PROJECT MANAGEMENT APPLICATION FOR ENGINEERING PROGRAM CDIO PROCESS IN ASIA

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ABSTRACT

This paper presents direction for applying project management techniques and tools to the CDIO engineering program preparation. The research has investigated the project management techniques and tools for the CDIO engineering program preparation as well as CDIO meeting and follow ups. The paper discusses about the project management level for CDIO process with equivalence corporate project management examples. This paper leads to multi dimensions of CDIO process project management and inner and outer closure loops for CDIO engineering program preparation and evaluation. This paper describes how the adoption of the CDIO standards contributed in the project management aspects with task responsibility metrics for project coordination. The paper is mainly divided into two parts. The first part briefly explains the CDIO engineering program preparation with project management techniques and tools like project management groups, system, level, triple C, and SMART. The second part cites two enhancing approaches examples of CDIO process, Inc. CDIO curriculum preparation at the Asian Technical Institutions.

KEYWORDS

Project Management, Project Level, SMART, Triple C, Standards: 1, 10, 11 and 12.

INTRODUCTION

CDIO framework emphasizes on engineering in the context of CDIO system and its outcome. It is continuously improved through quality assurance process with focus not accreditation aspects. A. Meikleham, R. Hugo, A. Kamp, J. Malmqvist (2018) CDIO bibliometric data analysis research supported for CDIO research growth. CDIO concept developed in MIT during 1997, has now reached all regions of the world (History of CDIO, 2021). CDIO is addressed the evolution of the engineering education with respect to disciplinary knowledge, system building, personal, and interpersonal. CDIO is one of the tool for satisfy major companies and accreditation bodies expectation that focused on skills and abilities for graduating engineers.

Project management is not only applicable for manufacturing and service industries. It is also for education management also. Project management is very important because it stated in terms of schedule, quality and budget. Academic entities who are tasked with engineering program preparation are usually not aware with project management techniques and tools.

FRAMEWORK FOR PROJECT MANAGEMENT

Lee Linda et al 2015 shared the five asian educational institutions CDIO teaching and learning framework. They are Chulalongkorn University and Rajamangala University of Technology Thanyaburi in Thailand, University of Science, VNU-HCM in Vietnam, Universiti Teknologi MARA in Malaysia and Singapore Polytechnic in Singapore. But they not compared the subjects in the CDIO framework. Adedeji B. Badiru et al 2010 attempts to explain the usefulness of project management application for engineering program accreditation preparation. The paper defines ABET preparation as a project and high lights project management levels, closing the project management loop, alignment of project requirements, Triple C model with respect to ABET preparation. From the paper, it is clearly inferred that project management can be used to CDIO process also. Project management process falls on five groups. Basic function and groups of project management for CDIO is shown in Table 1. The table presents general project management stages and CDIO process project management. The methodology for project management application for engineering program CDIO progress is shown in figure 1. As shown in figure 2 the CDIO process involves different levels, which all be coordinated within a hierarchical structure. In CDIO process, most of the project management efforts will be focused at the task and activity levels. Leadership support and enabling environment are key roles in this place. As shown in figure 3, CDIO process involves several dimensions. It identified and gaps of the CDIO process and reflects the impact of the outcomes.

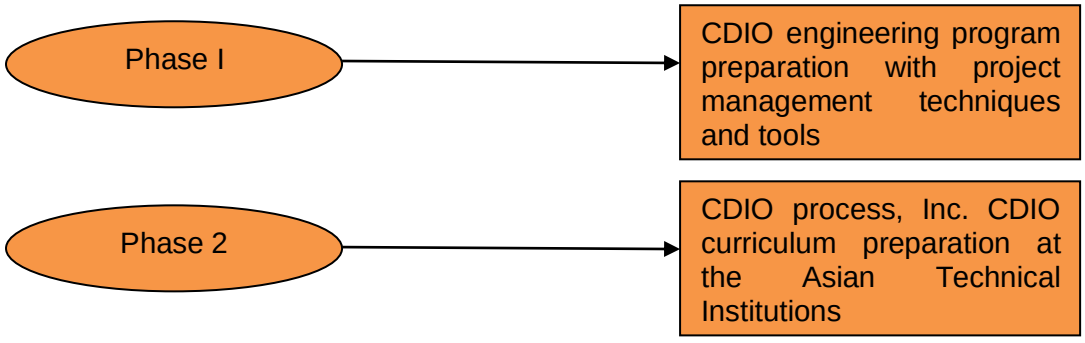

Figure 1. Methodology for Project Management Application for Engineering Program CDIO Progress

Defining CDIO Process as Project

CDIO process is to close the loop between inner and outer requirements as shown in figure 4. CDIO outcomes are linked with students' inputs, faculty and institutional resources inputs and feedback loop.

