



5S: A Leaner Workflow Tool at Agm Venture

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Abstract: This aims to generate a leaner workflow system through the use of a Lean Manufacturing Tool, 5S. The researchers have identified non-value added activities that exist in AGM Ventures Enterprise Inc. specifically the waste of motion, waiting and transportation. Tools such as questionnaire and observation through Work Sampling, Non-value Adding (NVA) Activity Sheet and Spaghetti Diagram were used to gather data. The researchers recommended a new layout, jig modification, ducting system and the implementation of 5S. In this way, worker's productivity will increase, long transportation will be reduced, and frequent delay of production will be minimized. From the researcher's proposals, numerous benefits will be gained by the company such as manpower savings of P243,803.5 a year for the 10 workers alone and P3,891.76 cost impact from the different processes if non value added activity were eliminated.

Keywords: 5S, Leaner, Workflow

1. Introduction

Many companies have implemented lean manufacturing techniques to create more efficient workflows. By using Lean approaches, processes can be streamlined and operating inefficiencies reduced (Deutsch, 2013). Lean Manufacturing emphasizes the prevention of waste, any extra time, labor or material spent producing a product or service that does not add value to it (Carter, 2012).

According to Alukal (2003), lean implementation focused on getting the right things to the right time in the right quantity to achieve perfect workflow, while minimizing waste and being flexible and able to change. Through minimizing of waste and the creation of flow through the various processes, companies are able to eliminate costly scrap and rework while contributing to their bottom line (Faro, 2011). Snyder (2012) states that one of the biggest way that companies lose money is poor use of time, most of time is spent on activities that do not significantly add values. According to Pefianco (2014), keeping costs down in operations, in the office or in production, is critically important today and 5S is a proven system that can help a company to become more efficient and to lower costs.

Every workplace needs to be organized to improve productivity (Hudgik, 2013). Lean manufacturing, or the use

of lean tools, has long been a hallmark for continuous improvement strategy. According to the 2003 Industry Week/Manufacturing Institute Census of manufacturers, about one-third (36%) of U.S. manufacturers identified lean as their primary improvement strategy.

Various companies here and abroad are not aware of the importance of eliminating non-value added activities that do not enhance the customer's judgment of the value of the product. Indeed, those companies do not know what non-value added activities are. These companies do not take into consideration recognizing different activities that add costs to the company.

Angeles Gabayan Mendoza (AGM) Ventures Enterprises Inc. is one of those companies who tend to spend large amount of production cost because they are not aware that there are lots of wastes that can be removed, resulting to maximizing company's profit.

AGM Ventures Enterprise Inc. is a wood-based manufacturing company located in Sta. Rosa, Laguna and is one of the leading wooden pallet manufacturers in South Luzon, distributing pallets all over the Philippines and abroad through other exporting companies for over 16 years.

The researchers would generate a leaner workflow system at AGM Ventures Enterprise Inc. by eliminating non-value added activities. The company can create more value in

manufacturing process by identifying activities that do not directly contribute to the products. The focus of the study are the use of 5S, non-value adding activity sheet and other lean manufacturing tools to reduce or eliminate direct wastes. Direct wastes results in unproductive work hours for employees, underutilization of machines and a slow production line.

The proponents’ area of interest is using 5S as a Lean Manufacturing tool, which involves never ending efforts for continuous improvement. Thus the researchers conducted a research study at AGM Ventures Enterprise Inc. to determine what non-value added activities are present and how to reduce, if not eliminate them.

According to Koskela (1992), there seems to be three root causes why non-value adding activities exist: design, ignorance and the inherent nature of production. Non-value adding activities exist by design in hierarchical organizations.

Every time a task is divided into two subtasks executed by different specialists, non-value adding activities increase: inspecting, moving and waiting. In this way, traditional organizational design contributes to an expansion of non-value adding activities.

Ignorance is another source of non-value adding. Many processes have not been designed in an orderly fashion, but instead just evolved in an ad hoc fashion to their present form. The volume of non-value adding activities is not measured, so there is no drive to curb them.

