

Research Article

Semi-Automated Adjustable Planting Pole

Dayang Muhaini^{1,*}, Louis², Mizinda Mayzin³, Nursyarafina⁴, Walter Dana⁵, and Jati Kasuma⁶

¹ 2021470506@student.uitm.edu.my, Undergraduate Student, Faculty of Plantation and Agrotechnology

² 2021864276@student.uitm.edu.my, Undergraduate Student, Faculty of Plantation and Agrotechnology

³ 2021627198@student.uitm.edu.my, Undergraduate Student, Faculty of Plantation and Agrotechnology

⁴ 2021898086@student.uitm.edu.my, Undergraduate Student, Faculty of Plantation and Agrotechnology

⁵ 2021467984@student.uitm.edu.my, Undergraduate Student, Faculty of Plantation and Agrotechnology

⁶ jati@uitm.edu.my, Jati Kasuma Ali, Assoc Prof Dr., Faculty of Business and Management, UiTM Sarawak

* Correspondence: email; telephone.

Abstract: This paper presents an innovative product design in the context of plantation studies, focusing on improving the planting pole, a widely used tool in the sector. We identified several issues with the current planting pole, including its limited effectiveness due to the ability to plant only one hole at a time, long-term health effects on workers caused by its use, and the preference for traditional planting methods among smallholders, who are not sufficiently exposed to new technologies. To address these issues, we propose an improved planting pole design that incorporates the principles of the Industry 4.0 revolution. Our product is constructed from PVC pipe, stainless steel, and electronic components, offering enhanced effectiveness and adjustability compared to conventional planting poles. By refining the existing tool, we aim to increase productivity and reduce the health risks associated with manual planting. Our primary target market is smallholders who have yet to adopt modern planting technologies. By introducing this innovative product to this demographic, we aim to foster widespread adoption of efficient and ergonomic tools in the plantation sector, contributing to increased productivity and improved worker well-being. This abstract emphasizes the potential benefits of our product design and the importance of innovation in addressing the challenges faced by the plantation industry.

Keywords: plantation, industry, product.



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1. INTRODUCTION

Nowadays, we are moving into the 4.0 industrial revolution which promoted technology into the planting industry. Various invention and innovation had been made to helps the farmers and to increase the yield by using the technology (Dallasega, 2020). In plantation industry, there are smallholders and estate company. Both will need to plant the seeds using few methods. Currently, both use manual planting method which using hands. This has been going on for years. After few years back, there was an invention that makes the planting process for the farmers much easier and more effective. The first planting pole were invented and could help the farmers especially smallholders to plant the seeds into the planting bed more efficiently. But, since our farmers are still not really adapted to the technology, so the use of planting pole are not fully adapted by them. Well known that the farmers that planted okra and corn will use manual planting method which is using hands (J., 2011). This will cause long-term health issues to the farmers if they keep planting the seeds using the old method. After that, the old planting method are also a bit slow and taking much more time than using the conventional planting pole. But, after investigating about the current conventional planting pole,

we found that there are only one planting hole that can be made by using the conventional planting pole. We found that, this will consume too much time in planting seeds process. So, we come with an innovation about adjustable semi-automated planting pole. This product could plant more seeds at one time by digging much more planting hole at one time. Not just that, this product is also moving using tire and could automatically dispensing seeds into the hole by using the sensory system. This product is called semi-automated because we could help the farmers especially smallholders to overcome the current issue which is labor shortage. Not only that, but we could also attract the youngsters out there to become farmers because this innovation will be less dangerous, less dirty, and much easier to handle since our youngsters prefer much safer and less dirty works. This product is also adjustable because as we know the planting distance for crops are different. So, we come with these features to makes life for farmers much easier. This innovation will help smallholders especially smallholders that planted okra and corn and could increase yield.

2. METHOD & MATERIAL

2.1 Methods

2.1.1 Product Making

For starter of the project, the materials need to be prepared and cut according to desired size and length. The lcd display must be programmed only for certain function. After that, the box that made out of PVC are cut for the placement and safe space for the LCD display and the rechargeable battery. The handle is made of stainless stell pipe than assembled into the box.

The priority after that is the wiring. All the wires must be done before attaching the box into the long adjustable PVC pole. Then the wires must be covered with cable sleeves so that the wire are more protected from any danger. Next is the PVC pole assembling. The adjustable PVC pole than attached to the stainless-steel rod that attached with tyres.

For the plating patch, the stainless-steel must be cut into desired length that can be adjusted. Poke a circular hole on the bottom for the next attachment which the planting mouth. This planting mouth cut into 3 pieces made from stainless-steel can mechanically opened by the LCD screen command. Next is the rubber pipes. The rubber pipes purposes are for the seeds flowing through inside the PVC pipes trough each planting mouth. This rubber pipe can automatically attach to the main PVC pipe and the stainless-steel plating patch. Next is the seed basket. This seed basked is for the name itself, to store the seed. This basket is mechanized that each plating mouth has its own seed count set.

