

Electric sand siever machine

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Abstract

This applied experimental research aimed to construct an electric sand siever machine and determine its effectiveness in sieving sand and abating the work of construction workers. Further, after the development of the product, the data gathered from the chosen respondents were encoded to test the difference between the electric sand siever machine and the manual sieving method. The researchers developed a product that would benefit construction workers because it requires less time and effort for the job to be done. The self-constructed questionnaires were made to determine the acceptability and effectiveness of the electric sand filter machine compared with the traditional sand filter. As a result, this study shows that there is a significant difference between an electric sand filter machine and manual sand sieving. In addition, the findings show that there is no significant difference between the manual sand sieving and electric sand siever machine in terms of speed to complete the task and output capacity. It was concluded that the electric sand filter machine is very functional and demonstrates high efficiency and usability. The electric sand filter machine is, indeed, highly recommended among construction sites, companies, as well as DWCSJ stakeholders due to its less manpower cost requirement and higher output capacity. In addition, the researchers also recommend that future researchers should conduct further related studies which will improve the present project, thereby contributing more to ease construction-related work.

Keywords: siever machine, manual sieving, sand, electric, output capacity, applied experimental research

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1. Introduction

Sand is a versatile resource that can be utilized in construction, glassmaking, and water filtration. One of the helpful elements people can use when constructing a house or other structure is sand (Kurnia, et al., 2019.). In construction, it is a very popular material. In addition to being reasonably priced, it also aids in giving your projects a greater degree of durability, thus it can avoid structural issues if they reconstruct the project (Khode et al., 2022). According to NevonProjects (2018), sand needs to be filtered since it contains huge stones and other undesirable particles that need to be removed before it can be used. Many people, particularly in the Philippines, still use the traditional sand sieving procedure. Laborers filter sand by hand for use in building a house. When they have to sieve the sand, many of them experience pain in any part of their body. According to Domingo et al. (2015), many construction workers suffer from musculoskeletal disorders. It is a common problem in the traditional sand sieving method, and manually filtering the sand takes a long time.

Nowadays, the construction of a building must be completed quickly. It is critical to complete your work as soon as possible (Chavan et al., 2022). Sand filter machines were being developed but were quite expensive (Fauzi et al., 2019). The researchers aim to create a sand filter machine that is relatively inexpensive, effective, and powered by electricity in this study. Using electricity, people can easily use the product. The back-and-forth movement will aid in the filtering of sand and the removal of unwanted substances. Despite pandemics, people all over the world continue to improve not only their lives but also their ways of doing things. The population is increasing as well as construction of houses or buildings. The use of technology in the construction of homes or buildings is in demand, but most workers use manual labor. With such confusion about which has the better capacity for speeding up the sieving of sand, this research about electric sand siever is suggested.

In this context, the researchers conducted this experimental study to help construction workers or even civilians by requiring less work. Not only for construction workers but also for some companies such as sand companies. The intention of this study is to construct an electric sand siever machine, to maintain efficient work, to have time to multitask, and to exert energy and effort. The said reasons led the researchers to construct an Electric Sand Siever Machine.

Statement of the Problem - This study aimed to construct an electric sand siever machine and determine its effectiveness in sieving sand and abating the work of construction workers. Specifically, it aimed to answer the following questions: (1) How does the electric sand siever machine benefit the construction workers and some companies? (2) As assessed by the respondents, how effective is the electric sand siever machine compared to the manual or traditional sand sieving used in construction sites? (3) Is Electric Sand Siever Machine more cost-effective than those being sold by big construction companies? (4) Is there a significant difference between manual sand sieving and electric sand siever machine in terms of speed to complete the task and output capacity?

Significance of the Study - Generally, the significance of the study on the electric sand siever is to help decrease the physical workload of construction workers who use the old manual sand filter and to help the process be faster, less time-consuming, and more efficient. The findings of this study can be defined as benefiting individuals or groups who are engaged in the research, namely: Ceramic Companies, since the study is about electric sand siever, it could be beneficial to them. The result of the study will be beneficial to the types of companies that produce different kinds of bricks and use sand in the construction business. The findings of the study will assist construction workers in performing their tasks more easily, quickly, and efficiently. The benefit that the consumers will receive is that the work that will be done with the product is going to take less time which means more time to focus or do other kinds of work in constructing a building or house. This research will be able to assist the community by being able to speed up the process of constructing houses and buildings in a community

which normally takes more time when using a manual sand sieve. This research will be able to assist other researchers by providing more relevant studies and information on the subject of the study. It can also serve as a useful reference for them in the future.