It is in the nature of production that non-value adding activities exist: work in process has to be moved from one conversion to the next, defects emerge, accidents happen. With respect to all three causes for non-value adding activities, it is possible to eliminate or reduce the amount of these activities.

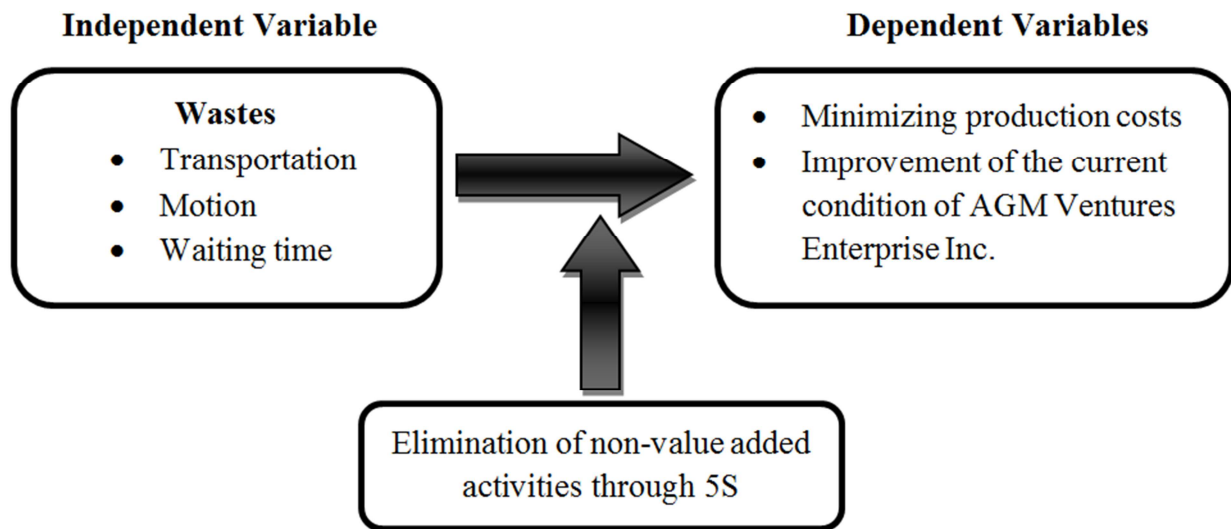


Figure 1. Operational Framework.

Figure 1 shows the independent variables which are the direct wastes: transportation, motion and waiting time. The intervening variables will be the elimination of non-value added activities through the use of lean manufacturing tool: 5S. Minimizing production costs and the improvement of the current condition of AGM Ventures Enterprise Inc. are the dependent variables which are the results of implementation of 5S.

The study will determine the impact 5S as a Leaner Workflow Tool in eliminating non value added activities at AGM Ventures Enterprise, Inc. Specifically, the study will answer the following sub-problems:

1. What non-value adding activities are currently present at AGM Ventures Enterprise Inc.?
2. What is the cost impact of eliminating non-value added activities to AGM Ventures Enterprise Inc.?
3. Is there a significant relationship between the existences of non-value adding activities to the productivity of the workers at AGM Ventures Enterprise Inc.?

The researchers assume that workplace environment is one of the factors that strengthen employee’s productivity. Since

they spend huge proportion of their lives at work, it is important that they have a good environment to work in. It is assumed that the presence of non-value added activities at the said company is due to the excessive motion of workers during work, poor facility layout and undue transportation. Also, the researchers assume that non-value added activities add expenses to the company. Determining non-value added activities present at AGM along with the necessary information, the company will have an improved workflow system in order to increase the productivity of the workers and output, as well as to reduce production costs and time. The researchers are guided by this hypothesis: There is no significant relationship between the existences of non-value adding activities to the productivity of the workers at AGM Ventures Enterprise Inc.

The setting of the study is limited to building 2 of AGM Ventures Enterprise Inc., located at Sta. Rosa Laguna, focused on the production of high quality pallets. Pallets that do not undergo kiln drying are the only products that the researchers dealt with. The respondents of the study came from the production workers of the 2nd building with a total

number of forty eight (48) production workers. Furthermore, the study only deals with the problems related to elimination of non-value added activities that is present in the company such as waste of transportation, motion and underutilized workforce.

