Exploring the Role of Training Within Industry in Lean Manufacturing: Insights from High-Tech Enterprises through Bibliometric and Qualitative Approaches

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Abstract

In today's global manufacturing landscape, the race to implement lean manufacturing (LM) systems and achieve best production practices has grown increasingly intense. To adopt lean manufacturing, standardized training should be established. In our first study of bibliometric analysis, training within industry (TWI) has proven to be an essential element in maintaining lean manufacturing. In the second study, the researcher initiated J company's whole plant implementation for 3 years involving over 1,500 employees. Organized in-depth interviews with 10 members from top to bottom, including the factory director, production manager, production line shift/line leader, and operator. Using the theme analysis method to record and analyze the interviewers. Qualitative analysis demonstrated the actual situation of modern lean manufacturing enterprise training programs, and provides strategic suggestions for improving and standardizing the training program. Results suggest companies should not only measure the success of training by observing the production of products, but also pay more attention to the perceived experience of trainers and trainees to ensure that the company's training system can assist the adoption of lean manufacturing.

Keywords: Lean manufacturing; training within industry; whole plant implementation; qualitative research; bibliometric analysis

1. Introduction

Organizational structures around the world are becoming more homogeneous, which leads to increasing competition for achieving the best production methodologies between manufacturing companies. This competition has been steadily increasing in recent years, and the adaptation of modern technology applications has always been a challenge for these companies to rise to the top. One of these methodologies is the realization of lean manufacturing (LM) practices. Furthermore, lean technology has always been one of the main driving forces for achieving a sustainable operation. However, due to inadequate implementation factors, the adaptation of lean systems and practices becomes more challenging.

A. Lean Production

Lean embodies the concept of Industry 4.0, optimizing modern production systems. It provides a platform for Industry 4.0 operational excellence by integrating standardized processes and developing a culture of continuous improvement for the ongoing automation of traditional manufacturing practices. Lean manufacturing practices aim to consistently standardize and further optimize the value flow, which is critical for a business to thrive (Prinz et al., 2018). With this said, Lean overcomes many production barriers such as automation, customers, human resources, suppliers, and waste. and is considered an Industry 4.0 driving force.

Lean technology adoption is not a smooth process because the establishment of the culture demands the contribution of all the teams within the business. Resilience will always be a big factor in any change implementation. Therefore, it is necessary to establish concrete guidelines for the sustainable development of enterprises.

B. Training Within Industry (TWI)

Training Within Industry TWI was established in the middle of World War II, when there was a significant increase in production output to support the war efforts of the Allied Forces (Huntzinger, 2016). The TWI program was introduced by the USA. Following Japan's defeat in the war, it incorporated the program into its country's reconstruction plan (Džubáková & Kopták, 2015).

Moving forward, the massive TWI programs of Japan helped catapult them to become one of the leading countries in the world for lean manufacturing systems. This research investigates the effectiveness of TWI in the plastic molding and assembly industry. Training

Within Industry, more commonly known as the TWI program, presents as an essential tool in the lean practice (Institute, 2020). This program highlights hands-on learning and practice adoption, which has the goal to demonstrate leadership skills that are essential for supervisors, line leaders, and any other individual who works directly with peers. TWI is divided into four training programs, namely Job Instruction (JI), Job Relations (JR), Job Methods (JM), and Job Safety (JS). The training program has a proven method to generate positive cooperation between employees, improve supervisors' skills in training their team quickly and effectively, establish and maintain standardized work, improve methods used, solve complex problems in a timely and effective manner, and create a safe working environment.

With proper planning and layout, TWI allows the trainers to identify the employee's strengths and weaknesses in the selected job. This, in turn, will have a great impact on the company's growth in terms of implementing lean principles in a way that trainers can focus directly on the employees' skills that need improvement. On the other hand, employees will be able to optimize their working capabilities and capacity. The TWI program elevates all parties involved to a higher level of working capability. In terms of consistency, TWI planning ensures that the employees have a consistent background and learning experience. This is particularly relevant for the company's policies and standard operating procedures that need to be followed. All in all, one of the main targets of TWI planning and training is the increase in efficiency and productivity. The increase in these two aspects will ensure a company's overall product turnover and potential market share (Džubáková & Kopták, 2015).

C. Research motivation

With the rapid expansion of manufacturing industries towards Industry 4.0, a great deal of effort should be made to harness the potential of the younger generation and prepare them for the new industrial world. According to the Ministry of Economic Affairs, R.O.C. (MOEA), as of 2020, there is a total of 1,391,420 small to medium enterprises (SMEs), which account for 97.65% of all enterprises in Taiwan. This shows the absolute importance of the role of SMEs in Taiwan's economic position. Although there is an ever-growing advancement when it comes to industrial technology, the importance of manpower still plays a critical role in the survival of a company. Therefore, one of the most critical roles that leaders play is the training and development of their employees (Perini et al., 2017). This raises the motivation to conduct research on the effectiveness of industry training programs.

D. Research Question

For the organization to have a successful lean journey, the stakeholders must be able to have a clear plan for implementing training for standard work. This is where TWI plays a critical role. The TWI program is one of the foundations of standard work (Institute, 2020). Moreover, when evaluating the effectiveness of any training programs, an evaluation of concrete evidence of results is necessary. The most common source of this evidence is the financial and productivity impact on the business. However, the perceived results on the side of the employees and trainers are commonly overlooked. We therefore proposed two research questions.

Research Question 1: What are the factors influencing the quality of training for the leaders who planned the TWI program, the trainers implementing it, and the employees who undergo the training?

Research Question 2: What are the perceived results of TWI training from the side of both the trainers and trainees?

