

MSWT-01, an alternative in combining Production Based Education (PBE) and student CSR program in Polman

Gamawan Ananto¹, Albertus B Setiawan² and Darman MZ³

Manufacture Engineering Dept, Bandung State Polytechnic for Manufacturing,
Jl. Kanayakan 21 Bandung 40135, INDONESIA

Email: gamawan@polman-bandung.ac.id

Abstract. MSWT-01, Mobile Surface Water Treatment, producing 1m³ per hour, is an alternative for providing clean water in flood disaster areas, and was developed at Bandung State Polytechnic for Manufacturing (Polman) as a part of institution research project. The combination of cartridge or membrane technology such as carbon block, MF, UF and filtration media is used for this machine, instead of coagulation-flocculation with chemical addition, due to emergency purposes related with its treatment processing time. The idea is that MSWT could be combined with Production Based Education (PBE) concept in Polman as a vocational education institution and students 'CSR', students social activities. With the number of implementation trials in real flood area condition, MSWT will be developed further based on the technical output result. The manufacturing process for improving or adding necessary features could be implemented as a student's project in PBE system. This might be an ideal combination alternative for such vocational institution that students get the product media for their PBE program and implement their work as a defined social activity. They will learn and experience related technical matters and more social interactions with the people and other disaster stakeholder as well.

1. Introduction

Since there are a lot of places in Indonesia with potential disaster that flood might be happened frequently, clean water lacking is one of problems faced in such places due to its water sources contaminating. For providing clean water, various solutions always initiated by all related parties such as Government mitigation programs, CSR program from some companies, and survival actions of people around these unlucky places. MSWT-01, Mobile Surface Water Treatment, that made for 1m³ per hour capacity, is an alternative to provide clean water in flood disaster area, which developed in Bandung State Polytechnic for Manufacturing (Polman) as a part of institution research project. The combination of cartridge or membrane technology such as carbon block, MF, UF and filtration media is used for this machine, instead of coagulation-flocculation with chemical addition, due to emergency purposes related with its treatment processing time. As known, in general, the optimal holding time of flocculation and coagulation process for such capacity is about 30-40 minutes[1].

Polman, as a vocational education institution, implement practical program in its laboratory or workshop that had the aim to build students skill competencies. For those practical product media the institution might create a structured exercise that referred to students competency levels needed, execute/ fabricate the research project result from internal demand of institution, and could also be initiated from external inquiry through collaborating with industrial parties. Such collaboration



concept between academia and industry called Production Based Education. Implementing real life industrial practice within education activities is considered as a catalyst in this collaboration[2]. This can help university or polytechnic to achieve student competencies by providing exact learning media for always relevant to the industrial need purpose. The application of technology for industrial service activities in the laboratory/ workshop will help to validate an education process, since products/ services are always tried to meet the industrial need[3].

From other point of view, students should learn things related to organization, team work and social interactions. In industries, there is a concept called Corporate Social Responsibility (CSR). This concept has evolved since its establishment in the 1950's. Bowen (1953) was the first to propose a definition for the construct[4]. Social responsibility in the higher education sector is not so different from the corporate social responsibility. Both universities and corporations have to provide sound responses to new realities of environment and society. The primary role of universities is to serve the society within it functions[5].

The idea is that MSWT could be combined with PBE concept and students 'CSR' in Polman. With the number of implementation trials in real flood area condition, MSWT will be developed further based on the technical output result. The manufacturing process for improving or adding necessary features could be implemented as a student's project in PBE system. This MSWT development and students 'CSR' combination through PBE system will enrich students insight in product variant. Therefore, this might be an ideal combination alternative for such vocational institution that students get the product media for their PBE program and implement their work for a defined social activity. They will learn more interactions with the people and other disaster stakeholder as well.