At the end of the study, the results will benefit the following: the company, the researchers, the institution, the future researchers, and it will contribute to the fund of knowledge in the field of Industrial Engineering. According to Wang (2011), Lean Manufacturing is the production of goods using less of everything compared to mass production and it is focus on reduction of Toyota's original "seven wastes" in order to improve overall customer satisfaction. Russel and Taylor (2000) states that waste was defined as anything other than the minimum amount of equipment, materials, parts, space, and time which are absolutely essential to add value to the product. While for Hirano (2006) waste is everything that is not absolutely essential.

Processes that deliver the product or service to the customer fall into groups which are value-added activities and non-value-added activities. Value-added activities is an activity that adds value if it is performed in a process that the customer is willing to pay for, it is done right the first time, and it transforms the product or service. While non-value added activities are those activities that adds unnecessary time, effort, or cost. (Breyfogle III, 2003).

According to Gopalakrishnan (2010), the identification of non-value added activities and eliminating them are the core objective of lean manufacturing. Managers should have complete knowledge of the process from start to end. They should study the process in its totality to identify and eliminate non-value-added activities. While Breyfogle III (2008) states that to help identify waste, the Lean philosophy breaks down waste into seven specific elements which are Overproduction, Inventory, Transportation, Waiting, Motion, Over Processing and Defects.

Rahman (2012) defined the waste in transportation, waste of waiting and waste of movement. Waste in transportation is concerned with the internal movement of materials on site where poor workplace layout or a lack of process flow creates many stops and starts in a production cycle. Waste of waiting is related to the idle time caused by lack of synchronization and leveling of material flows, and pace of work by different groups or equipment. Waste of movement is concerned with the unnecessary or inefficient movements made by workers during their jobs, which might be caused by inadequate equipment, ineffective work methods, or poor arrangement of the working place.

Alvarez (2009) state that implementation of a lean manufacturing strategy represents a robust contribution to the phase sequence that leads to operational excellence and the continuous improvement through the elimination on non-value-added activities. On the other hand, Homer Villa, 20102 said that "lean" is a business management philosophy and methodology that considers the expenditure of resources for any goal other than the creation of customer value to be wasteful, and thus a target for elimination. Meanwhile,

reviewed studies stated that Lean Manufacturing (wastes elimination) affects positively on reducing the production cost. These researches provide the manufacturing managers suitable tools and techniques of eliminating wastes, such as, 5S's system, VSM, TPM, and JIT. (Abu Shaaban, 2012).

Application of lean principles is one of the best method to use to enhance construction performance in Malaysian construction. The successfulness of lean principles in enhancing performance was due to its concept of optimizing and eliminating wastes, rather than minimizing them (Rahman et.al, 2012). In a journal by Kumar, C. and Kumar, P., it is stated that Lean manufacturing is a systematic approach to identifying and eliminating wastes (non-value added activities) through continuous improvement by conveying the product at the pull of the customer in pursuit of production. From the discussion of related literatures and studies, the researchers found out that there was no study that had been conducted on generating a leaner workflow system at AGM Ventures Enterprise Inc.

2. Methodology

The instruments used to collect data are observation, interview and questionnaire. Informal observation and interview was also conducted during data collection for validation purposes. Work sampling is a method in which a large number of instantaneous observations are made at random time intervals over a period of time on a group of machines, workers or processes/operations. In this study, work sampling was used whether a worker has been ultimately utilized or underutilized. It is where the researchers will also identify how much cost a company spends in a worker who is not efficient and productive.

Non Value-Adding (NVA) Activity Sheet was used to determine the non-value added activities that are present in the company. Spaghetti Diagram which is a Lean Six Sigma tool was used to expose inefficient process layouts, unnecessary travel distance between process steps and overall process waste.