II. BIBLIOMETRIC REVIEW

A. Literature Selection

To establish the research gap and strengthen the arguments of this research, a purposive sampling methodology was used as part of the literature gathering. The articles were carefully selected from various well-known and certified journals (Chang & McAleer, 2013). Using the SCImago Journal (2020) & Country Rank Portal. The criteria for selecting included 2 phases; the first phase was that the researcher considered the ranking of the journals provided in SCImago. In total, 58 articles from 21 journals were clustered and subjected to further analysis. These 58 journal papers are distributed in 20 countries. Although Lean methods have ensured sustainability, in reality, there is still an existing potential to extend applicable metrics to enhance the effectiveness of manufacturing systems (Huntzinger, 2016). This is where TWI comes in and fills in the gap.

B. TWI in the Lean Manufacturing Practice

This research collects 58 journals related to lean manufacturing and implementation from 1995 to 2019. After comparing and analyzing the literature, it is found that industry training is particularly important when implementing lean manufacturing. Most of the 58 articles mentioned the importance of training in the industry. However, there is a lack of exploration to actually establish the training process in the industry. Therefore, based on the literature

analysis of these journal articles, researchers believe that the establishment of a training process in the industry is a very important opportunity, which can be implemented in different studies or case studies. Table 1 shows the annual distribution of journal sources used for research. Then the article is further divided into four parts. They are job instruction (Ji), job safety (JS), job relationship (Jr), and job method (JM).

Table 1: TWI Opportunities by Year Cluster

NO. OF TWI OPPORTUNITIES					
TWI\Year	1995 - 2000	2001 - 2005	2006 - 2010	2011 - 2015	2016 - 2019
Job Instructions	5	8	6	8	9
Job Methods	4	1	2	3	8
Job Relations	1	1	3	6	3
Job Safety	1	0	1	2	2

The above four parts of job training have different functions, but have a single goal: to use standardized training methods to achieve sustainable development. Lean production requires consistent attention to eliminating the layers of waste that are not easily seen in production lines. To do this, it is required to have basic knowledge and implementation of practices in technical processes control, product design, manufacturing planning, human resources, and customer relationships. Many kinds of literature have highlighted the successful execution of lean tools and practices in various manufacturing companies. As per the study of Kafuku (2019), about 31.6% of manufacturing companies in India implemented the principles of lean manufacturing. This led to their ongoing and continuous success in the industry. TWI has an integral role in sustaining lean manufacturing initiatives. It provides the personnel with the proper skillset needed to establish a culture of change, achieve the successful setup of standard work, establish a Kaizen framework, and simplify methods resulting in better production processes (Institute, 2020).

C. Literature Findings

Figures 1 and 2 illustrate the breakdown of 58 articles based on the training mentioned or implemented. Figure 2 shows the comparison of the four types of industry training in each year. If the 58 journals are classified by year, it is clearer and easier to explain. From Figures 1 and 2, it can be observed that the frequency of training for job guidance is higher than for other training opportunities. This is one of the reasons why this research hopes to focus on the integration of work instruction and training programs. The program is mainly focused on EHS or environmental health and safety, which provides a framework of strategies for supervisors and managers to engage employees in identifying and recognizing potential risks and hazards so that a contingency plan may be put in place.

