

Quality Culture Development Through PBE (Production Based Education) System In POLMAN

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Abstract - Bandung State Polytechnic for Manufacturing (POLMAN) is an institution of vocational high education that implements certain portion of practical program in the laboratory or workshop to build students skill competencies. For those, product media are created from structured exercises, combined with external inquiries from industrial parties collaboration through a system called Production Based Education (PBE). Like usual production activity, there are number of tasks and actions in its order handling procedure that are gaining production objective; quality, cost and delivery (QCD). Students, that do not have any experiences in the production field need certain time of period to learn everything related with QCD issue. This could need unusual effort in the first couple time to learn or understand all about new technical things and build the quality culture, whereas they have to concern with everything to do related with cost and time of delivery as well. Through such PBE, students are involved in controlling the product quality they made which push them concern and realize how important quality is, and prevent potential problems in the real business point of view that influence customer satisfaction at the end. This involvement is arranged by referring to which or what students competency should get. They should gain the habit and culture in following the rules related with quality in the system such as product inspection, do the quality check of final product, verify the form they used, record the data etc. Besides, they are introduced to the basic of Quality Assurance where the students have to carry out incoming and outgoing check in every process they are assigned. This will prevent the product suitability failure and avoid the rejection, and would be very beneficially for all involved parties in education and production as well; either students, lecturers and institution.

Key words - quality, production based education

I. INTRODUCTION

Bandung State Polytechnic for Manufacturing (POLMAN) is an institution of vocational high education that implements certain portion of practical program in its laboratories or workshop to build students skill competencies. As known, there was the previous similar thing in the learning factory concept that integrating a set of intellectual and physical learning activities in the manufacturing process as a series of theoretical framework units and real field practicum[1]. For these practical sessions in Polman, product media are created from structured exercises, combined with external inquiries

from industrial parties collaboration, through a system called Production Based Education (PBE). This also in line with the aim for better prepare engineering students to function efficiently and adjust readily within the framework of the factories in the real world [2]. Industrial atmosphere within an educational institution can be created by replicating an industrial site plan in its workshop that could improve students' productive competences[3]. This collaboration concept is also a model of education program that aimed to provide workforces with new competencies and qualifications that suit for the new manufacturing generation[4].

Adopting the usual production activity, PBE order handling for customer runs comprehensively with all necessary tasks and actions needed, that are gaining production objective; Quality, Cost and Delivery (QCD). Figure-1 generally mentioned how all these activities flow, starts from customer's inquiry till deliver the goods. Comparing with six steps in TF-6M model that consists of receive the given order, analyze, express the readiness, execute the order, incorporate quality control and submit the order[3]; PBE -as a system-carry out the business by involving the whole parties in organization. Managerial aspect for instance, there are number of tasks related to document of quotation, negotiation, contract agreement, term of payment etc; or from technical side in addition to fabrication and machining process, the quality issue is included as well in manufacturer's duty which is supported by related procedures and work instructions.

Students, that do not have any experiences in the production field need certain time of period to learn everything related with QCD issue. They could need unusual effort in the first couple time to learn or understand all about new technical things and build the quality culture, whereas they have to concern with everything to do related with cost and time of delivery as well. As a part of PBE, involving the students in controlling the quality product they made is aimed to make them concern to this issue, besides preventing potential problems in real business point of view such as what, when and how the products should be delivered in proper way that could influence customer satisfaction at the end. Since quality is always related with technical specification of products and schedule that stated in the planned/ agreed contract, the study program content is considered with student assignment level in order to fit on which or what competency they should get.

