# The Acceptance Level of Silent Piling Technology Among Local Authorities in Malaysia

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**ABSTRACT**

Silent piling technology can be considered as a new piling method used for construction activities in Malaysia. Initial research by Goh & Yusoff (2014) shows that acceptance among designers are still low. The silent piling technology among local authorities are not fully understood. The importance of study is to show the current scenario, problems in practice and future opportunities of silent piling technology in the construction industry in Malaysia. In general, press-in piling technology provides a very positive future for foundation engineering construction but this new technology has not widely been used in Malaysia. Therefore, this research is aiming to study the level of acceptance of silent piling technology among local authorities in Malaysia. The research objectives are to evaluate the acceptance, the potential and the level of needs and technical 'know how' of press-in piling technology among local authorities in Malaysia. In order to achieve the objectives, a qualitative review on acceptance of this technology had been conducted to an engineering personnel working with the local authorities. In addition, short seminars, discussions with local partners and local authorities had been initiated in order to understand the scenario. Based on this study, it was found that the exposure and understanding of press-in method among the local authorities is still at a low level. More than 90% of the local authorities agree that large bulky machinery, excessive noise and vibrations and human disturbance are the main problems when piling at urban areas. They also believe that Press-in technology may be useful to overcome these environmental challenges. In conclusion, the research had successfully recognized the acceptance level of Press-in technology among the local authorities in Malaysia. The research model could be adopted in understanding and shaping practical strategies in promoting Press-In technology in other developing countries.

***Key words:*** *silent piling, local authorities, Malaysia*

## 1. Introduction

According to the Department of Statistics Malaysia (2017), RM2.55 billion was spent in 2015 on the environmental protections with an annual growth rate of 3.9 per cent compared to 2010. Operating expenditure amounted to RM1.5 billion while capital expenditure amounted to RM0.80 billion. For the construction industry, 7.6% or RM0.16 billion was spent to protect the environment. The scenario alarmed the country to look for more initiatives in managing this challenge. In the construction industry, press-in piling technology seems to provide a very sustainable and environmental friendly solution. However, this new technology has not widely been used in Malaysia. Therefore, this research is aiming to study the level of acceptance of this technology in Malaysia.

## 2. Aims and objectives of the study

The aim of this research is to study the level of acceptance of silent piling technology among local authorities in Malaysia. Therefore, three objectives have been listed as below:

(a) To evaluate the level of needs and technical 'know how' of silent piling technology among local authorities in Malaysia.
(b) To investigate the potential application of silent piling technology in Malaysia.
(c) To access the acceptance level of silent piling technology among local authorities in Malaysia.

## 3. Scope of study

This research was focused on the potential and acceptance of silent piling technology in the construction industry in Malaysia. This scope of research is as below.

a. A quantitative research was being conducted via a survey and qualitative research that had been conducted via in-depth interviews which involved local authorities in Malaysia.
b. The study covers two states (Johor and Selangor) and one federal territory of Malaysia (Kuala Lumpur).
c. There are about 230 respondents that are targeted to be inquired of in this research.
d. The local authorities involved are The Malaysian Public Works Department (JKR), Department of Irrigation and Drainage Malaysia (JPS) and Local Council.

## 4. Sustainable construction

Construction activities are one of the leading causes of pollution in the world. There is a large volume of published studies describing the sustainability in construction projects. In an investigation into the awareness of the importance of sustainable development, Preece *et al*. (2011) found that the construction industry has a huge responsibility to fulfil our quality of life.

Marhani *et al.* (2013) defines that the sustainable construction is the design and responsible management of a strong built environment based on resource efficiency and environmental principles. In another perspective, Al-Yami and Price (2006) stated that a sustainable construction can be defined as integration processes of sustainable development by aiming to restore and maintain harmony between the natural and the built environment. In addition, creating settlement that affirm human dignity and improve economic development.

In order to build sustainably, Mohammad (2013) suggested that sustainable approach and innovative techniques must be addressed through built environment planning, design and construction economics.