Figure 1: TWI Integration Division

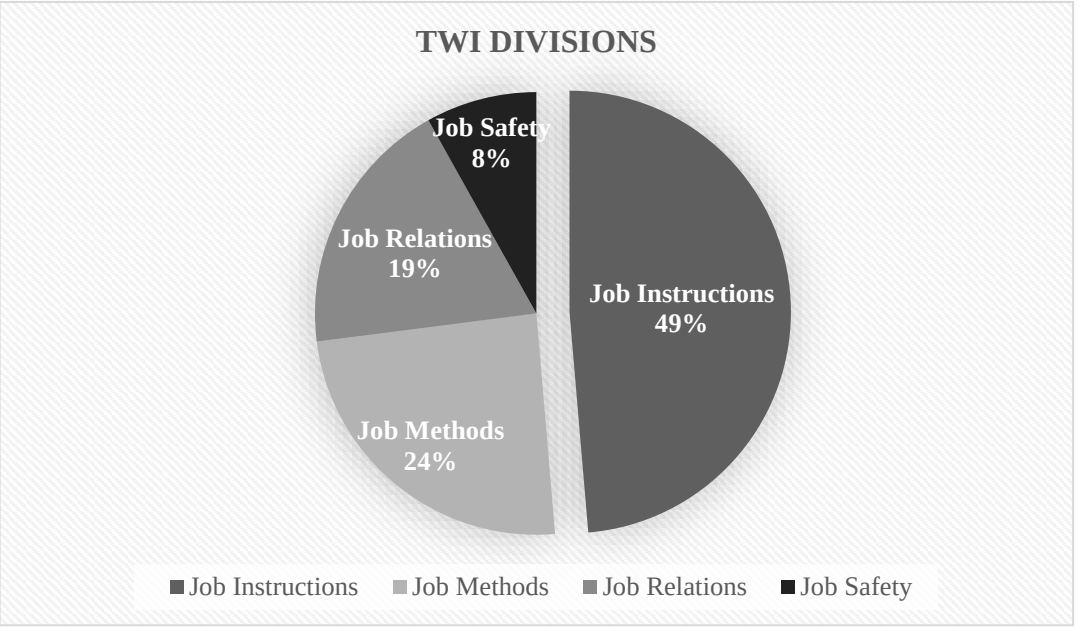


Figure 2: Application of JI, JM, JR, and JS Comparison

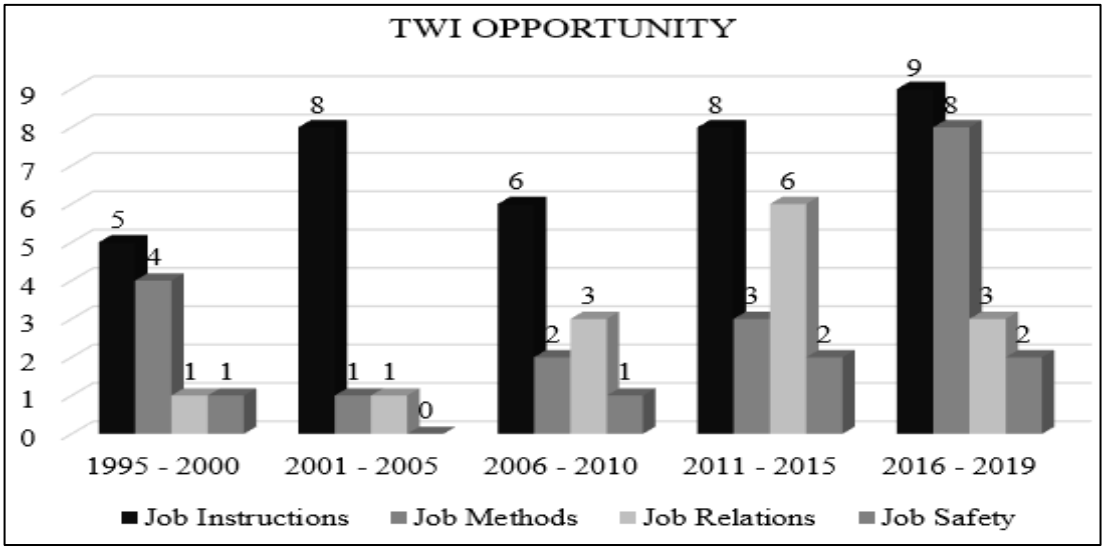


Figure 2 illustrates the division of training projects in the industry, which is applicable to 58 articles and documents collected. Among the 58 articles, the opportunities for job safety training are the least. According to the analysis, the article rarely talks about security and mainly focuses on improving methods and implementation. On the other hand, the concentration of work instruction training is the highest, as high as 49%. As mentioned earlier, articles on lean principles and manufacturing focus on solving existing problems or

innovating to reduce anticipated risks.

The Job Instruction training program was developed to address the issues brought about by the switch of TWI's focus from aiding the war efforts to establishing a Kaizen culture. With the steady increase in production demand paired with the decrease in experienced employees, recruitment and training became a critical factor for the survival of companies. This is the point where TWI introduced the program Job Instruction to alleviate the growing problem. Using Allen's four-step method as the foundation of the training program, Job Instruction became one of the most well-known and widely used training programs in the industry. Most of them are concentrated in the manufacturing industry, as shown in Table 2.

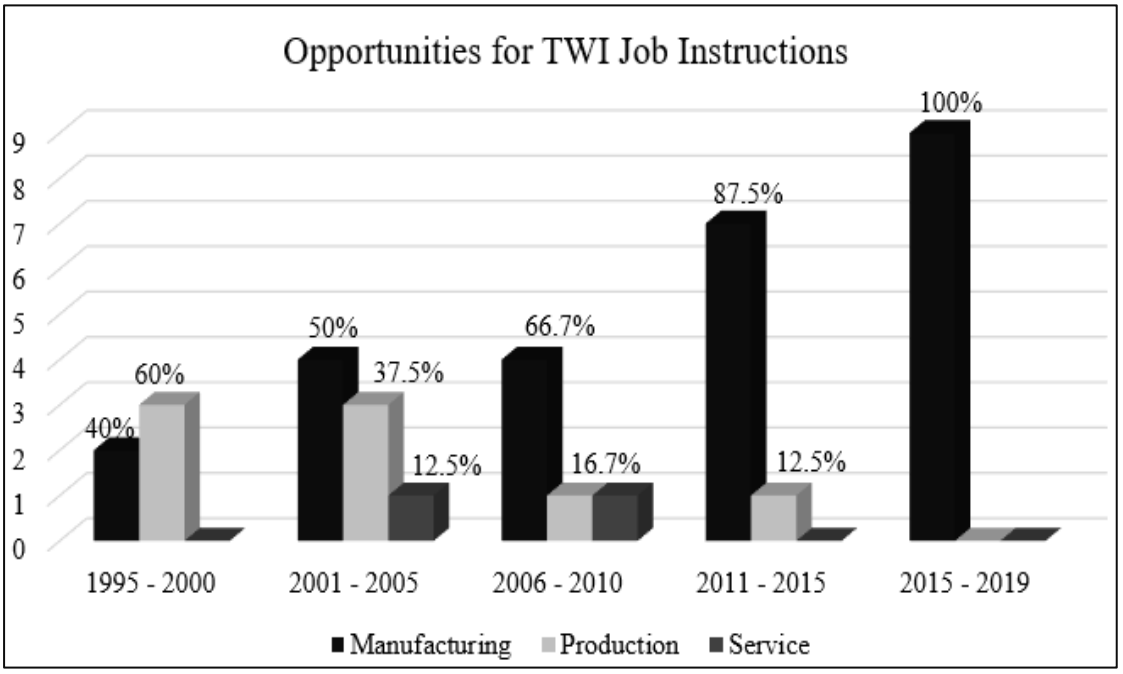
Table 2: TWI JI opportunities in different industries

Year/Industry	Manufacturing		Production		Service	
	Articles	Percentage	Articles	Percentage	Articles	Percentage
1995 - 2000	2	40.0%	3	60.0%	0	0.0%
2001 - 2005	4	50.0%	3	37.5%	1	12.5%
2006 - 2010	4	66.7%	1	16.7%	1	16.7%
2011 - 2015	7	87.5%	1	12.5%	0	0.0%
2016 - 2019	9	100.0%	0	0.0%	0	0.0%

D. The Research Gap

With the steady growth of production demand and the rapid development of manufacturing technology, it is now more challenging than ever before and is required rapidly. The mission of the industry training program is to ensure that the company adopts lean manufacturing. Based on the analysis of 58 articles from 1995 to 2019, which focused on the training plan for the lean manufacturing industry, 49% of the 58 articles mentioned the importance of a training guidance plan, but did not mention the establishment process in actual enterprises. It can be seen from Figure 3 that work guidance training in the industry is widely mentioned, but for practitioners, there is no actual operation process. This urges researchers to further explore and try to establish industry training programs, especially work guidance-related training. In the past, work guidance-related training was not regarded as a standard training program for lean manufacturing. Therefore, this study implemented the industry work guidance training program in the whole factory of J company, and conducted qualitative interviews with stakeholders of lean manufacturing to solve this literature gap.