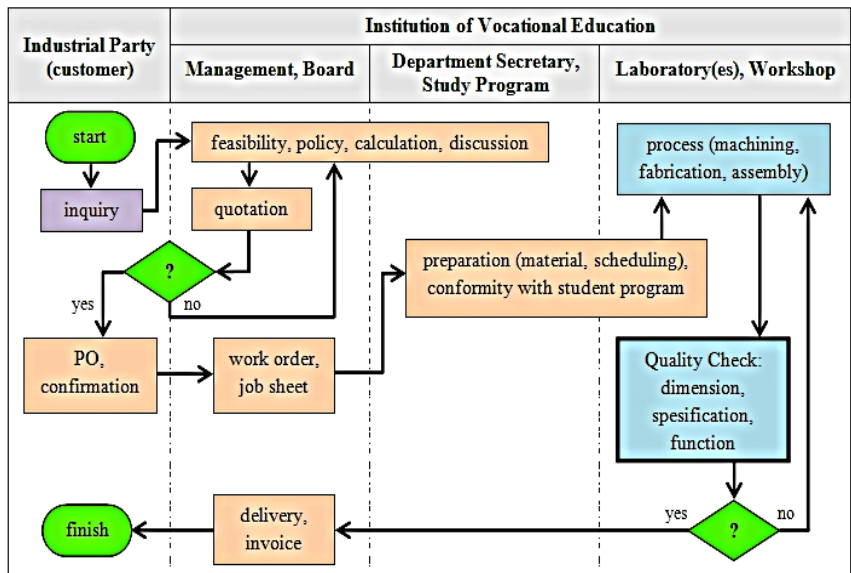


Fig. 1 General Order Handling In PBE

II. METHODOLOGY

In order to have the culture in obeying the rules related with quality, in the PBE system students learn and do necessary tasks such as product inspection as a very basic thing, verify the form they have to used, record the data etc. Following Figure-2 [5] elaborates the Quality Check from previous figure into more detail that is mentioning the number of activities where production participants should contribute. Developed from Quality Check of final product like in previous quality concept, they are introduced to the basic of

Quality Assurance where the students have to carry out incoming and outgoing check in every station or process. In this case, there is an option whether the product is just component or an assembly unit that Check List Form is needed. Further, in each process there will be decided conditionally whether outgoing check is possible to carry out, otherwise it has to be done by CMM or other special measuring equipment in certain Laboratory or Section, included the Check List Form for special machine or tools, if necessary.

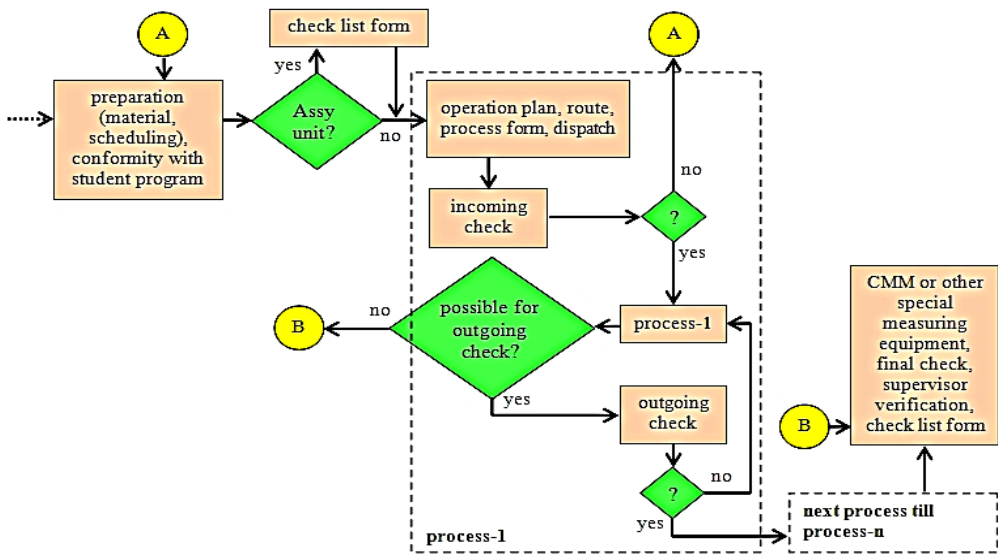


Fig. 2 Incoming and Outgoing Check in Each Process [5]

III. RESULT AND DISCUSSION

A. Inspection and Quality Control

As known, inspection is the most common method of attaining standardization, uniformity and quality of workman-

ship. It is the cost art of controlling the product quality after comparison with the established standards and specifications, as well as an indispensable tool of modern manufacturing process[6]. Polman students get the lesson of inspection session in semester 1 or 2, depend on which study program. In

this session they learn basic measurement using various equipment such as calliper, micrometer, block gauge and profile projector; therefore they are capable to do product inspection or quality control in general scope.

