Project Management Methodology for University-Industry Collaborative Projects

C.M.M. CHIN[1]
E.H. YAP
A.C. SPOWAGE

Abstract

University-industry collaborative (UIC) in Malaysia has received very little research attention in the literature. Furthermore, worldwide development of UIC project management approaches has been carried out without due consideration of the unique attributes associated neither with this specific environment nor with the high degree of uncertainty intrinsically associated with research projects. This investigation leverages on the available literature, interviews with university-industry research partners and our own works to understand the nature of UIC R&D. This work focuses particular attention on the factors that relate to current project management practices and the methodology applied. It present the findings of qualitative interviews conducted with respondents from universities and industries involved in collaborative R&D projects in Malaysia. Two aspects were investigated; the development process and project management practices in UIC. The study concludes by presenting an outline of the requirements and components required of a project management methodology (PMM) designed specifically for the management of UIC projects. It will provide valuable information and insights to both universities and industries on how to embark on designing a PMM specifically for use in the UIC research environment.

Keywords: *Project management methodology, university-industry, collaborative, qualitative.*

JEL classification: D74, O32, Y40

Introduction

In today's competitive and globalised business environment, the formation of university-industry collaborative (UIC) research is increasingly viewed as

[1] **C.M.M. CHIN** University of Nottingham, Malaysia,
Telephone: +6(03) 89248601
E-mail: may-may.chin@nottingham.edu.my
E.H. YAP, University of Nottingham, Malaysia
Telephone: +6(03) 89248609
E-mail: enghwa.yap@nottingham.edu.my
A.C. SPOWAGE, University of Nottingham Malaysia,
Telephone: +6(03) 89248600**,** +6(03) 89248017
E-mail: andrew.spowage@nottingham.edu.my

essential in building and maintaining a company's competitive position. With the increasing prevalence of UIC and their importance to the future success of both the organizations involved and to national economies, it is essential that we develop an in-depth understanding of the opportunities and pitfalls they present as well as the factors driving their formation. The benefits of UIC projects are widely cited as the unique challenges they create for project teams and the organizations involved (Chin & Spowage, 2008). Despite the extensive body of literature and a number of case studies, many UIC projects still fail to deliver. Commonly cited reasons for failures include the different motivations and objectives of the organizations involved (Casey, 2004; Rohrbeck R & Arnold H.M, 2006), variable level of commitment (Harris, 2007), failure to establish trust (Davenport et al., 1999), unclear requirements (Barnes et al. 2002; T.A., Barnes et al., 2000) and poor planning and progress monitoring (Ghani, 1991).

In the project management community, these factors have also been widely recognised as causing failure in more conventional projects and thus will not come as a surprise to professional project managers. It has been shown that the impact of these and other failure factors can be mitigated by the appropriate implementation of best practice project management methods (Barnes, 2002). However, the unique nature of collaborative projects, the specific nature of the project environment and the resistance of the people and organizations involved makes many conventional project management practices ineffective (T.A Barnes et al., 2000). Project management is concerned with the planning and coordination of projects from conceptualization to closing with common objectives in mind. UIC R&D projects are however, complex and at times the precise outcome may not be clearly definable at the initiation of the project. Indeed it is only after a significant amount of work has been carried out, will the solution and indeed an appropriate approach become apparent. Furthermore, strategic UIC R&D projects can only be successful if the partners are able to learn continuously and instigate adjustments and adaptations to the way the projects are managed (Weck, 2006; Huljenic, D et al. 2005). The issues associated with the management of collaborative research projects differs from more conventional projects and purely academic research projects (Huljenic, D et al. 2005; Erno-Kjolhede, 2000). Therefore, when developing a successful project management methodology (PMM) which attempts to enhance the success of UIC projects, consideration needs to be given to their unique nature.

1. Approach and results

A total of 19 structured interviews were carried out with university and industry partners by means of a face to face approach, while two interviews were carried out using the Skype video conferencing application. On average the duration of each interview lasted for 50 minutes to accommodate the respondent's tight schedules (see Table 1). Each of the interviewees were currently or had recently been involved in UIC R&D projects in the role of a project leader or lead researcher, while interviewees from a research agency and a spin off company were

obtained through the university research group social networking media and personal contacts. All interviews were carried out in a semi-structured approach, audio-recorded and transcribed to generate a written interview report and later sent to respondents for validation (see Table 1). Codes (Glaser & Strauss 1967; Bryman 2004) were generated using NVivo as analysis tool to develop meaningful categorical analysis.