Scope and Delimitation of the Study - The primary goal of the researchers on this study is to produce an Electric Sand Siever Machine to ease the burden on the bodies of workers when they use the machine rather than the manual sand sieving method during the process of construction. The study was confined primarily to develop a final product which was tested in one of the researchers' residence, wherein they conducted a series of tests to identify and see how much it can help the workers reduce their physical strain during work. In getting the perceptions of manual sand sievers as they compared their experiences with that of using electric sand siever machine, a survey was conducted specifically in the areas of San Jose, Occidental, and Mindoro from February to April 2023.

2. Methodology

Research Design - This study used applied experimental research. It intends to make an effective sand filter machine that can help people separate fine sand from other pebbles or gravel with the aid of electricity. This applies experimental research design in determining the relationship between the independent and dependent variables because the research is high in causal (internal) validity as cited by Punith et al. (2017). The independent variable is manipulated to observe the effect on the dependent variable. This study primarily aims to know the effectiveness, and benefits of the said equipment to improve the production of fine sand and lessen the time being consumed in sieving the sand.

Data Gathering Procedure - In proving the effectiveness of the Electric Sand Siever Machine compared to the traditional or Manually Operated one, the researchers conducted a series of tests. For these tests, the independent variable was the components in constructing an Electric Sand Siever Machine, while the dependent variable was the Electric Sand Siever Machine and its effectiveness and accessibility to its future investors. There was a control group, which consisted of the samples gathered from using a manually operated sand sieve, and an experimental group, which consisted of the sample gathered using the newly built Electric Sand Siever Machine. The questions revolved around the effectiveness of the Electric Sand Siever Machine compared to the Traditional Sand Siever, and using purposive sampling, 15 respondents participated in the study. The researchers targeted respondents that high benefit from their product – construction workers, so they could accurately answer the survey. The respondents were required to try the product for themselves and answer the survey. A short description of the study was provided to the respondents, as well as a sample of the product.

Research Process; Stage 1 Preparation and Gathering of Materials - The research materials needed for constructing the product electric sand filter machine includes:



Figure 1. Metal



Figure 2. Dry Sand



Figure 3. Motor



Figure 4. Bearing



Figure 5. Sand Sieving Filter



Figure 6. Cable Wire



Figure 7 Car Battery



Figure 8 AC/DC Converter

source: Battery types – Lead acid, AGM, EFB (n.d); Specializing in Lithium Batteries, Chargers, Solar Storage (n.d.)

As an alternative to the traditional sand sieving filter, the researchers constructed an electric sand siever machine. For the sand sieving machine's frame, the researchers used metal. A motor and cable wire is used to create an electric version of the sand-sieving filter machine. The car battery and the AC/DC converter are used to run the electric sand filter machine when the electrical power is off. The motor and gravel were gathered at each respective house, and materials like metal, a sand sieving filter, and bearing were purchased in shops and hardware stores in San Jose, Occidental Mindoro. Given that the virus is still present, the researchers took care to follow the protocols and guidelines before leaving to purchase the needed materials and start the research.

Stage 2: Construction and Development of the Project - The researchers aimed to reduce the workload for construction workers by using an electric sand filter. This electric sand sieving machine allowed the construction workers to filter the sand automatically and it reduces the strain on their bodies while working. In this experiment, the researchers built a table-like metal frame that acts as the body of the machine. The motor was placed in a slightly above position on the top part of the frame to give some space in the filtering mesh to move back and forth. The filtering mesh is connected to the grinder via a bearing and a metal rod that allows the mesh to move back and forth. The motor is powered by an electric outlet. Furthermore, the speed of the back-and-forth motion depends on the power of the motor. This experiment also aimed to fasten the work of the construction worker and the building time of a certain project.