In previous Figure-1, Quality Check placed as centralized inspection procedure for the finished product which is done in certain section called QC Lab. In this Lab a small group of students are assigned alternately to support Lecture or Supervisor In Charge. Such student group usually be on duty for one week, do the quality check for finished components before deliver to the customer. They have to fill the QC sheet form in order to determine if its dimensions are correct according to defined drawing. Figure-3 shows an example of such filled QC sheet. It is shown that the measuring product or item could be sketched on such sheet with several essential marked points and dimensions that have to be checked.

POLITEKNIK MANUFAKTUR BANDUNG		FORM INSPEKSI		No. Pesanan				
Pemesan : ADM		Diperiksa tol : 29-Sep-2018		PM 10998				
Nama Barang : PELAT PENUTUP		Pemeriksa		Penanggung Jawab				
No. Gambar : PG.10998		2018/01/01		2018/01/01				
Jumlah : 1		2018/01/01		2018/01/01				
Keputusan : Baik <input checked="" type="checkbox"/> Perbaiki <input type="checkbox"/> Gagal <input type="checkbox"/>		2018/01/01		2018/01/01				
Item No.	Standar Inspeksi	Toleransi Khusus	Hasil Inspeksi					Keterangan
			1	2	3	4	5	
1	(2.65)		3.34					✓
2	(2.65)		3.34					✓
3	Ø 34	+ 0.10 - 0.15	34.16					✓
4	(2.65)		3.32					✓
5	(2.65)		3.34					✓
6	3		3					✓
7	34		34.16					✓
8	12		12.7					✓
9	M 70		Mauk					✓
10	12		Mauk					✓
11	14		14					✓
12	Ø 9		9.3					✓
13	7		7					✓
14	14		14					✓
15	M 70		Mauk					✓
16	14		14.06					✓

Fig. 3 QC Sheet Example

The actual result of its measurements then written down and verify whether passed or not. Actually, the advantages of this kind of inspection are better in quality check up and closed supervision without any workers pressure, but on the other hand it needs more handling, increases production control and -from economical business point of view- higher cost of inspection due to numerous sets of inspections and skilled inspectors[6].

B. Quality Assurance

Further, without leaving out product inspection culture as an important basic thing, the system then developed rather to Combined Inspection, between Floor and Centralized, which

is in line with the Quality Assurance concept. However, inspection and testing are the most common methods of Quality Control (QC), and are widely used in education to determine whether standards are being met. Quality Assurance (QA) is different from QC. It is before and during the event process concerned to prevent faults occurring in the first place[7].

It is developed from just do the quality check on final product by centralized place of inspectors, the part of responsibility of product quality is taken over to the executors, in this case, the students. They are introduced to the system where they have to carry out incoming and outgoing check in every station or process they work. Before start processing they have to ensure whether received material or pre-machined component from previous process is acceptable, and after executing the job they do so, whereas these inspection results have to be written or recorded and validated on the Process Form that attached with related technical drawing, as shown on Figure-4. There could be of course the exception(s), in a condition that outgoing check is not possible to carry out by the direct workforce, for CNC machined part that had 3 dimensional contour for instance. In this case it has to be done by certain section like QC Lab with its CMM or other more sophisticated facility.

Actually, QA is a matter of the workforce responsibility, usually working in quality circles or teams, rather than the inspector. Staff can give their best only when they feel that they are trusted and their views listened to[7]. With these 'additional' tasks and such condition students will have more authority on their work and pushed their capability up, and this can be achieved by doing it right every time, consistently. It also strengthen the old view and ism that 'next process is our customer'.