2. Methodology

The steps of MSWT-01 implementation as shown on Figure 1. It has to be prepared before taken for 'lab. scale' trial or simulation on the nearest river or conditioned water source. The preparation is including previous data that content technical matters, check the general condition of electrical and mechanical properness, its mobile wagon etc. If this simulation is OK it will be brought for operation on real location of disaster after necessary improvement(s), if any. In this stage, there will be more proper preparations needed such as spare components, supporting tools, electric power generator, vehicle for trailing the wagon out, organizing related parties on disaster area etc. Post operation, an evaluation should be initiated that is following with improvement planning, feature adding, standard maintenance procedure or other necessary actions.

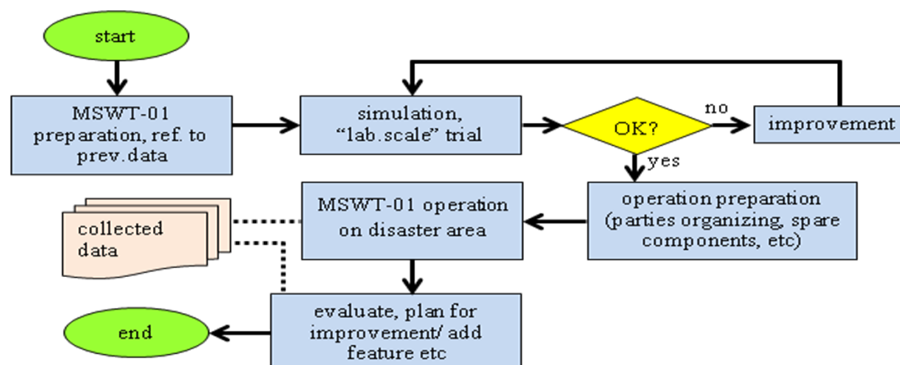


Figure 1. Implementation General Steps for MSWT-01

In vocational institution like Polman, necessary actions in improvement such as re-fabrication, features adding and other related tasks will be treated as 'research project' handling in PBE system, as mentioned on Figure 2. While job shop and batch products are running by students who assigned in

each machine, products that resulted from research activity managed by small team that consist of Lecturer who had relevancy with the research theme and supported by students as the ‘temporary’ member of the team. The way of such team handling caused necessary improvement flow will be easier either it is still in design process/ engineering, fabrication, or looping back for re-design during in machining stage[6]. For MSWT case as a result of ‘research project’, its implementation could be social penetration, utilizing for benefit activity or other program.

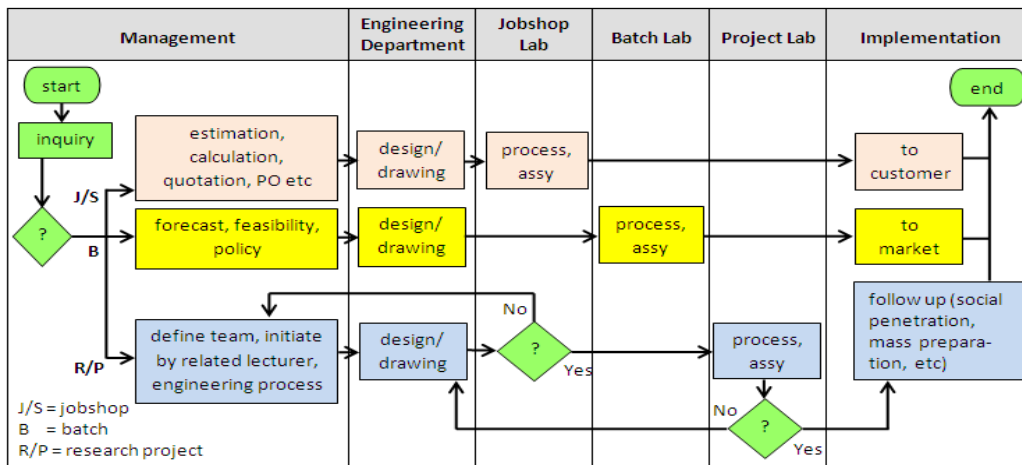


Figure 2. PBE General Order Flow for Job Shop, Batch and Research Project[6]

3. Discussion

3.1 Technical Aspects

MSWT-01 used the combination of cartridge or membrane technology such as carbon block, MF, UF and filtration media, instead of coagulation-flocculation, as stated. This is inspired by a number of references such as few water treatment technologies in Figure 3 [8] that shows how conventional filtration process may overcome undissolved compound content up to around 1µm dimension, whereas the most extreme condition such as seawater or brackish with salts content has to use RO (reverse osmosis) membrane. One situation may need conventional filtration only whereas the other could be added with MF for instance [9].