Project Phases

The development of new program for CDIO process is followed by project phases. The phases with tasks are given in the table 2.

ALIGNMENT OF PROJECT REQUIREMENTS WITH SMART PRINCIPLES

The cooperation of team can be ensured by developing a SMART approach for the CDIO process and disseminating. It agrees SMART with CDIO standard 3. As shown in figure 5, CDIO objectives and tasks be specific. If it is not specific, it will lead compliance. Factors with respect to CDIO tasks must be measurable, traceable and controllable. Task objective achievable with overall CDIO goals. Institutional CDIO task must be realistic and align with goals. CDIO task objectives must have a time basis. The development of CDIO process was with respect to time.

Table 1. Project Management Groups

Project Group	1	2	3	4	5
	Planning	Organizing	Execution	Control	Phase-out
CDIO Example	CDIO Curriculum Assessment	CDIO units Involvement	CDIO implementation	CDIO syllabus and Standard Audit and Continuous Improvement	CDIO loop closure with next standard and syllabus

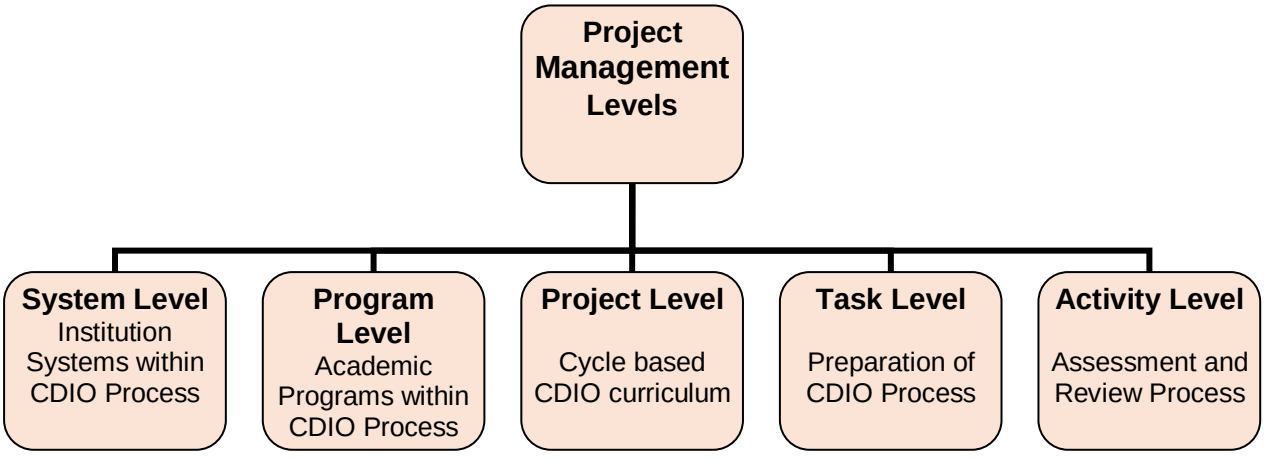

Figure 2. Project Management Levels for CDIO Process

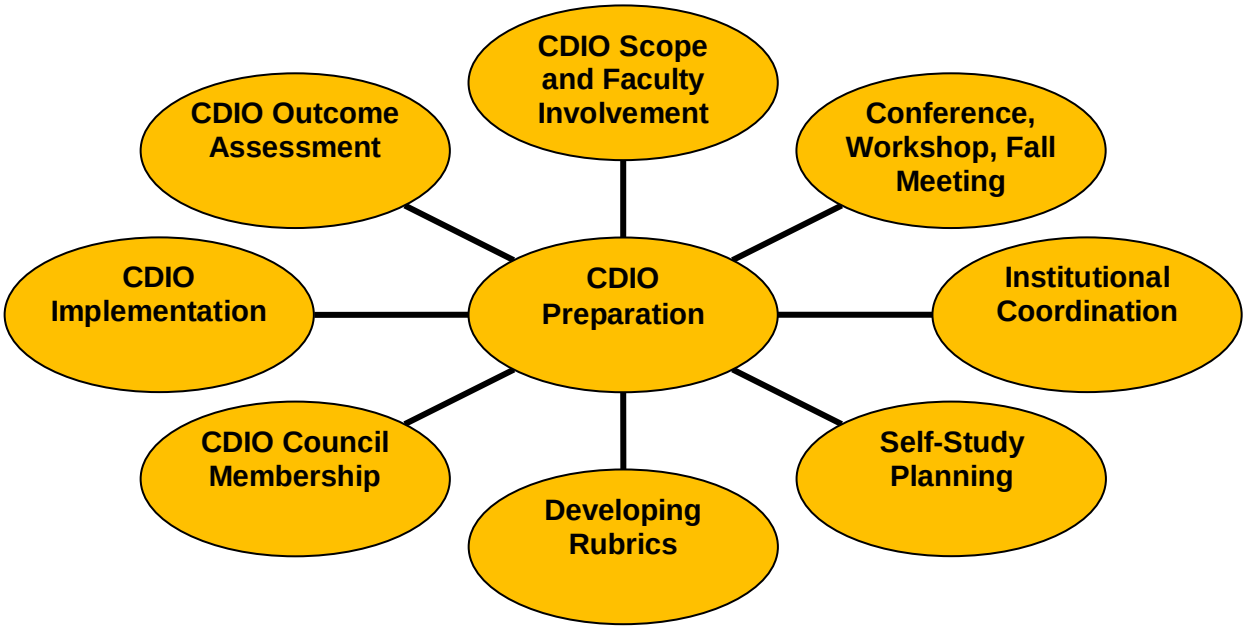

Figure 3. Multiple Dimensions for CDIO Process

Table 2. Tasks in CDIO Process

Initiating	Joint decision from constituency and institution with commitments
Planning	Benchmark other successful CDIO implemented institutions. Set CDIO goals with align resources and ensure CDIO objectives, syllabus and standards
Execution	Perform research, product and process findings
Tracking	Monitoring metrics of Standards and CDIO curriculum assessments and constituency students feedback
Control	Accesses 360 degree feedback and reports to curriculum committee for discussion
Closing	CDIO review, plan for next CDIO syllabus and standard