Table 1: Sample description of respondents

No	Respondent ID	Organization type	Method	Duration (mins)
1	U1	Foreign university	FTF	60
2	U2	Research focused university	FTF	60
3	U3	Focused university	FTF	40
4	U4	Apex university	TEL	64
5	U5	Comprehensive university	FTF	60
6	U6	Comprehensive university	TEL	31
7	U7	Research focused university	FTF	52
8	U8	Comprehensive university	FTF	50
9	U9	Focused university	FTF	50
10	U10	Focused university	FTF	52
11	U11	Research focused university	FTF	35
12	I1	SME	FTF	60
13	I2	SME	FTF	55
14	I3	SME	FTF	50
15	I4	SME	FTF	34
16	I5	SME	TEL	20
17	I6	SME	FTF	60
18	E1	Research agency	FTF	45
19	E2	University spin-off	FTF	66
Total duration				944

Notes: University (U); Industry (I), External research agencies (E); Small Medium Enterprise (SME); Face to Face (FTF); Telephone (TEL)

Interview questions were generated based upon research questions, categorised and coded for questioning purpose (see Table 2). As well as conducting structured interviews, respondents also participated in a self-administered questionnaire given at the end of the session to validate the factors and issues identified. The organizations selected for this interview represented a diverse range of UIC within Malaysia meeting the study's research objectives. These organizations were:

1. A foreign based university established in the market for ten years which is very keen to promote and establish more partnerships with the industry.
2. A research focused university established in 1962 as the first university in the nation ranked above 200 worldwide (THE 2009).
3. A number of focused universities recently established from the year 2000 that are still in their infancy stage of generating UIC.

4. A university established in 1969, was the first educational institutions in the nation to be selected and given the Accelerated Programme for Excellence (Apex) status. The university has continuous partnership with government linked companies (GLC).
5. A number of comprehensive universities established in the 1980s and 1990s whom are interested in establishing a UIC centre of excellence, yet lack the experiences and skills of collaborating extensively with industry partner on their own effort.
6. The external respondent was an ex-chairman for the Centre for Resource & Research Collaboration.
7. A spin off company from a research focused university, aiding the university from consultation services to commercialisation of innovated products.
8. A small medium enterprise involved in providing integrated engineering expertise and businesses in project management, project resources, IT, consultancy and other services.
9. An environmental biotechnology company with Bionexus status which had been in operation since 1980 and is in collaboration with one of the research focused university.
10. A consulting engineering company experienced in structural, engineering and designing which is specialised in buildings for the defence sector and has been in partnership with a focused university for the past two years.
11. A concrete based construction company in a successful collaboration with the focused university for over two years.

As discussed in the previous section, interview questions were categorised and displayed in Table 2 for analysis. Questions were developed from critical analysis of the literature, assigned with a category based variable and coded to generate the interview questions. A pilot interview was carried out with three university respondents; three industry respondents and one from a research agency. These pilot respondents were selected from the sample group aimed to validate the reliability and validity of this study. The following sub section will describe the results analysed, coded and outline the themes that emerged from the interviews.

2.1 Describe the processes involved in establishing collaboration?

One fifth of the university respondents indicated that they were approached by the industry due to their niche area of research expertise. This was mainly due to the fact, as noted by the industry partners, that there were no other university doing research in that specific field within Malaysia, hence restricting their options. On the other hand, a majority of respondents stated that the collaboration was more of an individually initiated effort that took place after several rounds of discussion. University partners commented that the amount of time and effort involved to convince their industry partners was very significant and the process was considered to be a ‘very challenging ordeal’.

Table 2: Theory Questions with Category Variable Used as Guideline in the Semi-Structured Interview and Questionnaire Development Relative to the Identified Literature Review

Table 2: Theory questions with category variable used as guideline in the semi-structured interview and questionnaire development relative to the identified literature review