2.1.2 Methods Using

First and foremost, the equipment must be checked before using any of it. The battery must be charged before using. Then the planting stainless-steel patch must be attached into the main PVC pole. The attachment must be secure enough to prevent any accident occur.

After all the attachment assembled, the technology can be moved using the tires into the planting site. Put the seed into the seed basket and start the machine. Align the measurement of the plating patch with desired length and press your leg close to the tires since it has suspension. Press the button to start the planting mechanize. After that, repeat the plating method to next bed and do the same. After finish plating, make sure the equipment is cleaned before storing it.

2.2 Materials

The raw materials used for creating a semi-automated adjustable planting pole include several items from the list provided. Firstly, PVC pipes are used as the main structural component of the pole, providing a lightweight and durable material that is resistant to corrosion and weathering. Stainless steel is also used in the construction of the pole, specifically for the adjustable locking mechanism, which requires a strong and sturdy material to hold the pole in place.

Wires are used for the electrical components of the pole, which control the automated features of the planting system. The circuit board acts as the brain of the system, controlling the signals and power flow to the various components. An LCD display is used to display important information about the system, such as the planting depth and soil moisture levels.

A stainless-steel plate is used as the base of the planting pole, providing stability and anchoring the pole in the ground. Rubber hoses are used to connect the planting pole to the planting hole. A spring is used to provide a cushioning effect when the planting pole is lowered into the ground, reducing the impact on the soil and roots. Lastly, a tyre is used as a protective covering for the base of the pole, preventing damage to the surrounding soil and plants. Together, these raw materials create a semi-automated adjustable planting pole that allows for efficient and precise planting.

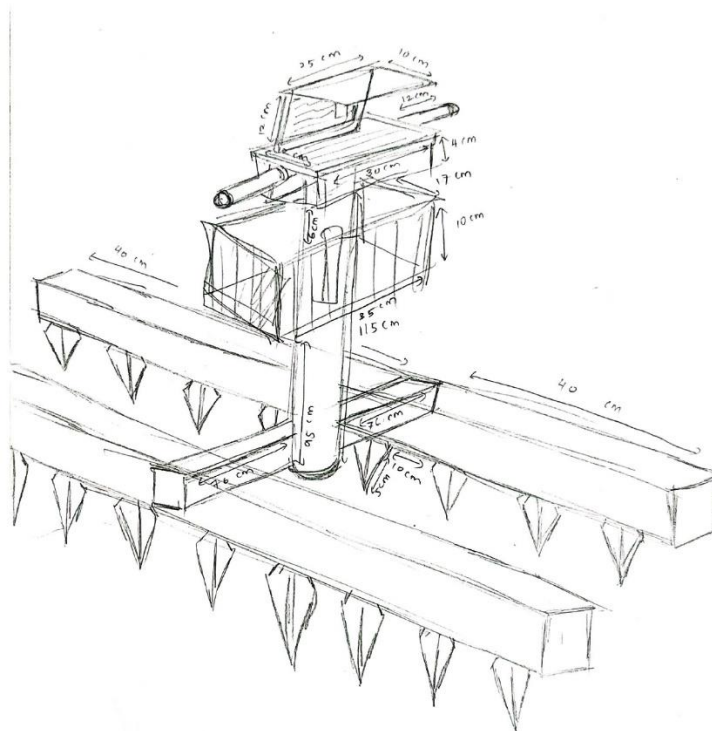


Figure 1: Conceptual Design

3. FINDINGS

The primary objective of this research is to innovate the existing planting pole that are used in plantation sector to plant the seedlings. A form have been conducted to find out the level of understanding of people towards our product. The form also come with questions that function as an identifier wether or not the respondents are having an agrotechnology based knowledge. Scaled question to identify and finding out the familiarity or adaptatibility of people towards using high tech agriculture-based tools are also presents in the form. The results are interesting and surprising due to the variation of respondent's answers. Students are the target respondents which help a lot in identifying different perspectives and opinions.