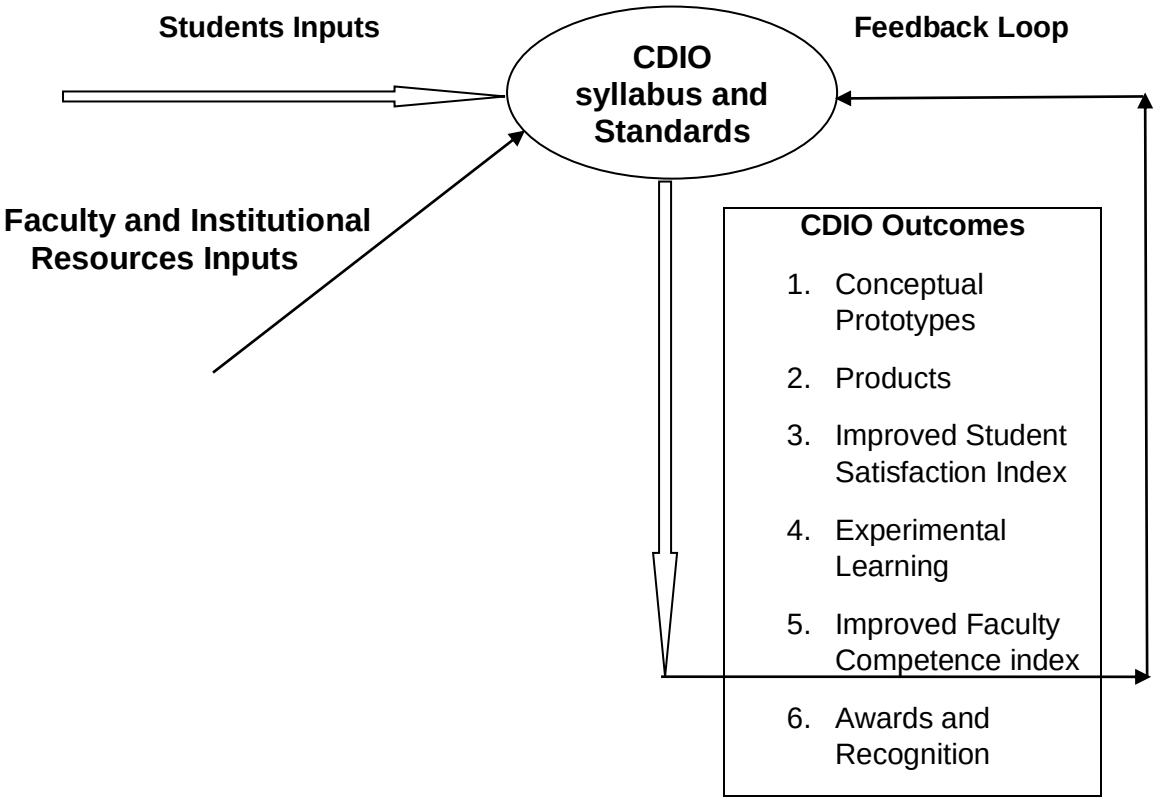

Figure 4. Closure of Inner and Outer loops for CDIO Process

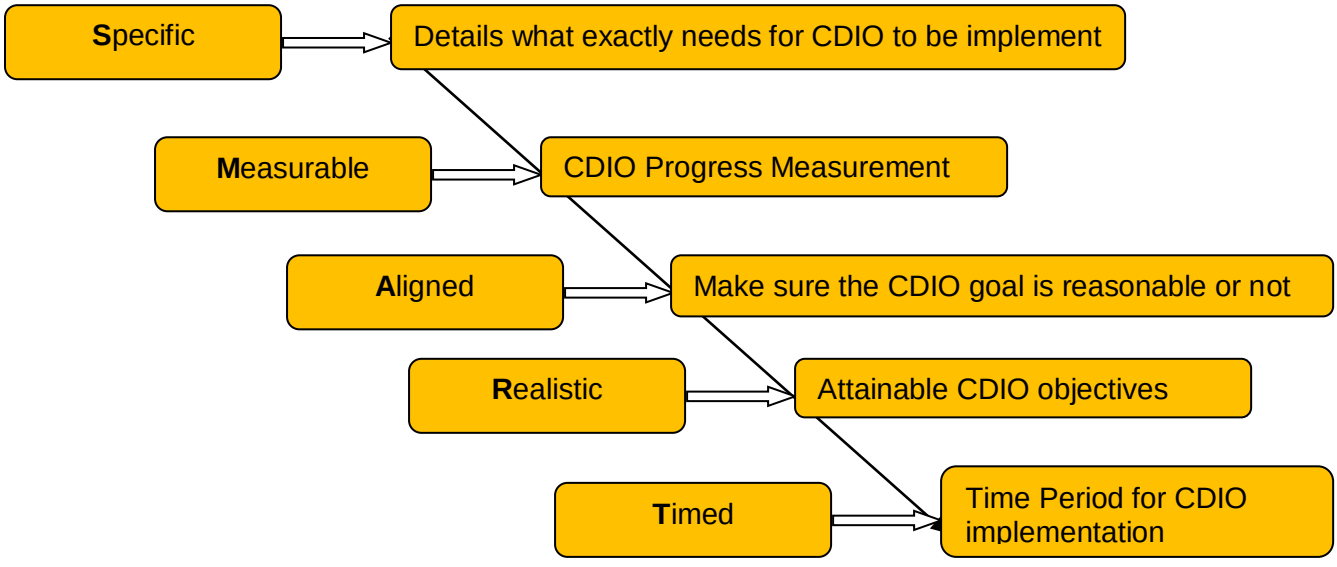

Figure 5. SMART Applications for CDIO Process

APPLICATIONS OF TRIPLE C MODEL IN CDIO PROCESS

Adedeji B. Badiru 2008 has worked out the Triple C model with developed communication matrix for ABET preparation. Similar kind of communication matrix for CDIO process with respect to communication sources and communication targets illustrates in table 3. what needs to be communicated to whom, can address through this communication matrix.