Figure 9. Actual Product of Electric Sand Siever Machine

Stage 3: Experimental Stage, Observation and Data Recording - First, the researchers placed the Electric Sand Siever in a controlled environment where operating the machine is easy. It is also important that the researchers made sure the place where the experiment will be conducted has the needed amount of electricity and sand. The researchers determined if the Electric Sand Siever is operating as intended and has no problems that may endanger the researchers or the people who use it. The researchers also witnessed how effective or efficient the Electric Sand Siever was compared with the traditional Sand Filter which people commonly use.

The researchers gathered and collected the data through experiments, observation, and surveys. The researchers personally distributed and translated the surveys into a language (Filipino) that the respondents can easily understand. Later, they found out whether the methods employed in the experiment were effective or not. Tools and materials were also observed and accounted for to determine their effectiveness in product development. All of the data gathered by the researchers were reliable and based on the accurate outcome of the experiment as well as the responses of the respondents through purposive sampling. The researchers performed

the observation and data collection processes with precision and honesty.

Statistical Treatment of the Data - The differences between the variables present in the study were ascertained using a frequency distribution and t-test. The researchers used the frequency distribution test to interpret the collected data or information more easily.

3. Results and Discussions

Table 1

Mean Level of Benefits of Electric Sand Siever Machine

INDICATORS	Frequency				Weighted Mean	Interpretation
	1	2	3	4		
The use of an electric sand siever machine requires less effort.	0	1	5	9	3.53	Strongly Agree
The use of an electric sand siever machine saves time.	0	1	6	8	3.47	Strongly Agree
Using an electric sand siever machine can be more cost-effective for me.	0	1	8	6	3.33	Strongly Agree
My body pain has been reduced by using an electric sand siever machine.	0	0	2	13	3.87	Strongly Agree
I can multitask while using the electric sand siever machine.	1	4	4	6	2.8	Agree
Overall Weighted Mean					3.4	Strongly Agree

Results of the data shown in Table 1 were obtained from the survey involving a total of four statements on the benefits of electric sand siever machines for the respondents. The participants tried using the electric sand siever machine before answering the survey. This experiment shows how an electric sand siever machine benefits construction workers and some companies. Nevon Projects (2018) asserts in the project Sand Filter & Separator Project that sand is used by numerous industries, including construction and manufacturing. They offer a system for separating and filtering sand that completely automates the process of filtering sand that is dumped upon it. With the help of a motor controller circuit, the system turns on the motor and makes it operational. This enables them to regulate the sand filter's motion to meet the necessary sand filtering needs.

The survey found that 9 out of 15 respondents (who participated in the experiment) strongly agreed that the use of an electric sand filter machine requires less effort than the manual sand sieving filter. 8 out of 15 respondents strongly agreed, 6 out of 15 respondents agreed and 1 out of 15 respondents disagreed. In the fifth question, 6 out of 15 respondents strongly agreed and 8 out of 15 students agreed and 1 out of 15 students disagreed. In the last question, 13 out of 15 respondents strongly agreed, 2 out of 15 students agreed and none disagreed that the electric sand siever machine is beneficial. In conclusion, the respondents found the electric sand siever machine to be a better replacement for the manual sand sieving machine they normally use. Also, according to the research of Fauzi et al. (2019), their respondents agree that the electric sand siever machine can reduce the construction workers' workload. That is because the sand filter machine will work to filter the sand using the shaker system. The electric motor will produce the shaker and sand will be filtered on its own. Furthermore, the sand siever machines have a funnel as a way for sand throughout and drop into the wheelbarrow.

Table 2

Survey Results about the Performance of Manual Sand Sieving after Using the Electric Sand Siever Machine

Indicators	Frequency				Weighted Mean	Interpretation
	1	2	3	4		
I can multitask while using manual sand sieving.	9	5	1	0	1.47	Strongly Disagree
The use of a manual sand sieving filter saves time and effort.	4	8	2	1	2.00	Disagree
I prefer using a manual sand sieving filter to an electric sand siever machine.	3	9	3	0	2.00	Disagree
Manual sand sieving filters is more effective than electric sand siever.	3	8	4	0	2.07	Disagree
Using a manual sand sieving filter is better for me than an electric sand siever machine.	6	7	2	0	1.73	Strongly Disagree
Overall Weighted Mean					2.15	Agree