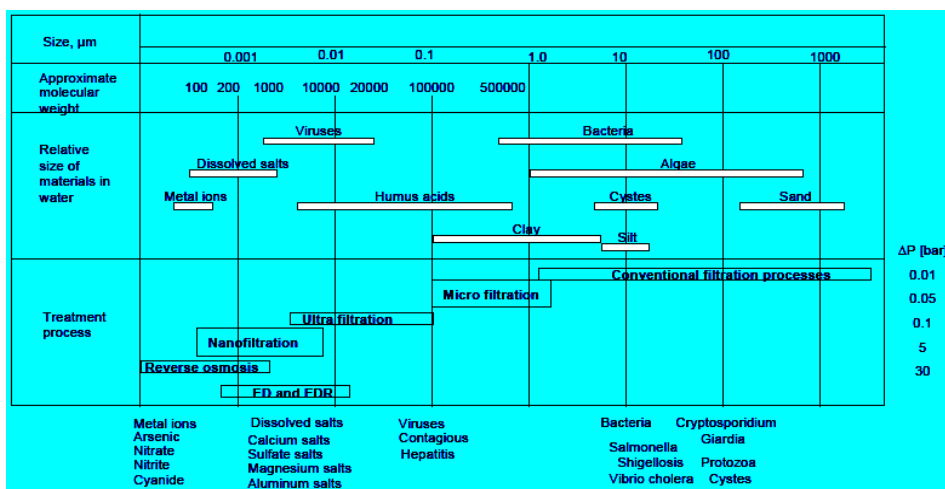


Figure 3. Water Treatment Process Technology Level[8]

On previous concept, there were number of trials that using oxidation and coagulation/ flocculation method. The result was absolutely not bad, but additional chemical solution and holding time are needed. Theoretically, the optimal holding time of flocculation/ coagulation process for such capacity is about 30-40 minutes[1] that to be considered due to emergency purpose for MSWT case. Therefore, standard cartridge is chosen for MSWT new concept instead of chemical way. The default features for treating the raw water source in MSWT-01 are carbon block (CB) cartridge, filtration media (active sand, active carbon & other mineral media) and micro filtration (MF) membrane. Referred to previous result of trials, this design is capable to produce deserved clean water that ready for cooking. In case the raw water condition on certain location is that worst or the asked demand is up to that high, the optional features such as ultra filtration (UF) membrane and ultra violet (UV) disinfection might be implemented or added, as indicated on Figure 4 [7].

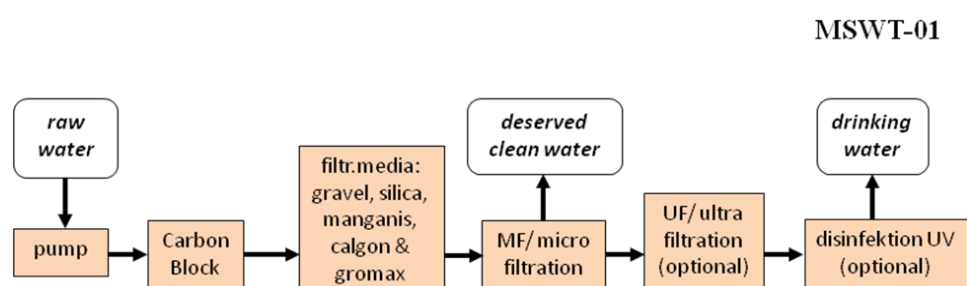


Figure 4. MSWT-01 Block Diagram [7]

Table 1 shows the result comparison between chemical (oxidation, flocculation/ coagulation) and CB (carbon block) & MF (micro filtration) cartridge method, which sand filtration are used for both. Since the Fe content in cartridge method result seemed not that proper, more trials still have to be initiated in order to show the stable and consistent result.