In the previous studies, many authors have reported that there are 6 main principles for sustainable construction (Kibert, 2003; Preece *et al*. 2011; Marhani *et al*.2013). The main principals are;

a. Decrease of resource consumption
b. Make best use of resource reuse
c. Use renewable and recyclable resources
d. Care for the natural environment
e. Produce a healthy and non-toxic environment
f. Pursue quality in creating the built environment

## 5. Press-in piling and Malaysian construction industry

The Malaysian construction industry registered positive growth during the review period (2013–2017), supported by large-scale investments under the government's 10th Malaysia Plan 2011–2015. Under this plan, the government invested MYR175.0 billion (US$44.8 billion) to develop the country's overall infrastructure by implementing various projects in the transport, tourism, telecommunications, education, healthcare and retail sectors.

Over the forecast period (2018–2022), the industry is expected to expand, albeit at a relatively slow pace. The industry's expansion is expected to be supported by the government's ongoing efforts to promote economic growth through large-scale investments under the 11th Malaysia Plan (11MP) 2016–2020. This plan is part of the government's aim to achieve the status of a developed economy by 2020.

Recently, the development of construction industry has been allowing more applications of press-in piling especially for urban constructions. For example, several recent construction activities in Malaysia involving a Mass Rapid Transit (MRT) project, a highway construction and residential projects had been initiated as shown in **Fig. 1** to **Fig. 5**. These applications clearly show a positive adaptation of the technology for the Malaysian construction industry.


**Fig. 1** Sheet pile installed by Super Crush Piler for MRT construction at Pasar Seni MRT Station


**Fig. 2** Construction at Bukit Bintang MRT Station

**Fig. 3** Retaining structure construction for highway near Taman Jasmin Indah

**Fig. 4** Sheet pile installed by Super Crush Piler at Sprint Highway

**Fig. 5** Sheet pile installed for commercial development near residential area

## 6. Local authorities involved in the study

The study covers two states (Johor and Selangor) and one federal territory of Malaysia (Kuala Lumpur). The local authorities involved in this study are the Public Work Department (JKR), Department of Irrigation and Drainage Malaysia and several municipal councils.

Public Works Department (JKR) is the federal government department in Malaysia under the Ministry of Works Malaysia (MOW) which is responsible for construction and maintenance of public infrastructure in Malaysia. Department of Irrigation and Drainage Malaysia (DID) which is under the direction of the Ministry of Natural Resource & Environment (NRE). The DID's duties encompass river basin management and coastal zone, water resources management and hydrology, special projects, flood management and eco-friendly drainage.

In Malaysia, local council are endowed with the power given by the Local Government Act 1976 to provide goods and services to local people. Local governments serve both obligatory and discretionary functions to local people, where the latter function is more towards local development issues. Obligatory functions can be generally categorized into five main sections: public amenities, enforcement and license grant, public health and hygiene (cleaning and waste management), social service and development, and environmental issues.

## 7. Methodology

### 7.1. Questionnaire development

a. Demography Characteristic,

This part contains several questions on background information of respondents. The variables and explanations are as follow;

i. Age
ii. Gender
iii. Highest Education
iv. Working Experience (Year)
v. Field of expert

b. Current Practice of Pile Installation Method and Sustainability,

This part contains 12 questions which are well recognized regarding the pile installation method and the sustainable piling work of respondents. The variables are as follows;

i. Do we have to find out new construction designs and technologies in construction process?
ii. Were sustainable practice implemented for piling construction where you worked/work
iii. Benefits of sustainable practices with piling construction
iv. The limitations for the sustainable construction practices with piling construction
v. In your experience, if your construction site has strict laws/codes/regulations, in terms of sustainability issues, which piling method or brand you use
vi. In your opinion, what are the advantages of using a conventional pile installation method compared to Silent Piling Technology?
vii. What problems do you normally encounter when piling in urban areas?