Course Code/Kod Kursus (OPTIONAL) Eg: AT220

12 responses

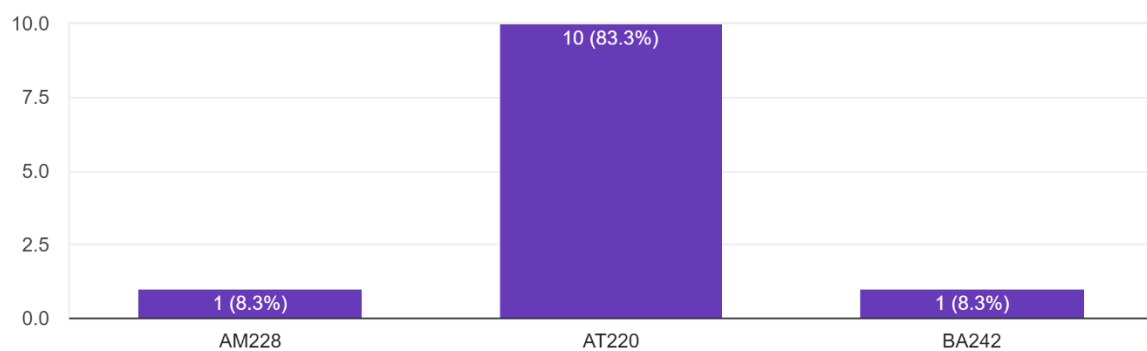


Figure 1: Percentage (%) of respondent course code

The scale of your familiarity/adaptability in the agricultural sector and the practical use of specific products/machines?/ Skala kebiasaan/kebolehsuai...dan penggunaan praktikal produk/mesin tertentu?

12 responses

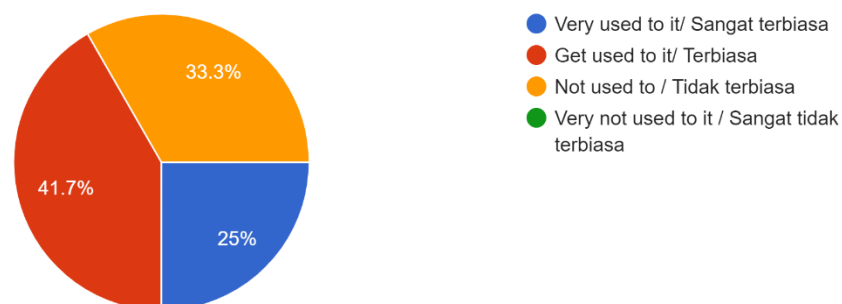


Figure 2: Pie chart of respondent's familiarity/adaptability towards agricultural and it's product usage.

Your usage rate using the product/machine in agricultural sector/ Kadar penggunaan anda menggunakan produk/mesin dalam sektor pertanian

12 responses

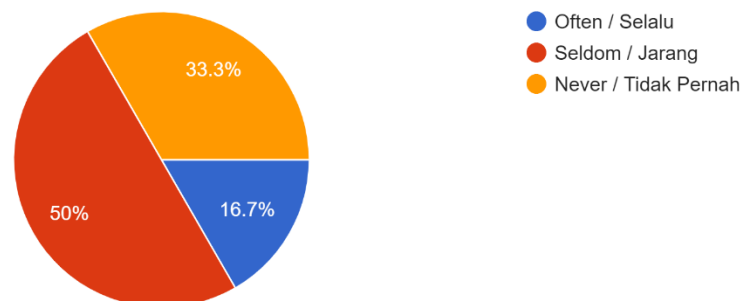


Figure 3: Pie chart of rate of agricultural machine usage

Eighty-three percent (Fig.1) of the respondents are from the plantation course while the other sixteen percent are from the other course. This concludes that the respondents are expected to have a good understanding of our product. However, only twenty-five percent (Fig.2) of the respondents were very used to the practical usage of agriculture machines, which is quite an interesting result. Following this, only sixty percent (Fig.3) of respondents often use agricultural machines.

From the responses, the question “How well do you understand about this product?” are answered in variation from very well understood and not understood. This kind of response concludes that not many people are used to our product yet. The form also includes some questions about the effectiveness of our product from a different perspective. We can conclude that this product can replace the conventional planting method as all the respondents answer positively. Labor shortage, time strain and cost of manpower are the main factors that can be seen throughout the responses. Increase in production is one of the main reasons why this product needs to be improved. But some concern from the respondents stated that this product may be high in cost due to product’s raw materials requirements and software uses. As for marketability, direct marketing and E-marketing are the chosen market strategies because of how convenient and fast the promotion can spread. A set of target markets from smallholders to plantation estate is preferred as this product can be use in any scale from small scale planting to estate scale planting.

4. DISCUSSION

With several technologies aimed at assisting farmers in enhancing yields, the planting operations is currently experiencing the 4.0 industrial revolution (KR, S. K., Gnanasekaran, T., Jebaraj, B. S., Vignesh, S., Vignesh, M., & Kavin, C. 2023, March). However, many farmers continue to plant by hand, which is slower than using standard planting poles and can have long-term negative health effects. An adjustable semi-automated planting pole that can plant several seeds at one time and automatically dispense seeds using a system of detection has been created to solve this. A key component of agricultural technology is the semi-automated adjustable planting pole. With the help of this equipment, farmers can sow seeds more quickly, effectively, and easily, which boosts agricultural yields. For smallholders who might not have access to large-scale farming equipment, this technique is very useful.