AGM Ventures Enterprise Incorporated has a total of one hundred twenty nine (129) employees, wherein seventeen (17) are the management staff and one hundred twelve (112) are the production workers. The researchers will only deal with the 2nd building of the company since the focus of the study are pallets not undergoing kiln drying are done in this building. This building has 48 workers and the researcher decided to use only 20% as sample respondent equivalent to 10 workers. Percentage and Coefficient of Correlation were used to determine the relationship of non-value added activities and productivity of workers.

3. Results and Discussion

It is through observation that the researchers were able to determine various NVA activities present at AGM. Table 1 shows Work Sampling results from the 10 workers.

Table 1. Summary of Percent Idle.

Sample Respondents	Total No. of Observation	Total No. of Working	Total No. of Idle	% Idle	Rank
Worker 1	125	76	29	23.2	8
Worker 2	125	73	32	25.6	4.5
Worker 3	125	73	32	25.6	4.5
Worker 4	125	68	37	29.6	1
Worker 5	125	71	34	27.2	3
Worker 6	125	82	25	20	10
Worker 7	125	77	28	22.4	9
Worker 8	125	74	31	24.8	6
Worker 9	125	75	30	24	7
Worker 10	125	69	36	28.8	2

Actual work sampling result done by the researchers can be found in Appendix A. Table 1, shows the summary of idles gathered from the 10 workers for 5 days. Worker 4 has the highest percent idle (29.6%) and worker 6 has the least percent idle (20%). Average percent idle form the 10 workers is 25.12% or equivalent to 2 hours (120.576 min).

Table 2. Reasons of Idle Time per Worker.

WORKER REASONS	1	2	3	4	5	6	7	8	9	10	TOTAL	%	RANK
Talking during working	8	9	4	6	6	3	4	4	4	7	55	17.5	4
Texting	7	6	4	5	4		1	1	1	4	33	10.5	5
Early Break	7	8	9	8	6	6	4	5	5	5	63	20	3
Walking not related to work	7	9	7	8	7	8	10	11	11	9	87	27.7	1
Waiting for Jack Pallet			8	10	11	8	9	10	9	11	76	24.2	2
TOTAL	29	32	32	37	34	25	28	31	30	36	314	100	

As evidenced by Table 2, walking ranked 1st, 87 out of 314 or equivalent to 27.7% of the total idle and the least is texting, 33 out of 314 or equivalent to 10.5% only.