viii. In your opinion, which method produces the lowest noise and vibration
ix. When dealing with sites with narrow access and zero clearance, which method do you normally consider
x. What technique you consider for constructing the high rise building at the peat soil area with lower environmental impact
xi. If you are engaged in a railway track extension project where the train operation is not halted, which method do you prefer
xii. Which method can mitigate a water seepage and settlement problem in deep sandy ground during excavation work for development involving an underground basement located close to the shore line

c. Knowledge and Technical 'Know How' of Silent Piling Technology

This part contains 4 questions which are well recognized regarding the knowledge and technical 'know how' of silent piling technology of respondents. The variables and explanations are as follows;

i. Do you know about Silent Piling Technology?
ii. Silent Piling Technology is a new pile installation method. If you like to explore more, where would you like to get the information
iii. In your opinion, do we have to support Silent Piling Technology in the construction industry in Malaysia
iv. Silent Piling Technology based on the environmental protection, safety, speed, economy and aesthetics. Based on your experience, how should we introduce this technology in our country

**7.2. Pilot test**

The questionnaire was developed based on the previous research (Zaiton & Yusoff, 2013). After constructing the questionnaire, this validated survey was adopted with some modifications and pre-test by carrying out a pilot study which was conducted at NIOSH and JPS Segamat as well as their responses in the completed questionnaire. Based on the feedback from the pilot study, the final version of the questionnaire was prepared.

Traditionally, a pilot test is a test to determine whether questionnaire that has been constructed are relevant and can be verified in the real world. In recent years, there has been an increasing amount of literature on the pilot study. Previous studies have reported that the pilot study of the current research was the first step before going to the real practical application (Calitz, 2009). Calitz also defined that a pilot study is a mini-version of a real study or a trial run done in preparation for the complete study. According to Powell & Renner (2003), there are some important things to be done while conducting the pilot study. The importance are explained below;

a. Make sure that all respondents understood all the words in the questionnaire.
b. Make sure that respondents followed the direction correctly while answering the question.
c. Record the time taken to the respondent to answer the question.
d. Check whether the respondent interpret the question in the same way.

Based on Calitz (2009), there are some advantages of a pilot study. The advantages of a pilot study are listed below;

a. It can give warning about where the main research project can fail
e. It indicates where research rules might not be followed
f. A pilot study can also identify practical problems of the research procedure
g. It indicates whether proposed methods or instruments are inappropriate or too complicated

### 7.3. Reliability test

According to Brown (2002), Cronbach alpha is used to estimate the proportion of variance that is systematic or consistent in a set of test scores. The example of using Cronbach alpha by Brown (2002) is for a set of scores which turns out to be 0.90, the meaning is that 90% of the test are reliable and, for unreliable, the value is 10% which are calculated by 100% - 90% = 10%. Table 1 show the value of Cronbach's alpha.

**Table 1.** Table of Cronbach's alpha (Cortina, 1993)

| Cronbach's alpha | Internal consistency |
|---|---|
| $\alpha < 0.5$ | Unacceptable |
| $0.5 \leq \alpha < 0.6$ | Poor |
| $0.6 \leq \alpha < 0.7$ | Acceptable |
| $0.7 \leq \alpha < 0.9$ | Good |
| $\alpha \geq 0.9$ | Excellent |

Based on the research made by Zaiton and Yusoff (2013), the result of Cronbach's alpha is 0.856, 0.946, 0.771 and 0.956 from the result of reliability. The results are above 0.6, so the data obtained by analysing the questions to achieve the objectives are verified. Based on the research by Syed (2013), the result of Cronbach's alpha is 0.870 from the result of reliability. The results are above 0.6, so the data obtained by analysing the questions to achieve the objectives are verified. The result of Cronbach's alpha made by Syed (2013) is in Table 2 below;

**Table 2.** Table of Cronbach's alpha value (Syed, (2013))

| Cronbach's Alpha | N of Items |
|---|---|
| 0.870 | 51 |

## 8. Result and analysis

### 8.1. Demographic analysis

This section deals with respondents' demographic information such as age, gender, education background, type of work specialization and years of experience as shown in **Fig. 6**.