Figure 3: Opportunities for job coaching and training in the industry



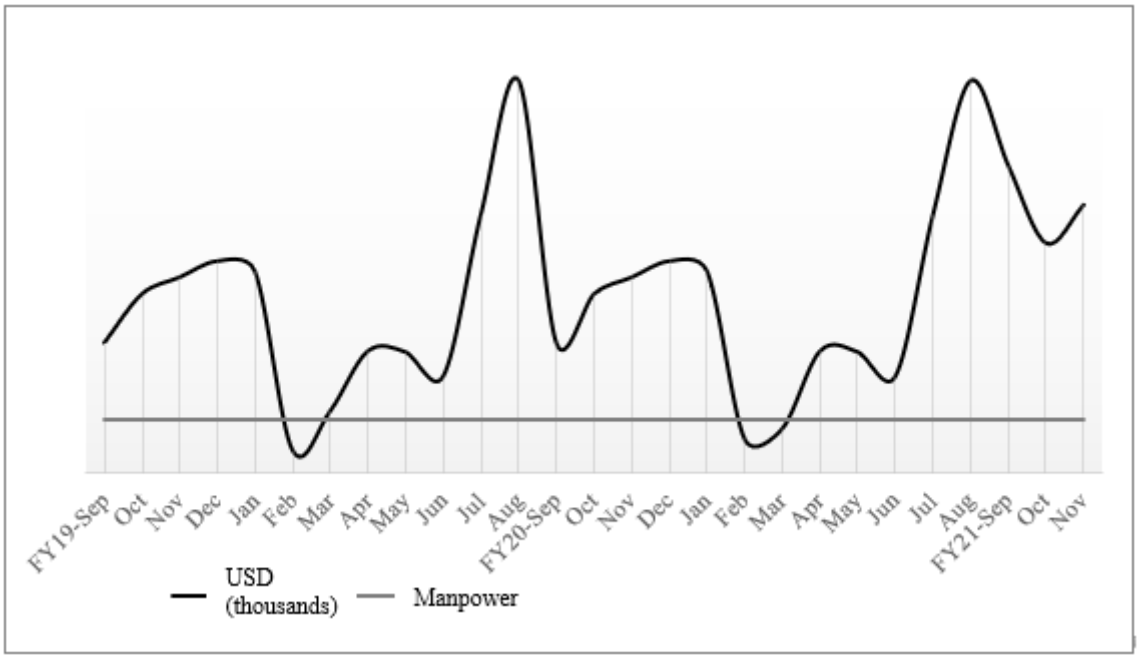
E. TWI Programs

Established in 1966, J Company is one of the world's largest electronics manufacturing providers with more than 180,000 employees worldwide. Figure 4 demonstrates that the turnover of the US Taiwan branch company J company fluctuates drastically, and the gap with basic manpower is quite large. It can be seen from the curve chart of J company's turnover and manpower demand that in response to this kind of high and low curve demand, industry training will affect the determinants of production ramp and yield improvement. Therefore, the long-term need is to rely on dispatched employees to adjust the gap between turnover and basic manpower; however, a large number of dispatched employees need a complete industry training system, so that dispatched employees can quickly achieve the enterprise's lean manufacturing standards.

Now more than ever, with the steady increase in production demand and the fast evolution of manufacturing technologies. The TWI Program plays a critical role in ensuring a company's survival and capability to be on top of its game. From the analysis of 58 collective articles from the year 1995 to 2019 that particularly talk about training programs in the lean manufacturing industry, 49% or 36 out of the 58 implement the TWI Job Instruction program but are not aware of or do not mention its use in their research. This prompted the researcher to investigate further and concluded that TWI programs, particularly Job Instruction training,

do not have the proper recognition to be identified as a standard training program in the lean manufacturing industry. This research addresses the gap by performing a qualitative interview with lean manufacturing stakeholders after the implementation of the TWI Job Instruction training program.

Figure 4: J Company's turnover and headcount



The J company TWI programs were modeled following Allen's four-step method. Which is more famously known as the "J" programs for training and development (Huntzinger, 2016). The 4 steps include preparation, presentation, application, and testing. The steps are interconnected, and each step is completely dependent on the previous one. On every step, TWI work guidance is prepared. Job instruction (JI), Job Methods (JM), Job Relations (JR), and Job Safety (JS) that follow the standard training method. The PDCA cycle in Table 3 ensures a standard implementation of the training, while a scientific method is produced as a basis for the procedure.

Table 3: TWI 4-step learning process

4-Step (Charles Allen)	TWI				PDCA Cycle	Scientific Method
Learning Process	**Job instruction (JI)**	**Job Methods (JM)**	**Job Relations (JR)**	**Job Safety (JS)**		
Preparation	Worker Preparation	Job Breakdown	Fact-Finding	Identify possible risks	**Plan** – Observe data and identify possible scenarios.	Observations and identification
Presentation	Operation Presentation	Detailed Questioning	Analysis and Decision	Layout countermeasures	**Do** – Identify the problem and feasible countermeasures	Hypothesis formulation
Application	Performance Try out	New Method Development	Implementation	Countermeasure tests and application	**Check** – Test the countermeasures and analyze results.	Layout predictions from the hypothesis
Testing	Follow Up	New Method Application	Result Review	Result Review	**Act** – If successful, layout standardization plan	Try out predicted scenarios by experimentation

