4.0); learning agility; SMEs

INTRODUCTION

History has proven that an industrial revolution is able to transform the industry, economy and all living aspects of human's life (MITI 2018). The fourth Industrial Revolution or Industry 4.0 (IR4.0) is the next stage of change that the engineers need to experience, especially in their working life and continuous professional development. The Government of Malaysia has designed the policies of Industry4WRD and Malaysia Productivity Blueprint, focusing on two core elements, which are humans and industry transformations (Prime Minister's Department 2016; MITI 2018).

Change is often associated with agility, particularly among engineers who must adapt to modern engineering practices. Ogburn's Cultural Lag theory posits that as

material cultures (technology) evolve; non-material cultures (engineers) tend to resist change temporarily (Ogburn 1966). In the context of social change, various social classes experience differing degrees of exposure to technological advancements, and the quality of technology influences employees' adaptation processes (Ogburn 1966; Nerre 2008; Liu et al. 2020). In Malaysia, engineers are employed in Multinational Enterprises (MNEs) or Small and Medium Enterprises (SMEs) (MITI, 2018). SMEs constitute 98.5% of the manufacturing sector and account for 42% of the Malaysian workforce (MITI, 2018). Yet, SME engineers experience slower social change than those in Mass Manufacturing Enterprise (MNE). According to Sameer et al. (2018), the SME workforce received limited training, financial aid and exposure to changing international standards less than MNE. Hence the SME workforce's change resistance is higher than that of the MNE workforce. These factors are known to produce barriers to social change among engineers. In this competitive era, SME engineers and employers both must seek out professional learning development or to create a new learning culture that encourages critical thinking and innovation. A supportive environment must also be established. With this interest, engineers' learning plays an important role in supporting organisational culture towards the achievement of organisational goals.

Engineers' learning, known as learning agility (LA) is linked to low productivity and inefficiency of employees even after training (Tripathi et al. 2020). Hence LA describes engineers' capacity to respond to the changes in the changing environments. Learning agility consists of four elements: people agility, change agility, result agility and mental agility (Howard 2017) with the conceptualisation of learning agility as an individual's learning experience (De Meuse 2017). The purpose of this paper is to explore and encapsulate the enablers that can facilitate engineers in the SME industry. This paper aims to analyze the engineers' learning agility to explain their readiness and adaptability to IR4.0, particularly within Malaysia's SMEs.

METHODOLOGY

PARTICIPANTS

This research uses the stratified random sampling technique, which is suitable for a large population, such as for this research to represent the entire country. This study was conducted in Malaysia, focusing on Malaysian engineers. A survey instrument was used to gather data on learning agility, organizational resources, and workplace practices. The survey was administered through Google Forms and distributed via WhatsApp and Facebook engineer groups. Additionally, company engineers were encouraged to share the survey with their colleagues. In total, 207 engineers participated in this study as shown in Table 3.

INSTRUMENTS

To analyze the engineers' learning agility to explain their readiness and adaptability to IR4.0, particularly within Malaysia's SMEs, this study will be using the Maturity and Learning Agility Level 4.0 (MLA) instrument, adapted from the Learning Agility Survey by Gravett and Caldwell (2014). Learning agility comprises four key constructs: mental agility, people agility, change agility, and results agility.

This survey categorizes competency into three levels. A low-level score below 18 indicates engineers who avoid activities that foster learning agility. A moderate-level score, ranging from 19 to 24, represents engineers who are open to promoting learning agility but lack the knowledge to apply it effectively. A high-level score above 25 signifies engineers who demonstrate a strong comfort level with learning agility (Gravett & Caldwell 2014). These constructs assess an engineer's current performance and potential based on their learning agility.

Table 1 below shows the distributions of questions according to the constructs.

TABLE 1. Survey Instrument

Learning Agility	Items	Characteristics	Example of questions Orientation
Mental Agility	1	Curious	If I hear an unfamiliar word in a conversation, I look up the meaning.
	6	Gets to root causes	
	8	Comfortable with ambiguity	I easily retain new information
	9	ty and complexity	I'm optimistic that I can learn new information.
	12	Finds parallels and contrasts easily	I don't make an effort to learn from my mistakes. RS
	20	Questions conventional wisdom	I understand the best approach for me to learn something new
		Finds solutions to difficult problems	
		Reads broadly and has broad interests	I do not enjoy assignments that force me to learn something new. RS

continue ...

... cont.