C. Toward The Total Quality Management

Generally, Total Quality Management (TQM) could be defined as an effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical level which allow for full customer satisfaction. It may be classified as a 'Management Tool' for many industries outstanding improvement in product quality design and reduction in operating costs and losses[6]. TQM programs do not have to use the initials TQM. Many organizations pursue the philosophy under their own brand name. Total quality control, total quality service, continuous improvement, strategic quality management, systematic improvement, quality first, quality initiatives, are some of the many titles used to describe what TQM is[7].

In PBE, the quality commitment seem could be developed more than till Quality Assurance only. There must be spirit from everyone in the institution for system improvement continuously. TQM dictates that everything and everybody in the organization is involved in the enterprise of continuous improvement. The *management* in TQM likewise means everyone, because everyone in the institution, whatever their status, position or role, is the manager of their own responsi-

bilities[7]. Though, one of TQM keyword in quality issue is 'integrating' all efforts at organizational scope. Therefore with

good willingness of all parties the whole good ideas should be well communicated, harmonized and bundled.

Kartu Proses

Order No : PM 14.0.0177
 Part No :
 Quantity : 2 set
 Nama : Plat
 Material : SS

Seq Nr	Wprkcenter	Waktu setup	Durasi (Est)/unit	Incoming Check
1	Milling	0,25	1,00	Outgoing Check
Operator	Agus Suherman	Tgl Renc. Mulai	11/04/2014	Durasi (Aktual)
Instructor		Tgl Renc. Selesai	14/04/2014	Tgl Akt. Mulai
				Tgl Akt. Selesai
2	LAS	0,25	2,00	Incoming Check
Operator	Ami.S.	Tgl Renc. Mulai	14/04/2014	Outgoing Check
Instructor		Tgl Renc. Selesai	15/04/2014	Durasi (Aktual)
				Tgl Akt. Mulai
				Tgl Akt. Selesai
3	Gergaji	0,25	1,00	Incoming Check
Operator	Harida	Tgl Renc. Mulai	15/04/2014	Outgoing Check
Instructor		Tgl Renc. Selesai	16/04/2014	Durasi (Aktual)
				Tgl Akt. Mulai
				Tgl Akt. Selesai
4	Milling	0,25	1,00	Incoming Check
Operator	Septi & Rizki 292/241	Tgl Renc. Mulai	16/04/2014	Outgoing Check
Instructor		Tgl Renc. Selesai	16/04/2014	Durasi (Aktual)
				Tgl Akt. Mulai
				Tgl Akt. Selesai
5	QC	0,00	0,50	Incoming Check
Operator		Tgl Renc. Mulai	16/04/2014	Outgoing Check
Instructor		Tgl Renc. Selesai	16/04/2014	Durasi (Aktual)
				Tgl Akt. Mulai
				Tgl Akt. Selesai

Keterangan	Dicetak tanggal	Dibuat	Dianalisis
	Jum'at, 11 April 2014	Cucu Suryani	

Fig. 4 Process Form Example

In the PBE problem of view for instance, as an example in the order handling, the quality of single product cases possibly could easily control by awesome workforce participation; but for assembly unit or project like special purpose machine, mould, dies or such things, more management tool is needed. One of the most successful methods applied in TQM is the concept of the quality plan (Schobert & Brown, 1990). A quality plan is defined as a "document setting out the specific quality practices, resources and sequence of activities relevant to a particular service" (Stebbing, 1989, p.20). Thus a quality plan is the quality assurance scheme developed for a program or project[8]. Previous Figure-2 mentioned that if the kind of job is 'assy unit' then a 'check list form' is necessary to implement. This only to say that a common technical drawing is not enough to express more specifications. Such more complicated project needs a list that contain product requirements conditionally as a 'quality plan'. In many cases, this quality plan have to be defined even from the design stage, referred to the customer requirement conditionally.

As an example, following Figure-5 is a Check List Form of a Dies (stamping dies) that contained number of things to be checked by manufacturer (NTC, 2013). Such as die height, quality surface of cutting and forming result, etc. Other kind of project or assy product surely will have other specific descriptions. An Injection Mould for instance, will highlight related technical points like appeared shrink mark on the product result, air trapped, pre-dry temperature etc.