Figure 5: TWI job instruction procedure for J company

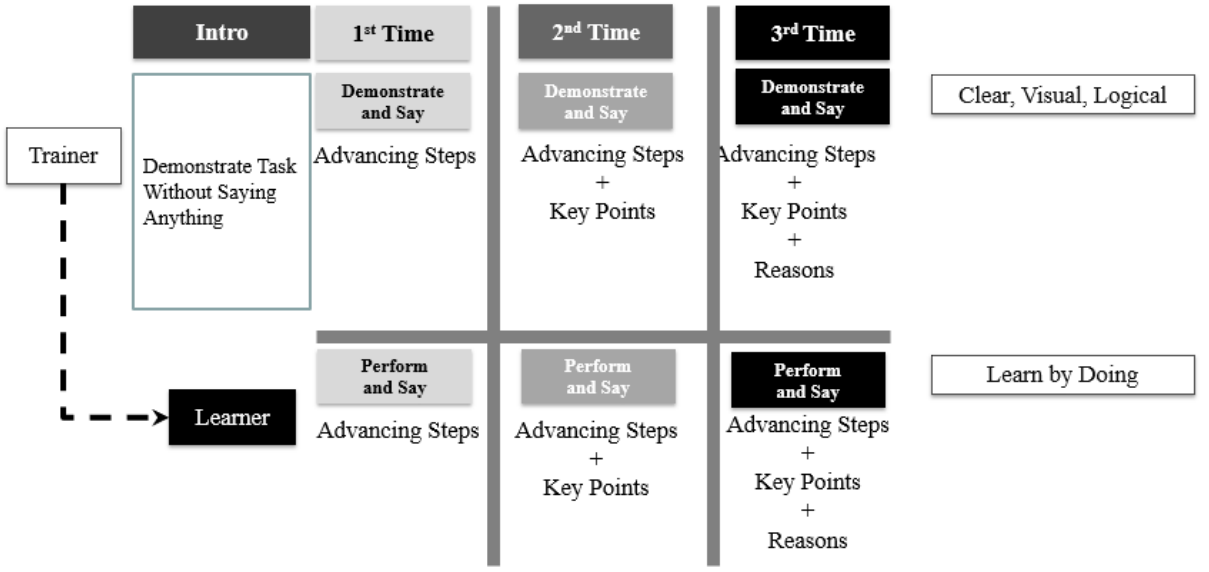


Figure 5 illustrates the TWI JI implementation procedure for J company. This study highlights the use of the TWI Job Instruction training program in a plastic molding and assembly factory. The figure illustrates the implementation procedure for JI training. Both the trainer and the trainee are responsible for the outcome of the activity. For every step of

the training, each person is assigned to an individual but connected job. This procedure revolves around the repetition of steps introduced by the trainer. The trainer's job is to show the specific task performed in a clear, visual, and logical manner, with each step introducing a new form of instruction. On the other hand, the learner must exhibit his/her learning by repeating the tasks shown.

III. METHODOLOGY

A. Research Design

This research incorporates the use of semi-structured interviews with employees, which includes all the stakeholders from senior management to operators. The techniques used elicited responses on factors influencing the effectiveness and the respondents' perceived effectiveness of TWI training.

B. Participant Selection

To have a wholesome view of the entire system, this study considered all the stakeholders involved in a plastic injection molding and assembly factory, from the top-level management to the direct laborers themselves. There were no exclusion criteria considered. It is also important to mention that the company conducts TWI JI training regularly. This means that the entire population has either knowledge or previous experience in implementing the TWI JI program.

Participants for the research were selected using homogenous purposive sampling described in Etikan et al. (2016), to include managers and employees across different training locations. This approach focuses on the samples' precise similarities in job classification and experiences that give a homogenous population. Using this sampling method, the researchers were able to select the participants in terms of their occupation and job experiences, particularly in the TWI JI training received.

C. Data Collection

This qualitative study conducted in-depth semi-structured interviews to have a better look at the employees' perceived and actual experiences on TWI JI training. The interview structure was developed using a comprehensive literature review (Gale et al., 2013; Lohmer & Lasch, 2020; Nordin et al., 2010; Skinner et al., 2019) with inputs from the company senior managers and TWI trainers. Written consent was provided by the participants before the interviews began. Three pilot interviews were conducted to develop a finalized version of

the interview guide.

Interview questions are focused on the employee's (1) knowledge about standardized training, (2) approach to learning, (3) knowledge retention strategies, and (4) training experience as a whole. Major interview questions below are stated in accordance with comprehensive literature (Kafuku, 2019). Each interview was conducted individually in a private meeting room, which took about 30 to 40 minutes. The interviews were audio-recorded and transcribed by the author verbatim.

D. Qualitative Data Analysis

The qualitative data from open-ended responses in the semi-structured interviews were processed using Thematic Analysis. To produce more accurate themes, each dataset was analyzed twice (individually and as a whole). This follows the research of Smithson (2000). In the analysis, the attention was focused on the two research questions, which particularly seek to understand the effectiveness of TWI JI and the training quality perceived by the employees. This analysis, therefore, focused mainly on the content and the dynamics of interaction between the interviewer and the respondent. The interview participant profile can be found in Table 4.

Table 4 Interview participant profile

Study ID	Assignment	Occupation	Yrs. Of Experience	Training Received	Expertise
A1	Assembly	Manager	30	TWI JI	Processing and assembly
A2	Assembly	Assembler	7	TWI JI	Burr removal processing and assembly
A3	Assembly	Assembler	3	TWI JI	Burr removal processing and assembly
A4	Assembly	Inspector	5	TWI JI	Final inspection and equipment operation
M1	Molding	Deputy Director	30	TWI JI	Plastic Injection Molding
M2	Molding	Supervisor	10	TWI JI	CNC processing
M3	Molding	Line Leader	10	TWI JI	Tool development and automation design
M4	Molding	Line Leader	5	TWI JI	Injection Molding and machine operation
M5	Molding	Operator	3	TWI JI	Injection Molding and machine operation
M6	Molding	Inspector	3	TWI JI	Final inspection and equipment operation

The sample size (n=10) for the interview was determined and sorted in accordance with the literature review summarizing all the stakeholders. Furthermore, the homogeneity of the responses has indicated a thematic saturation (Ando et al., 2014) with the absence of site-specific themes. All personal details from the participants were anonymized. Thematic analysis was conducted, and descriptive coding (Gonzalez, 2016; Hashimov, 2014; Vaismoradi et al., 2016) was performed by the researcher independently to locate similar ideas and significant concepts that came out in the interview. The codes were then categorized into themes that merge redundant ideas and eliminate unnecessary content.