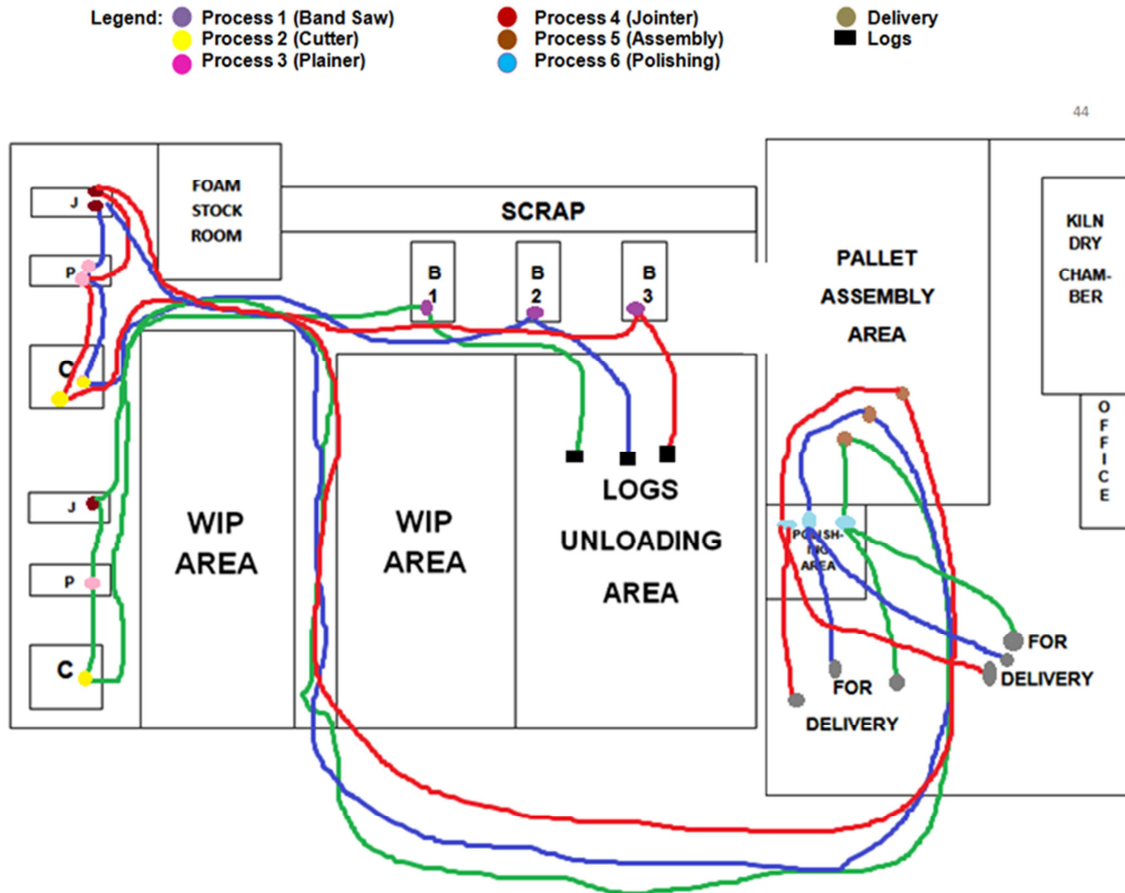


Figure 2. AGM Current Layout with Spaghetti Diagram.

The current layout of AGM (is shown in Appendix C) is one of the causes of the poor production flow which generates costs to the company. As observed from the current situation, long transportation exists. Poor layout has been one of the causes of having excessive transportation that adds to the non-value added activities of a worker. Barriers to the route of transportation are also a cause of delay during the transportation process of raw materials, Work in Process (WIP) and finished goods. There is also insufficient space for the mobilization of forklift and jack pallets. They are having difficulties in terms of the access to pathways due to the obstructions on their way. The foam stock room is also not utilized. The access of the way in transporting materials from pre-assembly area to assembly area is one of the causes of long transportation in AGM. The workers need to go on far/long distance to make it to the assembly area since they have placed the logs in these areas for them to create their own place for rest. Waste of transportation causes the company to spend money at an alarming rate which also gives many opportunities for handling damage and losses.

Details of the survey are shown in Appendix E, on the average, 7 out of 10 respondents answered that they can finish 51-70 pieces of pallets a day; while 3 out of 10 answered they are capable of finishing 30-50 pallets a day. As to enough space to transfer raw materials from one place to another, 1 out of 10 answered that their space is very adequate, 2 for adequate, 1 for fairly adequate and 6 for inadequate. By the term inadequate, this means that the space for transportation is not enough for the mobilization of jack pallets and forklift. Availability of forklifts and jack pallets to transfer goods shows that 1 out of 10 answered very adequate, 2 out of 10 for adequate and fairly adequate and 5 out of 10 for inadequate. This only shows that there is not enough number of jack pallets and forklift to use in the production area. As to access to pathways to transfer raw materials, work in process and finished goods, 2 out of 10 respondents answered very adequate, 1 out of 10 for adequate and fairly adequate respectively, 4 out of 10 for inadequate and 2 out of 10 for very inadequate. This shows that there is not enough access for transportation of raw materials, work in process and finished goods. In searching for tools, equipment and even raw materials to be used, 6 out of 10 respondents answered that they search for tools, equipment and materials very often, 3 out of 10 for often, and 1 out of 10 for fairly often. As to the barriers to the route of transferring raw materials, work in process and finished goods, 9 out of 10 respondents answered yes, while only 1 out of 10 answered that there is none. Barriers like scattered scraps of the different parts of a pallet, unorganized arrangement or stacking of the pallets and narrow pathways for transportation.

Having idled in work is a waste, and has a big impact to the company. AGM Ventures Enterprise Inc. pays the workers in right amount which in return the worker should endeavor themselves in doing the job well without wasting every second and make sure that the product is on its best condition. The actual collected data gathered using NVA

activity sheet can be found in Appendix B. Table 3 shows the average NVA activity in minutes and the output produced with the NVA activity present.