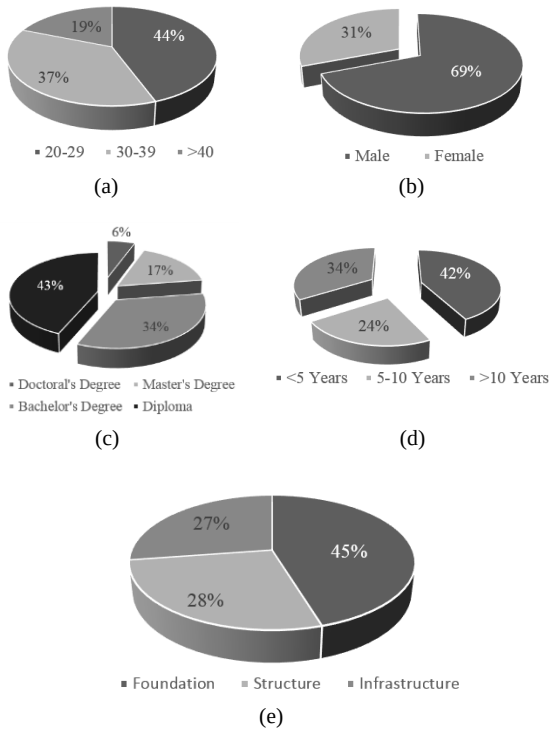


**Fig. 6** Demographic analysis chart (a) Age of respondent (b) Gender of respondent (c) Highest level of education of respondent (d) Experience in civil engineering (e) Field of civil engineering of respondent

Based on the pie chart, 43.6% of the respondents are in the 20-29 years age group, 41% respondents are in the 30-39 years age group and 15.4% respondents are above 40 years old. It is apparent from this survey that those who are actively responded to this survey are younger than 40 years old.

**Fig. 6 (b)** shows that 69% are male respondents and 31% are female. It is fairly understandable that in Malaysian construction companies, the majority of engineers are male. In regard to the academic background, 43% of the respondents hold a diploma, 34% hold a bachelors' degree and 17% hold master's degree and 6% hold PhD degree. This shows that most of those surveyed are having a fair academic background.

Referring to the respondents working experience, most of them are having less than 10 years' experience. In addition, a small number of respondents have more than 40 years of experience. In respect to a field of civil engineering, most of the respondent are in the foundation

engineering which accounted for about 45%. For other civil engineering fields, 28.2% working in structural field and the rest are in infrastructure.

### 8.2. Benefits of sustainable practices in piling construction

Based on the response, most of the respondents agreed that by applying this sustainable practice in the piling construction, it may provide a positive benefit for the construction industry in Malaysia. It also distinguishes that 85% of the respondents believe that there will be a positive impact on the quality of built environment.