Table 1. Result Comparison, Chemical and Cartridge Method

Parameter	Unit	Std. max spec.	Source, raw water	Result, oxidation & flocculation	Result, CB & MF cartridge
Color	TCU	15.0	35.90	6.00	3.00
Turbidity	NTU	5.0	199.80	2.00	0.80
Fe content	mg/L	0.3	8.96	0.20	0.56
Mn content	mg/L	0.4	0.46	0.30	0.22
Organic (KMnO ₄)	mg/L	10.0	51.81	4.73	1.74
Hardness (CaCO ₃)	mg/L	500.0	136.04	117.70	114.62

3.2 PBE (Production Based Education) and Students' Activities

Through PBE, Polman acts as an industry partner in components, tools and machine making. In general basic concept these activities are created to follow the present and updated technological needs of industries. The students practical program schedule is made structurally, combined with theory and other contents needed according the planned competency for each study program in 3 years (6 semesters) for Diploma-3, or 4 years (8 semesters) for Diploma-4.

As an example of Diploma-4 Study Program, Figure 5 shows how the education program is developed based in three phases arrangement: Problem-Based, Production-Based and Project-Based. Problem-Based is started using standard product as a structured job in order to train the student in basic

competencies, fit to the standard with low-mid speed whereas ordered job in deepening a competences for more speed in delivering a product to the industry as a customer. Production-Based is operated in the real industry; students are working full time for 1 year according to daily industrial problem[3] that could be an external OJT (On the Job Training). Another case, one of Diploma-3 Study Program arranged these 2nd phase as an internal ‘OJT’ that students are doing the Industrial Practice in the campus.

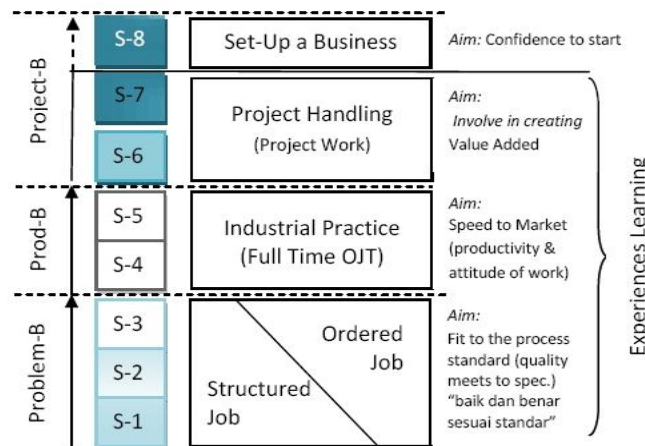


Figure 5. Education Management Program[3]

Called as ‘321’ program idea, in this Diploma-3 students will get the first 3 semesters (sem) for basic matters needed including theory sessions, the next 2 semesters (sem 4 and 5) in integrated project program continually, then the last 1 semester for finalization and the additional enrichment items. Basically, instead of doing machining or other process respectively like sem 1-3, these sem 4 and 5 are defined to a few subprograms that won’t be interrupted with any theory week nor surrounding from one kind of machine to another[6]. These subprograms will be accommodated in Engineering Department, Job Shop Lab, Batch Lab and Project Lab by turns.

	Month-1		Month-2			Month-3			Month-4			Month-5			Month-6									
Group A	BV	BV	JS1	JS2	JS2	D	D	D	M	P	P	P	P	P	P	A	A	PR	PR	PR	PR	E		
Group B	JS2	JS2	BV	BV	PR	PR	PR	PR	D	D	D	M	P	P	P	P	P	P	A	A	JS1	E		
Group C	D	D	D	M	P	P	P	P	P	P	P	P	A	A	PR	PR	PR	PR	JS1	JS2	JS2	BV	BV	E
Group D	PR	PR	PR	D	D	D	M	P	P	P	P	P	P	P	A	A	JS1	PR	BV	BV	JS2	JS2	E	

Notes:

- BV = bench vice product, in Batch lab
- JS1 = Jobshop Lab, external customer’s job
- JS2 = Jobshop Lab, external customer’s job
- PR = Project Lab, internal customer’s job
- D = design, drawing
- M = component & material preparation
- P = machining process
- A = assembly

Figure 6. 321” Practical Work Schedule For Semester 5 [6]

A simplified example program schedule in sem 5 is shown by Figure 6. One of subprogram is a ‘project based’ for each subgroup (A, B, C and D) that composed -in this case- for 6 students, since 1 group consists of 24 students. MSWT-01 could be done by one of such project based subgroup. When the machine is ready, related subgroup will be assigned to do the implementation on disaster location as far as their schedule program fitted with the disaster case, otherwise other student group should be assigned conditionally through extracurricular program that prepared as a student ‘CSR’ program,

where they could experience all related technical matters and more social interactions with the people. A maintenance procedure could be initiated as well for this MSWT-01 periodically, through project based subprogram or part of it.

4. Conclusion

MSWT-01, Mobile Surface Water Treatment, is developed in Bandung State Polytechnic for Manufacturing (Polman). As an institution research project it has to be implemented as proposed, by utilizing on flood disaster with number of improvements and maintenance support. With the number of trials in real flood area condition, its further development based on the technical output result. The steps of implementation are; preparing all necessary things such as spare components, supporting tools, organizing disaster area related parties etc, and operation itself. Post operation, an improvement planning, feature adding, standard maintenance procedure or other necessary action has to be initiated based on obtained evaluation.

In Polman as a vocational institution that implement Production Based Education (PBE) system, necessary actions for MSWT-01 manufacturing, assembling & function tests could be treated as 'research project' handling. Such product that resulted from research activity will be managed by small team that consist of Lecturer with relevant research theme and supported by students as the 'temporary' team member. When the machine is ready, a student subgroup will be assigned to do the implementation on disaster location following their schedule program, or other student group should be conditionally assigned through extracurricular program that prepared as a student 'CSR' program. This might be an ideal combination alternative for such vocational institution for education that students get the product media for their PBE program and implement their work for a defined social activity. In addition, they will learn and experience all related technical matters and more social interactions with the people and other disaster stakeholder as well.

5. References

- [1] Lindu M 2008 The Effects of Gradients Velocity and Detention Time to Coagulation-Floculation of Dyes and Organic Compound in Deep Well Water *Indo. J. Chem.* **8** (2) p146-150
- [2] Ilyas PI and Semiawan T 2012 Production Based Education (PBE): The Future Perspective of Education on Manufacturing Excellent *SciVerse ScienceDirect, Procedia-Social and Behavioral Sciences* **52** (2012) p5-14
- [3] Nurdin M 2012 Technopreneurship Model Through Industrial Collaboration In Applied Technology Higher Education *IC-GWBT2012, Ahmad Dahlan University* p192-199
- [4] Poulton E and Barnes L 2012 Corporate Social Responsibility: an Examination of Business Students' Perceptions of Materialism *Zenith, International Journal of Multidisciplinary Research* **Vol.2 Issue 6**, June, ISSN 2231 5780
- [5] Burcea M and Marinescu P 2011 Students' Perception on CSR at The Academic Level case Study: The Faculty of Administration and Business, University of Bucharest *AE (Amfiteatru Economic), Corporate Social Responsibility* **Vol. XIII no 29** p207-220
- [6] Ananto G 2012 '321' Program In Polman For Better Operations Management Understanding *Advanced Material Research* **576** (2012) p685-689
- [7] Ananto G, Setiawan AB and Darman MZ 2013 MSWT-01, Flood Disaster Water Treatment Solution From Common Ideas *IOP Conf. Series: Material Science and Engineering* **46** (2013) 012036 doi 10.1088/1757-899X/46/1/01/2036
- [8] Heijman SGJ 2007 Nanofiltration and Reverse Osmosis **CT4471 TU Delft**, p2.
- [9] Boselovic L and Mc Clatchy 2009 Carbon wins contract for Phoenix water treatment *ProQuest document ID1923254051*, Washington: Calgon - Tribune Business News Dec 17