Table 3. Breakdown of NVA activity per Process with corresponding Output.

BAND SAW	TRIALS (min)					AVE
	1	2	3	4	5	
NVA activity						
Searching for log to be used	8.15	6.22	10.01	7.35	5.66	
Set-up jigs to desired length	0.25	0.17	0.08	0.23	0.13	
Talking during working time	1.01	2.32	1.49	1.18	3.21	
Stacking processed log to jack pallet	1.25	0.96	1.12	1.21	1.16	
Total	10.66	9.67	12.7	9.97	10.16	10.632
Output	79	83	72	80	87	80
CUTTER						
Set-up jigs to the machine	1.21	0.54	0.77	0.93	1.16	
Removing the scrap from the machine	0.67	1.03	0.82	1.09	1.11	
Total	1.88	1.57	1.59	2.02	2.27	1.866
Output	49	65	54	62	56	58
PLAINER						
Talking during working time	1.23	1.08	0.76	1.14	1.11	
Removing the scrap from the machine	1.87	0.87	1.65	1.28	1.02	
Total	3.1	1.95	2.41	2.42	2.13	2.402
Output	41	47	39	44	39	42
JOINTER						
Cleaning the workplace	1.2	0.41	0.92	0.65	0.89	
Total	1.2	0.41	0.92	0.65	0.89	0.538
Output	70	71	64	70	68	69
ASSEMBLY						
Talking during working time	0.69	1.18	0.5	0.73	1.21	
Waiting for jack pallet to transport the finished product to the storage area	0.58	0.82	1.04	0.32	0	
Total	1.27	2	1.54	1.05	1.21	1.302
Output	8	8	7	8	6	8
POLISHING						
Talking during working time	0.23	0.58	0.34	0.18	0.11	
Waiting for jack pallet to transport the finished product to the storage area	0.25	0.14	0.18	0.1	0.26	
Cleaning the workplace	0.84	0.59	0.91	0.68	0.84	
Total	0.25	1.31	1.43	0.96	1.21	1.302
Output	36	24	31	28	36	31

Table 3 presents the NVA activity incurred per process with their corresponding output when observed using NVA activity sheet 5 times. Band Saw has the highest average NVA activity of 10.632min. and the least is Jointer process with 0.538min. only.

Table 4. Cost Impact of NVA per Process.

	Average NVA Activities (min)	Cost Benefit per Day	Cost Benefit per Month	Cost Benefit per Year
Band Saw Process	10.632	P7,963	P191,112	P2,293,344
Cutter Process	1.866	1,398	33,552	402,64
Plainer Process	2.402	1,799	43,176	518,112
Jointer Process	0.538	0,403	9,672	116,064
Assembly	1.302	0,975	23,4	280,4
Polishing Process	1.302	0,975	23,4	140,4
TOTAL	18,042	13,513	324,312	3891,76

In computing the cost benefit of the excessive motion shown in Table 4 of each worker per process, the researchers multiply the total NVA activities by the daily rate which costs P337. The company will save P3891.76 per year if non value-added activities are eliminated.

Computation of Manpower Savings per Process:

Rate per day = P337 this is from 8am to 5pm or 540min

Actual working hours is 540min less break time of 90 min

= 450min

Rate per min = P337/450 = P0.749 per min.

Band Saw: (P0.749min) (10.632min) = P7,963 per day

(P7,963/day) (24days) = P191,112 per month

(P191,112/month) (12months) = P2,293,344 per year

Note: Cost benefit per year for other processes were computed the same way.

Table 5. Cost Impact of Percent Idle.