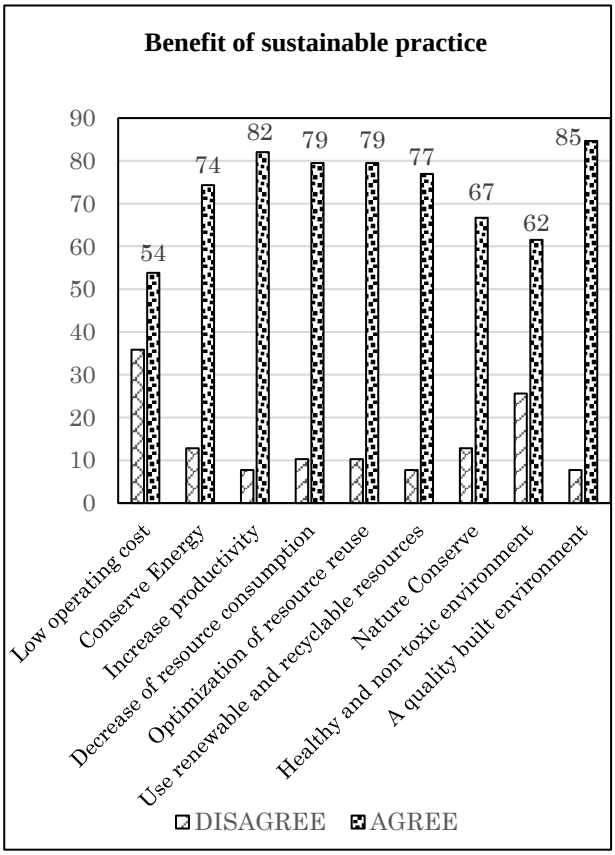


**Fig. 7** The benefits of sustainable practice in piling construction

It is visible that the silent piling technology is lightly used in Malaysia. Interestingly, most of the respondents could recognize the positive remarks of this technology. The majority of them agreed that low operating cost, conserving energy, increasing productivity and other positive benefits could be resulted if silent piling technology is considered. Therefore, it is possible to hypothesise that the acceptance of this technology in Malaysia will be in a positive direction in the near future.

### 8.3. Limitation for the sustainable construction practices with piling construction

In order to implement the technology further, several limitations had been outlined at the earlier stage before the survey conducted. The known limitations outlined are skill level, unavailability of sustainable materials, financial consideration, non-mandatory sustainable regulations, lack of awareness and lack of incentives/motivation.

The overall response to this question was very positive. The majority of those who responded (92%) to this item felt that the skill level is the most important limitation to be considered. In addition, 82% of those who were interviewed indicated that non-mandatory sustainable regulations in Malaysia could be the second important limitation. The third limitation was lack of incentives and motivation. It was followed by lack of awareness, in which 69% of the respondents surveyed agree on this issue. A small number of those interviewed suggested that both financial consideration and unavailability of sustainable materials were not the main limitations. In summary, in order to observe more applications of silent piling in Malaysia, there should be more initiatives initiated in order to improve the skill level of this new technology, outlining mandatory sustainable regulations and more incentives given to the industrial players.

### 8.4. Common problems encountered when piling in urban areas

The questions are posted in order to recognize the common problems of the personnel working with local authorities in dealing with a construction in urban areas. Interestingly, in the aspect of excessive noise and vibration, human disturbance and large bulky machine, 92% of the respondents agreed that these three factors are the most common problems encountered. In addition, the survey found that few issues of dusty concrete plant are experienced or recognized by the respondents.