Next, the semi-automated adjustable planting pole will be created to help solve the currently existing labour crisis in agriculture, especially among smallholders who do not have sufficient access to labour to properly plant their crops. Farmers may save time by planting their crops more effectively and with less physical labour by using the semi-automated adjustable planting pole. For smallholders who do not have access to the same levels of resources as more expansive estate corporations the semi-automated adjustable planting pole is very useful. For example, by used this technology, farmers can sow more seeds in less time because to the tool's capacity to dig several holes at once. This will make it simpler for farmers to manage their crops and will assist the sector handle the issue of a labour shortage.

Additionally, the semi-automated adjustable planting pole is also more adaptable and can support a wider range of crops since it can be modified to plant at different distances. Because different crops require various planting spacing in order to thrive, flexibility is crucial (El-Gendy, H. A., El-Halim, A., Morghany, H. A., & Aboukarima, A. M. 2009). The semi-automated adjustable planting pole's technology also has the potential to improve planting efficiency and productivity, which will help farmers produce more crops and earn a greater profit. Farmers will be able to plant seeds with more consistency due to this innovation, giving each one the best opportunity to develop into a healthy plant. This can result in a crop that is more uniform, which might decrease losses and boost overall production.

Furthermore, other benefits of this technology are being safer and simpler to use than conventional planting pole and hand techniques. Farmers who often use a traditional manual planting method, which can result in perennial pain and suffering, might experience less long-term health problems as a result. For example, farmers who was plant seeds by hand must regularly lower yourself over and make planting holes with their hands, which can put pressure on their back and neck. So, this technology will improve the health and well-being of farmers. Moreover, younger people may be attracted to agriculture by the usage of the semi-automated adjustable planting pole since it provides a more secure and clean working environment. This can be especially helpful because the agricultural sector requires younger individuals to get involved it in order to assist assure a sustainable food supply for the future.

In overall, the semi-automated adjustable planting pole is an innovative technology that can assist farmers in boosting crop yields while lowering the amount of physical labour needed. It is a flexible and effective equipment since it can automatically release seeds, plant at different distances, and move using a tire. Additionally, it can help farmers who use manual planting techniques in the past bring in younger people and manage their long-term health concerns.

5. CONCLUSION

Overall, Semi-automated Adjustable Planting Pole gives a good impact to the farmers, crops plant and agriculture industry. Problems such as health problems, labour shortage, time crisis can be control and we can generate more income. In addition to this, it consists of ergonomic design and easy to handle by the end user. By using Semi-automated Adjustable Planting Pole, the statistic of health problem causes by the traditional way of planting can be decrease since the farmers do not need to use their traditional way of planting which is by hand. When the number of health issues decreases, people can work more comfortably, and they will be able to produce a productive result. The labour shortage does not need to be concern anymore since this product will help them to reduce human energy to produce yield.

Based on our findings which include respondents from different courses, there are also those who are used to using machines. Half of them also rarely use machines in agriculture. This means that they use the old way more than the machine which is likely that they feel that the existing machine

does not give them much good to use or is less interesting and that is why they prefer not to use the machine. The production of this high-quality technology to attract their interest in using a machine that is very convenient for them and can be owned at a reasonable price. In the process of improving the economy of the farmers, Semi-automated Adjustable Planting Pole will give better yield production of crops to them and this can increase their income as well. The farmers can reduce time, health problems and they can supply high number of yields to the consumer. As a result, the production of yield can also be sustained in a longer period, marketable and can supply enough food to the consumer.

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References

- El-Gendy, H. A., El-Halim, A., Morghany, H. A., & Aboukarima, A. M. (2009). EVALUATING PERFORMANCE OF A POST HOLE DIGGER. *Journal of Soil Sciences and Agricultural Engineering*, 34(5), 5783-5793.
- KR, S. K., Gnanasekaran, T., Jebaraj, B. S., Vignesh, S., Vignesh, M., & Kavin, C. (2023, March). Design and Fabrication of Multi-functioned Seed Sowing Machine. In *2023 Second International Conference on Electronics and Renewable Systems (ICEARS)* (pp. 151-155). IEEE.
- Pilger, N., Berg, A., & Joosse, P. (2020). Semi-Automated Roadside Image Data Collection for Characterization of Agricultural Land Management Practices. *Remote Sensing*, 12(14), 2342.
- Dallasega. (2020). "Industry 4.0 technologies assessment: A sustainability perspective". *International Journal of Production Economics*, 229.
- J., R. (2011). "Plantation Agriculture". *The Encyclopedia of Alabama*, 338.