IV. RESULTS AND DISCUSSION

A. Thematic Analysis

Pilot Test

To optimize the interview guide, Table 5 represents a pilot study conducted on three employees on a different assignment: A1, M2, and M5.

Table 5: Factors Influencing TWI JI Program Effectiveness

Factors Influencing TWI JI Program Effectiveness (Trial Run)				
Themes				
1	2	3	4	5
Learn by doing	Trainer-trainee relationship	Specified Training Issues	Monitoring and Auditing	External Factor
Action repetition	One-on-one training	Equipment function	Production goals	Government regulations
Action observation	Teaching method	Repairs	Customer audit	Customer special requests
Trial runs	Knowledge transfer	Time constraint	supply and demand	Customer demand
Training phase	Mutual perception		Trial progress	Company culture
Training goal	Trainee feedback		Data Management	Manpower management
Awareness			Internal audit	

From the pilot semi-structured interviews, five major themes make up the initial analysis. A total of 25 codes that describe factors influencing the TWI JI program effectiveness were

identified. The themes presented came about by analyzing the interview transcript verbatim, highlighting repeated words, stressed descriptions, and the total time the participant spent talking about a specific topic.

Final Thematic Codes

After the interview, trial runs, and initial coding, the researcher found that the questions are sufficient and can represent the research goals set in this investigation. Therefore, interviews were carried out with the 10 employees who were strategically selected to represent the whole population. With the initial codes, there were a total of 4 themes that were made up of 22 codes in Table 6. These codes will undergo the second stage of thematic coding, which is sorting and organizing to develop better themes and remove redundancies.

Table 6: Initial coded themes

Factors Influencing TWI JI Program Effectiveness (Initial Codes)			
Themes			
1	2	3	4
Learn by Doing	Trainer-trainee relationship	Specified Training Issues	Monitoring and Auditing
Action repetition	One-on-one training	Equipment function	Production goals
Action observation	One-to-many training	Machine repair time	Customer audit
Trial runs	Knowledge transfer	Assembly time	supply and demand
Training phase	Mutual perception	communication	Trial progress
Training guide	Trainee feedback	language	Data Management
Awareness			Internal audit

The second stage of coding involves sorting out and refining the initial codes. This stage removes redundancies and compiles similar ideas within the interviews into clearer or more understandable themes. The researchers ended up with 3 main themes (Table 7), which showcase the factors that influence the effectiveness of the TWI JI program being implemented in a plastic injection molding and assembly factory.

Table 7: Final coded themes for factors influencing the effectiveness of TWI JI

Factors Influencing TWI JI Program Effectiveness (Final Codes)		
Themes		
1	2	3
Training Method (190)	Training Challenge (146)	Monitoring and Auditing (62)
TWI specific guides (56)	Learning environment (36)	Adherence to SOP and SIP (33)
one-on-one training (53)	Instructors' teaching method (52)	Meet production goals (29)
one-to-many training (29)	language barrier (23)	
online courses (52)	time constraint (35)	

(#) Number of interview mentions and stressed ideas.