Name of Worker	Percent Idle	Cost Benefit Per Day	Cost Benefit Per Month	Cost Benefit Per Year
Worker 1	23.2%	P 78.18	P 1,876.32	P 22,515.84
Worker 2	25.6%	P 86.27	P 2,070.48	P 24,845.76
Worker 3	25.6%	P 86.27	P 2,070.48	P 24,845.76
Worker 4	29.6%	P 99.75	P 2,394.00	P 28,728.00
Worker 5	27.2%	P 91.66	P 2,199.84	P 26,398.08
Worker 6	20%	P 67.40	P 1,617.60	P 19,411.20
Worker 7	22.4%	P 75.49	P 1,811.76	P 21,741.12
Worker 8	24.8%	P 83.58	P 2,005.92	P 24,071.04
Worker 9	24%	P 80.88	P 1,941.12	P 23,293.44
Worker 10	28.8%	P 97.06	P 2,329.44	P 27,953.28
Total		P 846.54	P 20,316.96	P 243,803.5

Table 5 showed the manpower savings of AGM Ventures Enterprise Inc. for the ten workers. Manpower savings is computed by multiplying the daily rate of the workers by the percent idle. If the NVA activities were eliminated through the strict implementation then, the company will save P243,803.5 yearly just for the 10 workers.

Computation of Manpower Savings

Rate/day = P337

Working days/month = 24

Months/year = 12

Worker 1: (23.20%) (P337) = P78.18/day

(P78.184/day) (24days) = P1,876.32/month

(P1876.416/month) (12months) = P22,515.84/year

Note: Computation for other workers in terms of cost benefit per year were computed the same way.

Computation as to the significant relationship of the presence of NVA activities and the productivity of production workers in each process, using coefficient of correlation can be seen in Appendix C. To sum up the results based on the computed data, the existence of different kinds of waste has no effect/impact on productivity. This is so because in computing the output of the worker the researcher focus on the actual processes in making the product and other NVA activity such as texting and early break were not seen during these times.

4. Conclusion

Based on observation conducted by the researchers at AGM, direct wastes are identified. It is through the use of some lean manufacturing tools that the observation cited are supported. With the percent idle ranging from 20% - 29.6% through the use of work sampling, it is undoubtable that the waste of underutilized workforce exists. In the application of non-value adding activity sheet in gathering data, waste of motion and delay is observed due to the searching of logs to be processed in band saw, frequent cleaning of their workplace and waiting of transferring equipments. The researchers have also analyzed the current layout of the said company with the use of spaghetti diagram. Excessive transportation was scrutinized because of the obstructions in the access of ways and the poor layout of the company that causes rough production flow and delay in producing the goods.

From the computed findings through work sampling, AGM Vantures can save up to P243,803.5 per year for ten (10) workers and P3,891.76 cost impact from the different processes. Through the use of coefficient of correlation, it is proved and concluded that there is no significant relationship between NVA activities and the productivity of the workers.

5. Direction for Future Use

5S is a team-based activity where everyone works to improve the conditions on a specific area. A clean and well-organized workplace provides a foundation for: a good company image bringing more business, improving worker's morale removing frustrations, improving quality, eliminating wastes, safer workplace, cost reduction, and better efficiency.

A 5S Audit checklist – workplace evaluation, as shown in the Appendices F may be implemented by the management in every production line. Each day, the supervisors will check and rate the workplace of every lines, whoever line got the highest points at the end of the month will be rewarded. With this implementation, workers will be encouraged to organize their workplace.

The objective of the proposed layout is to reduce

materials-handling costs, allow space for production machines, provide for volume and product flexibility, provide for employee safety and health, allow ease of supervision, allow ease of maintenance and achieve objectives with least capital investment. Access to pathways has given spacious area in order for them to fully mobilize the transferring equipment without any obstruction or difficulties. The machineries or equipment are arranged to ensure continuous flow of material in an orderly mode throughout the plant. The foam stock room was eliminated since it is no longer utilized.

Since the layout corresponds to the sequence of operations, smooth and logical flow lines can result. The work from one process is fed directly into the next. Total production time per unit is shortened. The machines are located in order to minimize distances between consecutive operations, material handling will reduce.