Table 3. Communication Matrix for CDIO Process

Communication Sources	Communication Targets				
	Faculty	Students	Administration	Employers	Evaluators
Faculty	CDIO strategy	Aware of CDIO	Resources Request	CDIO Standards	Review and Materials
Students	Homework Folders	Program Support	CDIO outlines		CDIO outcomes Samples
Administration	Resources Allocation	CDIO outlines			
Employers	CDIO Objectives	Career Paths			
Evaluators	CDIO implementation stages	CDIO info	CDIO info	CDIO info	Schedule

TWO CASES EXAMPLES

We have chosen two education institutions from Asian countries which follow CDIO model curriculum. In 2018, both educational institutions Rajamangala University of Technology Thanyaburi from Thailand and Thiagarajar College of Engineering from India have successfully implemented. The data has been taken from Proceedings of the 16th International CDIO Conference, hosted on-line by Chalmers University of Technology, Gothenburg, Sweden. The CDIO enhancing approach for both institutions is shown in figure 6.

Case 1: Rajamangala University of Technology Thanyaburi, Thailand

Rajamangala University of Technology Thanyaburi, Thailand has started CDIO framework with two programmes in the year 2013, now they successfully implemented 28 non engineering programmes and 6 engineering programmes. CDIO curriculum mapping based on the Thai Qualification Framework (TQF), Social, Technological, Economical, Environmental, and Political (STEEP) analysis, accreditation criteria and stakeholder Survey. They have linked 34 programmes with respect to 18 program attributes. Next level of mapping, for the enhancing approach, two new mandatory courses, namely, Introduction to the Engineering and Multidisciplinary Project (MDP) courses included in the curriculum based on the 3 Ps concept – Play, Passion and Purpose for engineering courses. For example Industrial Engineering Program students taking Introductory Course as Industrial Design and Build and Multidisciplinary Project (MDP) course as Innovative Product Design and Entrepreneurship.

Case 2: Thiagarajar College of Engineering, India

In India, syllabus should be framed as per the apex bodies like AICTE guidelines. In Thiagarajar College of Engineering, India, though CDIO was started in 2015, it was successfully implemented seven undergraduate engineering programs from the year 2018. CDIO curriculum mapping based on the CDIO Syllabus, Guidelines of Regulatory Authorities, Professional Societies Guidelines, Washington Accord Graduate Attributes/Programme Outcome Credit distributions and Feedback Report on existing Curriculum by Students, Faculty members, Employers, Alumni. In the CDIO Curriculum framework, 26 credits of CDIO subjects are also included with in AICTEs' 160 credits norms. CDIO subjects are centralized by all curriculum which is studied by all students. For example subject will be studies all program students.

Thailand	
Rajamangala University of Technology Thanyaburi	
Year	**CDIO Subjects for Engineering**
I/ II	Introduction to Engineering
II/III	Multidisciplinary Project (MDP) course
III/ IV	Capstone Design Project

India		
Thiagarajar College of Engineering, Madurai		
Year	**Sem.**	**CDIO Courses for Engineering**
I	I	Engineering Exploration
I	II	Lateral Thinking
II	III	Design Thinking
II	IV	Project Management
III	V	System Thinking
III	VI	Engineering Design Project
IV	VII	Capstone Design Project
IV	VIII	Major Project

Figure 6. CDIO Enhancing Approach for CDIO Courses

CONCLUSIONS

The CDIO enhancing approach with respect to curriculum for two education institutions' from Asian countries were discussed in this paper. The CDIO review has always been regarded for the process changes with the focus on CDIO inspection to educational optimization. The effects along with improving the program, it will also improve the probability of successful CDIO review, as the goal is to encourage optimum performance. The potential project management approach is not only CDIO visit, schedule and assessment, can be overrated with strategic and proactive approach.

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BIOGRAPHICAL INFORMATION

Dr. T. Sasipraba joined Sathyabama Institute of Science and Technology in 1995 as a Lecturer and her 26 years of meritorious career has promoted her as a Vice Chancellor in the year 2020. During the course of her career at SATHYABAMA, Dr. T. Sasipraba has made exceptional contributions in the areas of research and developments, international linkages and Publications.

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