In Table 2, Statement 1 has a total calculated mean of 3.60, which is similar to strongly agreeing. Statement 2 has a total quantity of the mean of 1.47, which is similarly very undesirable. Statement 3 has a mean of 2.00, which is unsatisfactory. Then in assertion 4, it is 2.00, which is incorrect. Statement 5 has a mean of 2.07, which

disagrees. Finally, assertion 6 has a 1.73 mean, indicating that it strongly disagrees. According to the observations and the survey of the researchers, construction workers indicate that when they use a manual sand sieve, they experience body pain, but this pain is lessened when they use an electric sand filter machine. 11 out of 15 respondents strongly agree that using manual sand sieving causes them to feel body pain. 13 out of 15 respondents strongly agreed that the sand filter machine lessened their physical aches and pains. It is easier to use an electric sand siever machine. Therefore, based on the answers of the respondents in the survey, the majority of the respondents have a positive reaction towards the electric sand filter machine because it helps them in terms of saving time and reducing the body pain they may experience compared to using the manual sand sieving machine. According to Tigadikar et al. (2019), screening has typically been done by hand using equipment or fixed screens. It is said in their findings that using a traditional sand-sieving filter is difficult, expensive, and time-consuming. It has also been noted that the usual equipment is inefficient or of limited utility because different sand sizes necessitate manual transportation and two material handling processes. As a result, this reflects the findings of the data in Table 2 above, which shows that employing a manual sand sieving filter is inefficient, time-consuming, and restricts multitasking.

Table 4

Survey about the cost of Electric Sand Siever Machine

Indicator	1	2	3	4	Mean	Interpretation
Using an electric sand siever machine can be more cost-effective for me.	0	1	8	6	3.33	Strongly Agree

Legend: 3.26- 4.0 Strongly Agree; 2.51-3.25 Agree; 1.76 – 2.50 Disagree; 1.00 – 1.75 Strongly Disagree

Table 4 indicates that an electric sand siever machine is indeed more cost-efficient to the respondents than the ones being sold by big construction companies. Based on the data that the researchers collected through the research survey, in the fifth statement on Electric Sand Siever Machine “Using an electric sand siever machine can be more cost-effective for me.”, 6 out of 15 respondents strongly agree, 8 out of 15 respondents agree, 1 out of 15 respondents disagree and no one totally disagrees. With a mean score of 3.33, the respondents strongly agreed that using an electric sand siever machine can be more cost-effective for them. Fauzi et al. (2019) claim in their study entitled Sand Filter Machin" that the cost of their invention is RM760.90, or roughly Php9, 000 in Philippine Pesos. It will cost Php18, 832 to purchase an electric sand filter machine from a construction company, not including tax. The results of this investigation, along with the data obtained and presented in Table 4, indicate that the electric sand siever machine is different from and more affordable than those offered by large construction companies.

Table 5

The amount of Sifted Sand (kg) and Time Taken to Sift (second)

Number of Trials	INPUT Initial Volume of Sand (kg)	Electric Sand Siever Machine	Manual Sand Sieving	Electric Sand Siever Machine	Manual Sand Sieving
		OUTPUT Amount of Sifted Sand (kg)	OUTPUT Amount of Sifted Sand (kg)	Time taken to Sift (second)	Time taken to Sift (second)
1	2	1.3	1.2	7.81	10.63
2	4	1.6	2.3	9.57	14.36
3	6	4.1	3.5	14.53	16.22
4	8	5.8	5.6	16.88	17.69
5	10	7.7	5.6	19.29	19.28
Total	30	20.5	18.2	68.08	78.18

Table 5 shows the amount of sand sifted (output) and the time required to sift using the electric sand siever machine and manual sand sieving. There are five trials and each trial has a different volume of sand (input), which is 2kg, 4kg, 6kg, 8kg, and 10kg. As indicated in Table 6 below, the computed t - value of 0.77 is less than the critical value of 2.36. This means that there is sufficient proof to accept the null hypothesis. In terms of task completion speed, there is no discernible difference between manual sand sieving and electric sand siever machine. In relation to that, the researchers don't have the right amount of budget to use the desired voltage of

the battery, which is higher than 12V. Even while there is no major difference in terms of speed to finish the task between manual sand sieving and electric sand siever machine, the Electric Sand Siever Machine is still effective in that it exerts the energy and effort of construction employees. Shende et al. (2022) mentioned in their research that the main notion of sieving sand is consistent speed, however, people who use manual sieving are not always consistent in their speed. In terms of the result, construction workers do not sieve sand at a consistent speed. It sometimes depends on the strength of the personnel. They are wearier. It takes a long time when they are resting. Though the results show that there is no significant difference in speed to complete the task between manual sand sieving and electric sand sieving, the electric sand sieving machine is still effective and helpful in that it allows construction workers to use less effort and time.