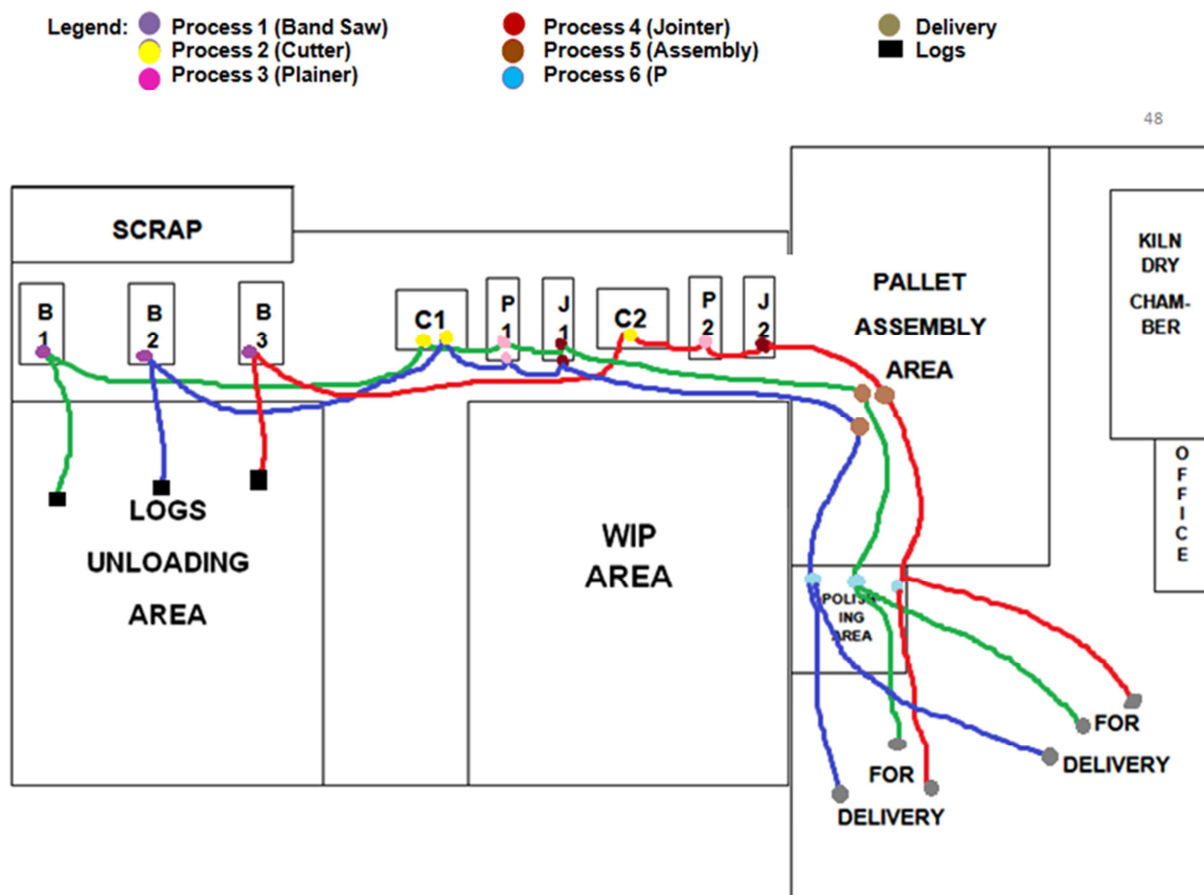


Figure 3. Proposed Layout.

On the band saw and cutter machines, wood jigs were not fixed on the machine resulting to workers to constantly adjust it to its required measurement. Bad thing if wood jigs were not precisely aligned. For this reason, the researchers recommend to have Jig Modification/ Machine modification. This will modify machines to set jigs to be fixed. In this way, workers can continuously work without bothering the adjustments of jigs, and delay with this process will be eliminated.

In the production area, particular to Building 2, with the

processes of band saw, cutter, plainer, and jointer, cleanliness cannot be maintained through installation of a machine that automatically suck in and out the saw dust wood residues out of the work area to eliminate frequent cleaning that adds to the non-value added activities of the company. Workers are unable to work productively if their workplace was too untidy, thus, they keep on sweeping the scraps mounted on their place. This condition causes process delay. With the implementation of a Ducting System, constant cleaning which is a NVA activity may be eliminated or if not, it can be reduced.

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