D. Devide The Authority Of Control

The TQM philosophy is large-scale and inspirational, but its practical implementation is small-scale and highly practical. By way of illustration, Joseph Juran talks of 'elephant-sized' and 'bite-sized' projects. He argues that the best way to tackle the 'elephant-sized' projects is to divide them up into manageable 'bite-sized' assignments. He recommends assigning one team related to 'cutting-up the elephant' (Juran, 1989). Regarding 'assy unit' handling approach for a job that categorized as a 'project' due to its complexity level, a Personal In Charge (PIC) could be assigned.

This PIC should manage and control all necessary actions related to the job he or she assigned to, on all event across departments, as a delegated representative of higher management board. Through this project based and temporary assignment PIC has the access to 'push' all related department head in order to ensure that the project runs well. Figure-6 illustrates this authority by the blocked arrows whereas the normal arrows represent work flow and dashed arrows accommodate feedbacks from certain task of operations, if any.

E. The External Quality Standard

Referred to some suggestions, external quality standards have an important role to play in helping organizations develop a TQM culture, as stated as well by British Standard Institution: "the customer needs the assurance and confidence

that the supplier has the ability to provide the product or service consistently to the defined quality". Therefore, PBE through Polman adopt the ISO9000 series in order to get the soul of TQM. The philosophy behind the ISO9000 series is

that quality should be built into the systems and procedures of the organization, where the emphasis is on prevention rather than cure.

Fig. 5 Check Sheet Form Example

To be able to meet the demands of ISO9000 an organization has to build quality in at each stage, from design through to delivery, assessment and evaluation, through a formal and rigorous management system to ensure conformity of the product to its specification[7]. This would be very

beneficially for all involved parties in education and production as well; either students, lecturers and institution. Students will have the culture in obeying the rules related with quality whereas lecturers and institution could perform better in satisfying the customers.

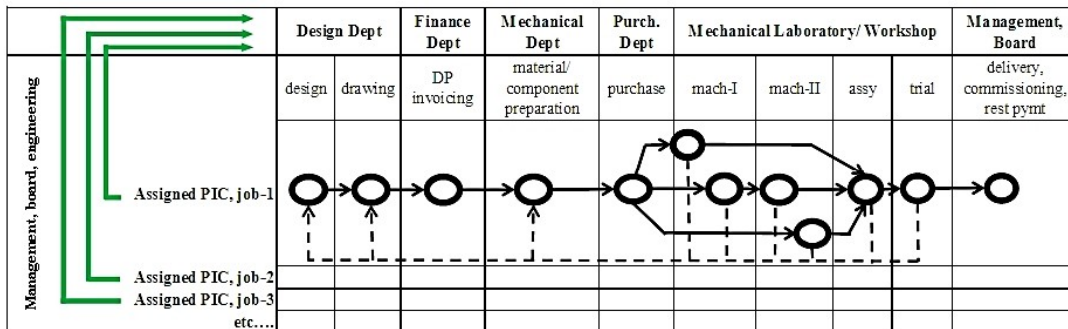


Fig. 6 Illustration of Person In Charge (PIC) for Assy Job

IV. CONCLUSION

Through the PBE (Production Based Education) system in Polman, number of tasks and actions in its order handling procedure are implemented in the education process that are gaining the QCD (quality, cost and delivery), as the objective of production activity. Referred to the design of study program the students are involved in controlling the product quality, therefore they got the capability to do product

inspection or quality control in general scope, and carry out incoming and outgoing check as well, in every station or process they are assigned.

Supporting such system, the ISO9000 series as an external quality standard is adopted in order to get the soul of TQM in this Polman PBE. The quality should be built at each stage, from design through to delivery, assessment and evaluation, through a formal and rigorous management system to ensure the product conformity to its specification.

Since the students are experiencing all issues about production while learning, their quality culture are developed. This would be very beneficially for all involved parties in education and production as well. Students will have the culture in obeying the rules related with quality whereas lecturers and institution could perform better in satisfying the customers.

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