Table 6

T-test for the amount of Sifted Sand (kg) and Time Taken to Sift (second)

t-Test: Two-Sample Assuming Unequal Variances	Variable 1	Variable 2
Mean	13.616	15.636
Variance	23.44078	11.13173
Observations	5	5
Hypothesized Mean Difference	0	
df	7	
t Stat	-0.76819401	
P(T<=t) one-tail	0.233745399	
t Critical one-tail	1.894578605	
P(T<=t) two-tail	0.467490799	
t Critical two-tail	2.364624252	

As indicated in Table 7 below, the computed t - value of 0.31 is less than the critical value of 2.36. This means that there is sufficient proof to accept the null hypothesis. Furthermore, the p-value of 0.38 is greater than 0.05, indicating that the null hypothesis should be accepted. Therefore, there is no significant difference between manual sand sieving and electric sand siever machine in terms of output capacity. In addition, Emagbetere et al. (2021) wrote in their work, that the machine runs at various rates, from slow to medium to fast. As a result, they discovered that sifting all of the sand through the sieving mesh at a slow speed takes longer. Because the amount of sand deposited on the mesh affects the size of the impurities, there are variances in the sieving process.

Table 7

T-test for the Output Capacity of the Electric Sand Siever Machine and the Manual Sand Sieving Filter

t-Test: Two-Sample Assuming Unequal Variances	Variable 1	Variable 2
Mean	4.1	3.64
Variance	7.485	3.863
Observations	5	5
Hypothesized Mean Difference	0	
df	7	
t Stat	0.305339627	
P(T<=t) one-tail	0.384493498	
t Critical one-tail	1.894578605	
P(T<=t) two-tail	0.768986997	
t Critical two-tail	2.364624252	

Regarding Table 7, there is no distinction between a manual sand sieving method and an electric sand sieving machine in terms of output capacity since the output and the time it takes to accomplish a task depend on the components and types of sand that workers are using. Although there isn't much of a difference between the manual sand sieving filter and an electric sand siever machine in terms of output capacity, the electric sand siever machine is still useful in that it makes the job easier while still being able to do its intended task of sifting sand.

4. Conclusions and Recommendation

After the findings of this experiment, the researchers had the following conclusions: Electric sand siever machines benefit the construction workers and some companies by means of having less effort, time, and cost, as well as body pains of the users or sievers. The Electric sand siever machine was more effective compared to the manual or traditional sand sieving used in construction sites in terms of convenience, less effort, cost, and

time. In addition, the electric sand siever machine was able to multitask aside from sand sieving. The Electric Sand Siever Machine in this study is different from the ones being sold by big construction companies because the total cost of all the materials that were used is cheaper than an electric sand filter machine that is being sold by other companies. There is no significant difference between the manual sand sieving and electric sand siever machine in terms of speed to complete the task and output capacity. Despite the fact that there is no major difference, the electric sand siever machine is still functional and helpful to construction workers in that it costs less and decreases their effort and time to complete their job.

In light of the findings and conclusions of the study, the researchers recommended the following: Use an electric sand sieve machine as an alternative means of sieving among construction workers due to its higher output capacity. The electric sand separator machine is highly recommended for construction sites since it lessens the manpower cost requirement as well as the time consumed in filtering sand for construction purposes. The present project should be modified in order to lessen the cost of materials spent and, thereby, find a more cost-effective means of improving it. In the future researcher, they should conduct further related studies that will improve the present project, which is projected to be more beneficial to society, specifically among construction workers and even household laborers for immediate yet durable construction outputs. It's also advisable for them to use a battery and motor with a higher voltage for the system to work better and more efficiently.

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