Figure 6: Frequency of theme reporting

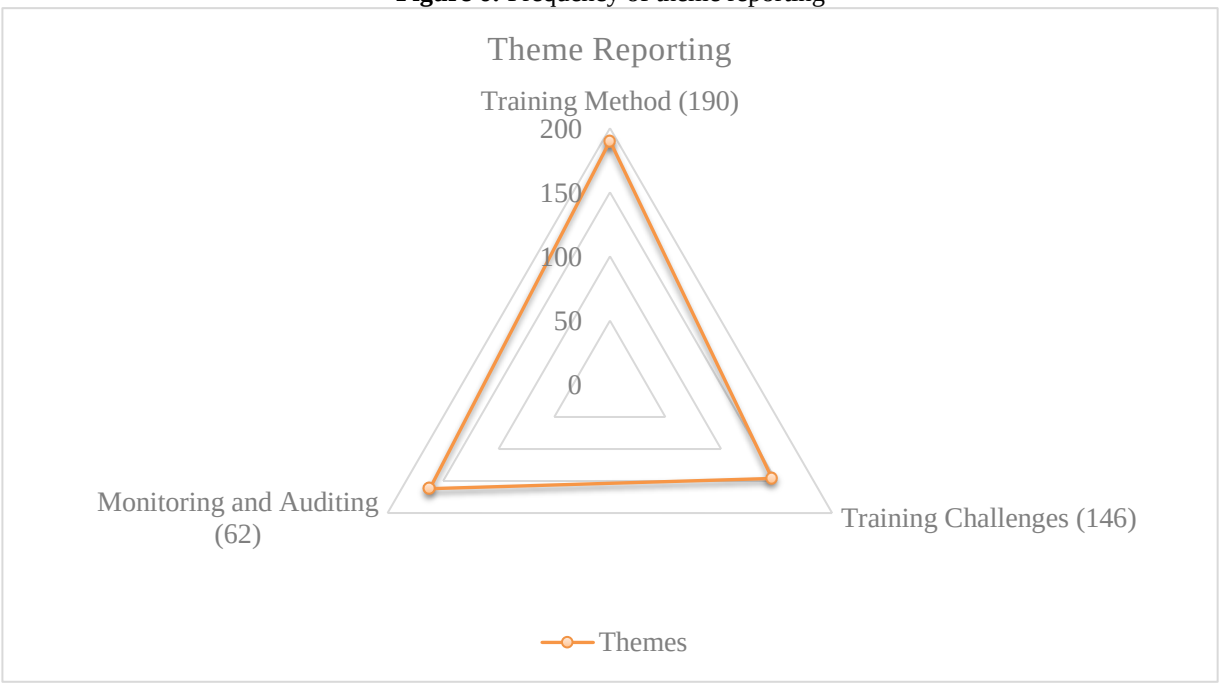
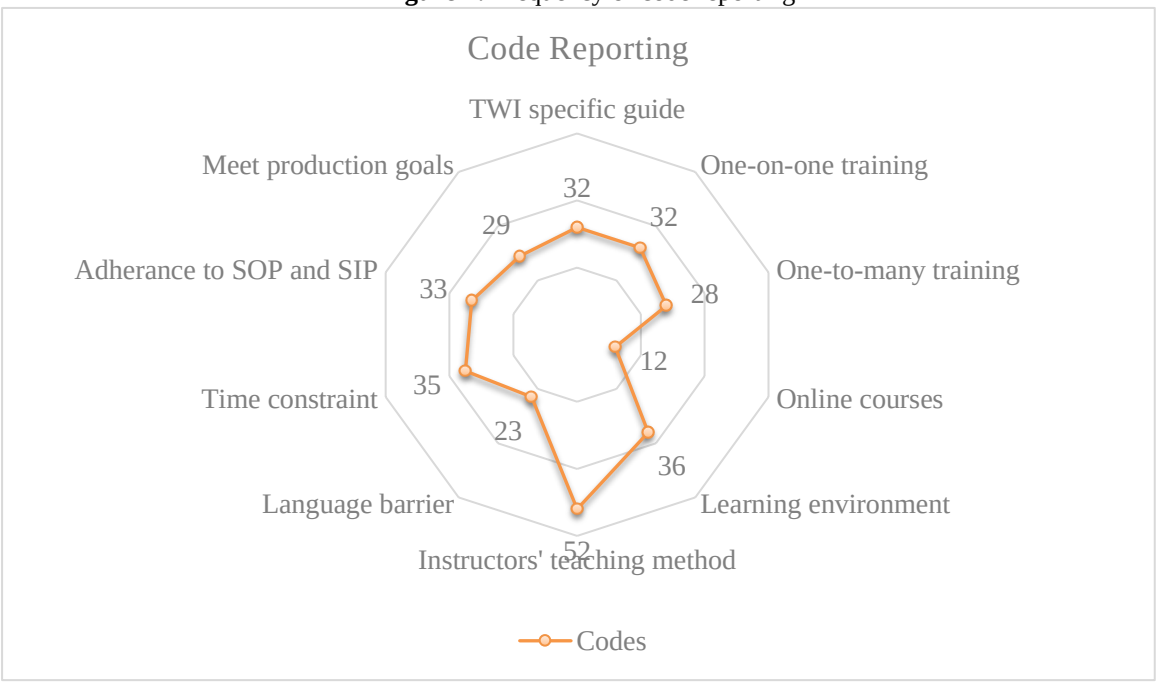


Figure 7: Frequency of code reporting



A total of 10 participants participated in a semi-structured interview conducted at the factory. After sorting and cleaning out redundant and misleading codes, there were a total of 3 main themes that ultimately gave light to the factors influencing TWI JI effectiveness from the employee standpoint.

Theme 1: Training Method

The training method was indicated to be the theme that was mentioned the most within the interviews, with a total of 190 mentions/ideas stressed. TWI-specific guide tops the list of training methods with 56 mentions. Most of the participants stressed the importance of the TWI guide as an integral part of employee training. Sample respondent verbatims are as follows:

"The TWI guide is very important for me as a line leader because it guides me on the proper way of training my people and helps us to have a clear definition of training goals."

"I have been an operator for more than 5 years, and continuous TWI training helps me improve the skills needed to perform my job."

"I want to stress that in this company, the TWI training guide is an integral part of the training programs as it guides our employees to perform their job in a faster and more

efficient way, which ultimately leads to better and excellent quality production."

Respondents also stressed their preference for one-on-one training, which is also a technique under the TWI JI training program. TWI JI focuses on implementing training that would shape the leaders to become more effective and efficient in transferring knowledge. This includes one-on-one training that, in this company's case, has proven to be very effective. In addition to one-on-one training, the use of one-to-many training is also a part of the regular TWI training program in the company. This is in the form of training in the classroom to set the trainees' training foundations, such as the explanation of basic concepts and terminologies, safety procedures, and familiarization with the SOPs and SIPs.

Theme 2: Training Challenges

On the second theme, the participants talked about what they think would be their issue and experienced difficulties during the training. The code that they frequently mentioned was the instructor's teaching method for the training procedure. Before the training even started, respondents wanted to know the flow of the training so that they could have a clear idea of what to expect during and after the TWI training began. Sample respondent verbatims are as follows:

"After understanding the TWI training procedures, it looks very straightforward and easy to follow. However, I am worried that the teacher will not be able to deliver the kind of training that I expect."

"I think the most important part of the training is how the teacher delivers the training program. It will depend on the teacher's expertise and his ways to communicate and build a relationship with the trainee."

"Having the right tools and using them well will have a great influence on the training. If the teacher can't properly communicate with the trainee, then the training will absolutely fail.

Further, the respondents also repeatedly talked about the learning environment. This pertains to the physical condition and the equipment condition of their training location. They have mentioned that this could also significantly affect the trainee's ability to absorb knowledge.

In this factory, a significant percentage of the employees are foreigners, of whom the majority are Vietnamese. Therefore, the respondents also stressed their concern about the

language barrier. Although most of the respondents do speak and write in Mandarin, most of them preferred to have the training guides translated into their own language. This is for them to have a better understanding and to clearly follow the training, particularly the TWI JI training guide.