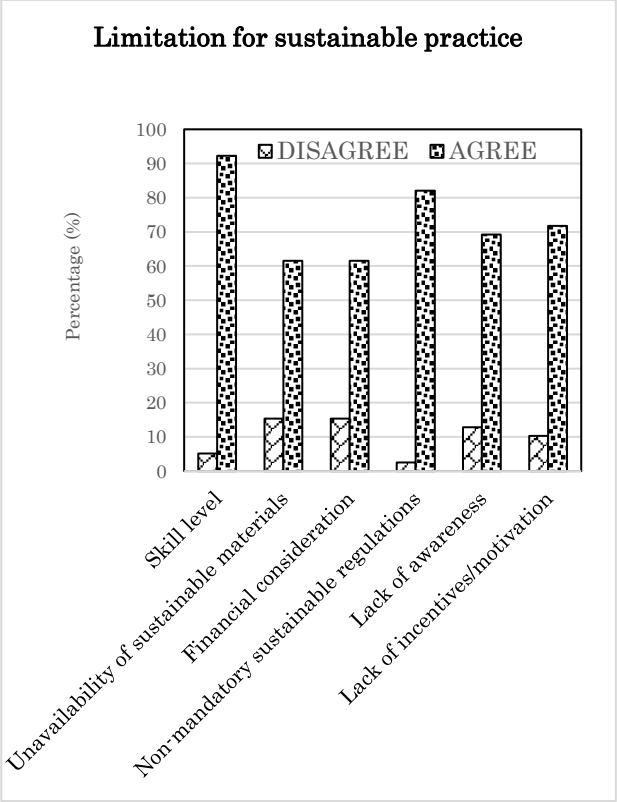


**Fig. 8** Limitations for sustainable construction practices with piling construction

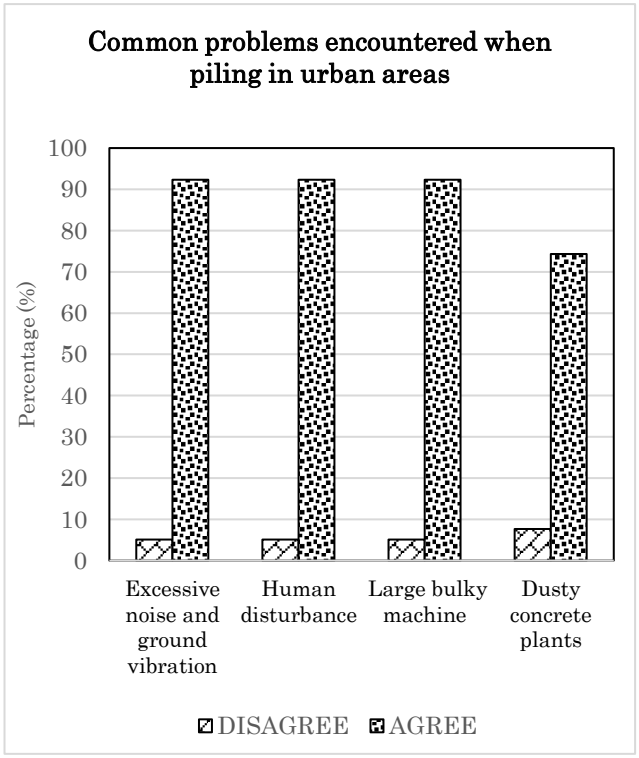


**Fig. 9** The common problems encountered when piling in urban areas

In this particular perspective, the Press-in piling technology fits well with the current challenge of construction in a city. Based on the reaction principle of the Press-in piling method, pre-fabricated piles are hydraulically jacked-in into the ground with minimum noise and vibration. This technology uses a relatively small and lightweight Press-in piling technique complemented by several successful examples of silent piling applications all over the world. It is therefore likely that this technology may encounter this current challenge in Malaysia.

### 8.5. Technical 'know how' of silent piling technologies among local authorities

The figure shows the perception of the respondents regarding the technical ‘know how’ of silent piling technologies among local authorities in Malaysia. Most of the respondents realize that the press-in method is one of the best options in solving the problem in the construction industry. However, due to a socio-economic perspective, this technique is still very new for the Malaysian market.

### 8.6. Pearson Correlation

Based on the **Table 3**, the technical 'know how' of silent piling technologies among local authorities in Malaysia has weak degree of correlation with the acceptance of silent piling technologies (0.393). Same goes to the correlation that contributed to the weak degree of correlation between the technical 'know how' of silent piling technologies among local authorities and potential of silent piling technology in Malaysia (0.314) and technical 'know how' of silent piling technologies among local authorities and implementation of sustainable in construction Industry (0.465).