People agility	25 14 19 22 23 2	Open-minded and tolerant Self-aware communicator Comfortable with diversity and differences of opinion Can play many roles simultaneously Understands others and Politically agile	I enjoy working with others to try to solve problems. I seek out feedback on my skills and abilities I seek out people to learn about subjects outside my work field. I seek out people to show me ways to be more efficient and effective. I enjoy learning from others People seem to come to me when they need help solving problems.
Change Agility	4 5 7 11 13 16	Loves experimenting and trying new things Easily accepts challenges Accepts responsibility and accountability Introduces fresh slants on old ideas	I'm comfortable when circumstances that affect my work change. New experiences are not learning opportunities for me. RS I can deliver results amidst changing circumstances. I enjoy a change of pace in the way I do things I enjoy researching new information. I can put aside a project and switch to another when necessary
Results Agility	3 10 15 17 18 21 24	Builds high-performance teams Can achieve goals against the odds Has a tremendous drive to accomplish tasks Very flexible and adaptable Has significant personal presence	If I don't know the answer to something, I am comfortable asking I'm very logical when I solve problems I don't accept others' information at face value I find satisfaction in digging deeply into ways to solve problems If one problem-solving approach doesn't work, I move to another I can find a way to get things done, even when I don't have clear directions. I look for ways to use new knowledge

DATA ANALYSIS

Data analysis is fundamental as it involves converting the raw data into useful information. For the data analysis, this research will use descriptive analysis. Once the data are received, the researcher will upload the CSV format data to complete descriptive within SPSS version 18.9. Descriptive analysis is a statistic that includes the meaning, standard deviation and frequency (Salkind 2006). The demographic data will be collected and analysed using descriptive analysis to understand the population better. In addition, this study also measured mean and standard deviation to provide data of individually analysed scores to present the distribution and dispersion.

RESULTS AND DISCUSSION

DESCRIPTIVE ANALYSIS

Learning agility represents the potential of success among engineers in SMEs. The variables are agility, change agility, people agility and mental agility. As in past studies done by Lombarbo and Eichinger (2000), De Meuse et al. (2011) and DeReu et al. (2012), it focuses on general group of people in their sample and through this research, we managed to specific the focus of learning agility towards engineers. Statistical analyses were conducted to explore these survey questions. The first set of data collected will cover participants' background, including demographics, education, and socio-economic status as in Table 2 and Table 3. Following this, the survey findings on learning agility will be presented.

TABLE 2. The proportion of ages of males to females in all age groups

Gender	Frequency	Percent	Cumulative Percent
Female	31	15	15
Male	176	85	100
Total	207	100	

The proportion of ages of males to females was about 85% and 15% in all age groups.

TABLE 3. Location of respondents

Location	Frequency	Percent	Cumulative Percent
Johor	121	58.5	58.5
Kedah	21	10.1	68.6
Melaka	10	4.8	73.4
Negeri Sembilan	1	0.5	73.9
Perak	3	1.4	75.4
Pulau Pinang	12	5.8	81.2
Sabah	7	3.4	84.5
Selangor	12	5.8	90.3
Terengganu	10	4.8	95.2
W.P Kuala Lumpur	10	4.8	100
Total	207	100	

A total of 207 responses were collected from across Malaysia, following the sampling method recommended by Delice (2010). As shown in Table 3, all responses came from Peninsular Malaysia, with no participation from the Borneo region. Johor recorded the highest number of responses at 58.5% (N=121), while Negeri Sembilan had the lowest, with only one response (0.5%). The central region contributed 10.6% of responses, while the northern region accounted for 15.8%. Overall, the southern region, including Johor and Melaka, had the highest response rate, making up 63.3% (N=131) of the total responses.

TABLE 4. Education Level

	Frequency	Percent	Cumulative Percent
Diploma	21	10.1	75.8
Degree	136	65.7	65.7
Master	50	24.2	100
Total	207	100	

As shown in Table 4 all engineers working in SME factories hold at least a degree as their highest qualification, with 65.7% (N=136) having a bachelor's degree. This is followed by 24.2% (N=50) holding a master's degree and 10.1% (N=21) with a diploma. Although a PhD was an option in the survey, no respondents selected it.

TABLE 5. Board of Engineering Malaysia Membership status

	Frequency	Percent	Cumulative Percent
Maybe	13	6.3	6.3
No	123	59.4	65.7
Yes	71	34.3	100

Out of 207 engineers surveyed, only 34.3% (N=71) are registered with the Board of Engineers (BOE), as shown in Table 5. Despite BOE Malaysia recommending engineers to register, a significant 59.4% (N=123) of respondents have not become members.

As shown in Table 6, six questions were used to assess this variable. The highest mean score (4.26) indicates that most engineers enjoy researching and finding new information. However, on average, engineers do not strongly perceive new experiences as valuable learning opportunities, with a mean score of 2.89. The willingness to change projects when necessary, scored slightly above average at 3.8. Overall, 64.73% (N=134) of engineers demonstrated a moderate level of change agility, while only 32.37% (N=67) exhibited a high willingness to learn through research. This suggests that while many engineers are comfortable seeking new knowledge, they are less inclined to immerse themselves in new experiences, switch projects when needed, or embrace changes in their work routines.

For result agility, seven questions were used to assess this aspect. The highest mean score (4.39) indicates that engineers are highly willing to ask questions when they do not have the answers, with a standard deviation of 0.767. Additionally, they actively seek new methods to apply their knowledge and go the extra mile to solve problems. However, most engineers do not readily accept information at face value, preferring to verify or find answers themselves. The lowest mean score (2.8) reflects this tendency to question the information they receive. Based on Table 6, 81.16% (N=168) of respondents demonstrated a high level of result agility. This suggests that while engineers are open to seeking help, they often remain skeptical and prefer to validate information before fully accepting it.