Time constraint was also a major concern for the respondents. The total population not only includes new employees but also experienced employees; therefore, they have other duties to perform, which means that time is an essential consideration. Respondents mostly worried about having to extend training that could overlap with their main job.

Theme 3: Monitoring and Auditing

The third theme is monitoring and auditing, whether internally or externally. The most important code that the respondents frequently talked about was the adherence to or following the standard operating procedures (SOP) and standard inspection procedures (SIP). Sample respondent verbatims are as follows:

"The company has a very high reputation for product quality; therefore, we are very strict on our standard inspection procedures (SIP)."

"We need to work hard to maintain the product quality by continuously improving our inspection procedures and optimizing our procedures. Our SOPs and SIPs are regularly revised to make sure that we comply with the internal and customer audit."

"As employees, we always make sure to follow the operating procedures not only to have better productivity but also to keep us safe from the hazards of work, which are constantly present. I think this company does a good job in auditing and making sure that their employees are safe and productive by continuously updating and optimizing operating procedures."

Due to strict company regulations on employee safety and product quality, respondents repeatedly mention that their major concern is achieving production goals and balancing quality and quantity.

V. CONCLUSION AND IMPLICATIONS

A. Conclusion

The TWI program is undeniably one of the most effective training programs that could shape employees to be an integral part of the company's ecosystem. In this study, based on the literature analysis of 58 papers in 21 extinguish journals, the researcher then initiated the whole plant implementation of lean manufacturing starting from 2015 until now, followed by qualitative in-depth interviews, and thematic analysis research methods were applied to explore the effectiveness of TWI training in a manufacturing setting from the employee point of view.

Based on the thematic analysis, this research identified factors (codes) that drive the effectiveness of the training program and was ultimately organized into three themes: training methods, training difficulties, and monitoring and auditing. The codes are interconnected and were well-defined to make sure that each one backs up the research goal. The results provide the readers with a better understanding and guidance on how the TWI JI program implementations can be further improved, taking into account the perceived effect on the employees themselves and digging deeper into hidden factors that cannot be observed physically. This research concludes that for the traditional training satisfaction survey, respondents tend to be more concerned and stress the importance of the training procedures and outcome, meaning that they tend to focus more on performing the job correctly and giving a satisfactory result. The use of standardized training guides such as the TWI JI program plays a crucial role in achieving an effective and sustainable training methodology. Future studies should explore more methodologies in measuring training effectiveness by focusing their attention on frontline workers and investigating other industries that are facing similar issues.

B. Implications

With the company's growing concern about training effectiveness and sustainability, this research recommends a bigger focus on the training procedures and delivery. THE TWI JI program that is being implemented in companies has no doubt been an important guide for learning and development. However, there is no such thing as a "one-size-fits-all" training guide. The company must continue to optimize this standard training guide according to the company's needs and available resources. This is in particular to the themes and corresponding codes that were produced in this research. With that being said, this study produced 10 codes under 3 individual themes.

Theme 1: Training Method

Optimizing the training method is arguably the most important aspect for having a successful training and learning & development program. This study recommends the strengthening of TWI-specific guides, particularly on optimizing the standard guide of the TWI JI program that is widely implemented in the company. Although the program has a good record of training results, this study still highlights the employees' concern about the training methodologies, such as having more one-on-one classes and improving the quality of online classes, so that the effort and resources put into the whole training program will not go to waste.

Theme 2: Training Challenges

Further studies on developing standardized TWI JI programs should also be conducted, focusing on the work cell niche, which will be able to identify significant learning and development challenges. For the learning environment, the most important thing mentioned by the respondents is the physical environment (lighting, noise, and surroundings). This study recommends a focus on the ergonomic aspect of the workplace. Integrating strong ergonomic solutions has a high potential to solve such a challenge and would minimize, if not eliminate, health risks for the workers. A further recommendation is focused on the instructors' teaching method. Every instructor has a different style of teaching, which is one of the barriers to implementing a standard training program, such as TWI programs. Companies should be able to implement complete standardization, especially for the trainers, so that they have a step-by-step guide on how to execute the training itself. Language barriers could be overcome by integrating a comprehensive language course for trainers. Time constraints are one of the most common but also the most important challenges to overcome in any training program. For a manufacturing company, efficiency is everything; therefore, the training should not only be set to follow procedures but also be focused on the time of execution.

Theme 3: Monitoring and Auditing

Having a clear sight of every training function is an important aspect of the success of any training program. To achieve this, standard operating procedures (SOPs) and standard inspection procedures (SIPs) should be in line with the training program itself. On the other hand, SOPs and SIPs should also consider the training procedures and be more flexible in terms of adherence. Production goals should be set in consideration of the training method, time, and level of trainer expertise. However, safety and product quality should never be

sacrificed to achieve these goals. That is why standard training programs such as TWI JI should be optimized in accordance with the company’s needs and capacity.

C. Research Contributions

Undoubtedly, the only difference in a homogenized enterprise comes from the result of lean manufacturing. An enterprise is like a large machine. Numerous screws make up the molding of the machine. The firmness of these screws represents the life and contribution of the machine, so the contribution of employees will completely form the strength of the company. These forces come from industry training. The industry training program is one of the most effective training programs, which can make employees an integral part of the company's ecosystem. In this study, qualitative research methods were used to explore the effectiveness of industry training in the manufacturing environment from the perspective of employees.

As mentioned above, the business dilemma caused by the ups and downs of J company's turnover curve is one of the main motivations of the researchers. With the decline of Taiwan's birth rate and the decline of the proportion of employees willing to work in the manufacturing industry, the proportion of foreign migrant workers in J company is only 2.89%. The most important thing is the effectiveness of the thorough implementation of training in the lean manufacturing industry. This research will provide a reference for enterprises with similar attributes and a low birth rate country context.

Data availability statement: The data that support the findings of this study are available from the corresponding author, FYL, upon reasonable request.

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