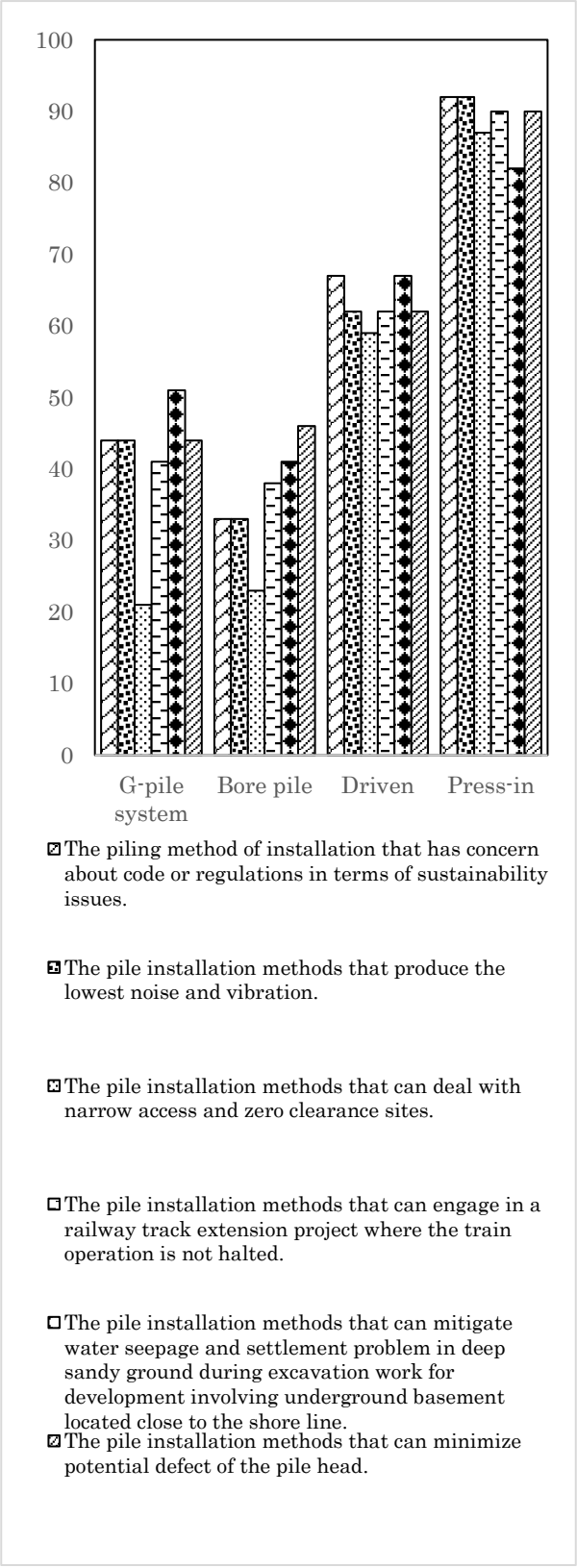


**Fig. 10** Technical 'know how' of silent piling technologies among local authorities

**Table 3.** Correlation among respondent's acceptance and technical knowledge of silent piling technology

| | Pearson Correlation | | |
|---|---|---|---|
| | Technical | Acceptance | Potential |
| Technical | | | |
| Acceptance | 0.393 | | |
| Potential | 0.314 | 0.817** | |
| Implementation | 0.465 | 0.507 | 0.539 |

The strong degree of correlation is contributed by the acceptance of silent piling technologies among local authorities in Malaysia and the potential of silent piling technology in Malaysia (0.817), implementation of sustainable construction and the acceptance of silent piling technologies among local authorities in Malaysia (0.507) also between the implementation of sustainable construction and potential of silent piling technology in Malaysia (0.539).

## 9. Conclusion

The purpose of the current study was to determine the acceptance of silent piling technology among local authorities in Malaysia. This study has identified that the acceptance of silent piling technology among local authorities is considerably good. The most important limitation lies in the fact that the respondents believe they should improve their knowledge and encourage other departments to support the application of such new technology.

Notwithstanding these limitations, the study suggests that the major benefit of this technology may reduce human disturbances in noise and vibration, faster and organized completion of construction projects, handling problems of piling at zero clearance access using small size machinery and implementation of sustainability in the construction industry.

Hence, it can be concluded that most of the respondents agree that the press-in method could be promoted as a sustainable method in the construction industry. Therefore, it is hoped that press-in technology will be recommended in promoting sustainability for the construction industry in Malaysia.

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