In people agility, six questions were assessed, with Table 6 summarizing the responses. Most questions had similar mean scores, with the highest (4.46) indicating that engineers enjoy working with others to solve problems. The lowest mean score (4.02) reflects the extent to which others seek them out for problem-solving. According to the frequency analysis in Table 6, 59.42% (N=123) of engineers demonstrated a high level of people agility, while 40.58% (N=84) showed a moderate level. This suggests that more than half of the engineers enjoy teamwork, actively support each other in problem-solving, and seek knowledge collaboratively.

The final variable in learning agility is mental agility, which consists of six questions. Table 6 presents the mean, mode, and standard deviation for each item. The analysis shows that engineers are highly curious when encountering new information, with the highest mean score of 4.31, indicating their willingness to seek out meanings. However,

the data also reveals that most engineers do not actively make an effort to learn from their mistakes, as reflected in the low average score of 2.56. Additionally, many do not enjoy tasks that require them to learn something new. This suggests that while engineers are open to learning within their current projects, they are less inclined to embrace new projects that push them out of their comfort zone. Table 6 further indicates that only 19.32% (N=40) of respondents demonstrate a high level of mental agility, while the majority (N=164) fall within the moderate range. This suggests that not all engineers in this study are proactive in seeking out information they do not understand or making a conscious effort to learn from past mistakes.

Table 7 presents the overall distribution of responses across each construct of learning agility. The data indicates that 55.56% (N=141) of engineers exhibit high learning agility, while 44.44% (N=92) fall into the moderate category. When examining the constructs individually, the highest percentage of engineers demonstrating a high level is in result agility, whereas mental agility has the lowest number of high-level responses.

TABLE 6. Learning Agility Towards Engineers

Change Agility							
Questions	I'm comfortable when circumstances that affect my work change	New experiences are not learning opportunities for me.	I can deliver results amidst changing circumstances.	I enjoy a change of pace in the way I do things	I enjoy researching new information.	I can put aside a project and switch to another when necessary	
Mean	4.15	2.89	4.03	4.11	4.26	3.8	
Std. Deviation	0.752	1.382	0.713	0.71	0.73	1.047	
Result Agility							
Questions	If I don't know the answer to something, I am comfortable asking	I'm very logical when I solve problems	I don't accept others' information at face value	I find satisfaction in digging deeply into ways to solve problems	If one problem-solving approach doesn't work, I move to another	I can find a way to get things done even when I don't have clear directions	I look for ways to use new knowledge
Mean	4.39	4.25	2.8	4.21	4.09	3.95	4.35
Std. Deviation	0.767	0.627	1.309	0.671	0.903	0.82	0.604
People Agility							
Questions	I enjoy working with others to try to solve problems.	I seek out feedback on my skills and abilities	I seek out people to learn about subjects outside my work field.	I seek out people to show me ways to be more efficient and effective.	I enjoy learning from others	People seem to come to me when they need help solving problems.	
Mean	4.46	4.24	4.28	4.19	4.45	4.02	
Std.Deviation	0.621	0.659	0.0681	0.848	0.646	0.844	
Mental Agility							
Questions	If I hear an unfamiliar word in a conversation, I look up the meaning.	I easily retain new information	I'm optimistic that I can learn new information	I don't make an effort to learn from my mistakes.	I understand the best approach for me to learn something new	I do not enjoy assignments that force me to learn something new.	
Mean	4.31	4.12	4.24	2.56	4.3	2.48	
Std.Deviation	0.802	0.644	0.836	1.264	0.689	1.257	

TABLE 7. Learning Agility Level count

	Change Agility level	Result Agility level	People Agility level	Mental Agility level	Learning Agility level
High	67	172	123	40	114
Moderate	134	34	84	164	92

CONCLUSION

This study highlights the crucial role of learning agility in shaping engineers' adaptability to IR4.0, especially within Malaysia's SMEs. While macro-level initiatives like Industry4WRD and the Malaysia Productivity Blueprint provide a strategic direction for industrial transformation, their success at the micro level depends on engineers' ability to embrace technological advancements and continuously update their skills in response to evolving demands. The findings reveal that engineers excel in people agility, demonstrating strong collaboration and communication skills. However, mental agility scores the lowest, indicating difficulties in learning from mistakes, thinking critically, and adapting to change in unfamiliar or unpredictable contexts. Given that SMEs form a significant part of Malaysia's industrial workforce, targeted efforts such as specialized training programs, financial assistance, and greater exposure to emerging technologies are essential for improving adaptability. Furthermore, integrating soft skills development, such as creative thinking, adaptability, and emotional intelligence, into technical training moduls (Kumar et al. 2022) can reinforce mental agility among engineers.

Enhancing learning agility, particularly in mental agility, will be key to overcoming resistance to change and ensuring a smooth transition to IR4.0. Addressing these challenges will not only support individual engineers in their professional growth but will also strengthen Malaysia's industrial sector, driving long-term competitiveness and growth. This will drive long-term productivity, foster innovation, and improve global competitiveness in an increasingly digital economy.

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DECLARATION OF COMPETING INTEREST

None

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