Theory Question	Category Code	Interview Question	Literature review
What is the significant relationship between the establishment, project management and outcome evaluations in a UIC?	DEV	Describe the processes of establishing UIC?	FORMATION (COLLABORATION) Conception of research IDEA /strategy Prepare an in-house proposal Identify organization core competencies Decision to form Identify potential alliance partners Distribute solicitation letter to interested parties/partners identified Select and identify potential partner Negotiate and plan collaborative research agreement Submit for external funding and approval Alliance project approved, sign agreement OPERATION (PROJECT MANAGEMENT) Launch execute the collaboration project Plan and monitor collaboration project progress Take correction action review Completes project EVALUATION & TERMINATION (TRANSFER) Performance evaluation Transfer technology and knowledge Sustaining relationship
		How is the performance of the collaboration measured?	Tangible performance indicators - potential spin-off; number of graduates generate; patents and non patentable property; list of publications in journals or conferences and financial success Intangible performance indicators exploration of new knowledge or findings; increase of experiences, relationship building

Theory Question	Category Code	Interview Question	Literature review
What are the requirements for a UIC PMM?	PROJ-MG	What key elements are needed in the planning process? Do you/ institution adopt a PMM to manage UIC? If there is a PMM, what should be included in it?	METHODOLOGY REQUIREMENTS • Principles & processes • Organizational standards/regulations • Model work flow of project • Promote organizational learning • Technology element • Tools & techniques • Specific & customisable • Scalable & adaptive • Identify risk & opportunity
How UIC are being managed in the organization? Is there any structured approach to the project management?		What structures are created /adopted to coordinate the collaboration? Who are the key people involved in the project management? Is there a project manager from each partner? If yes, how has it benefited the collaboration? If not, why?	OPERATION (PROJECT MANAGEMENT) Launch/execute the collaboration project Plan and monitor collaboration project progress Take corrective action review Completes project
		How is the progress of the collaboration monitored and controlled?	MONITORING & CONTROL (PROJECT MANAGEMENT) Progress reporting, technical reporting, financial reporting Frequent communication planning

One university respondent recounted the numerous visits to the industry partner over the course of two years before eventually being given a project as a trial. In the view of university respondents, the majority agreed that there was a lack of direct involvement from their institutions to facilitate the engagement or to assist with the selection of industry partners. These following comments are reflective of the findings in this investigation with respect to the establishment of a UIC in Malaysia:

Industry partners directly approached university researchers due to their interest in the niche area or an immediate technical problems requiring experts solution.

- Pre-existed relationship (Dyer et al. 2006); initiation as a result of professional work, academic connection or mutual interest in specific areas of research.
- Joint effort/balance contribution (Vyas et al. 1995); whereby each partner contributed to the research via a 'win-win' partnership. For example as indicated by a university respondent, industry partner contributes samples and in return the university partner carries out experiments on the samples. As a consequence the collaboration became ideally beneficial, sustainable and synergistic (Barbara 2008; Lasker et al. 2001).
- Individual initiatives/effort; whereby university researchers select their own partners via personal contacts without significant guidence from the university was stressed by the majority of respondents. One industry partner similarly agreed that in his view, direct contacts and involvement with the university researcher rather than university administrators was the normal practice.

Among the 19 respondents, only a few were able to provide a more descriptive response to the process involved in UIC establishment. Based upon the responses a diagrammatic representation has been developed illustrated in Figure 1. At initiation, collaborations were commonly established as either through pre-existed relationship or individual effort initiated by either one of the partners.

According to the respondents, UIC begins with an identification of research idea by either party before a decision to collaborate is initiated. Once the relationship between partners has been established as showed in Figure 1, the next step involves negotiating the contractual agreement between the two parties. Once an agreement is reached, a memorandum of understanding (MOU) is to be signed by both parties. An industry partner identifies the importance of a MOU in the set up of the collaboration because it clearly spells out the terms and conditions of the relationship, deliverables, expectations and scope of work. The second aim involves solidifying the partners' relationship. It was noted that small to medium enterprises (SMEs) are more flexible with the contractual agreements with university researchers. This is mainly due to SMEs inadequate understanding and knowledge of UIC establishment creating greater dependency on university researchers to progress with the agreement.

Surprisingly the findings in this investigation indicate that the formation of UIC(s) without any contractual agreement was not uncommon. Evidence collected from both the literature (Matthew & Norgaard 1984) and the interviews indicates that it is important to create a written agreement to optimise the probability of fulfilling the project requirements. However, one of the partnerships interviewed in this study did not consider this to be a significant success factor. In their one and half year of partnership, they commented that their collaboration set-ups were mainly based on research without commercial interest. As a result, no form of contractual agreement was utilised. However, they did indicate an interest to generate an agreement in the future to support their long term collaboration.

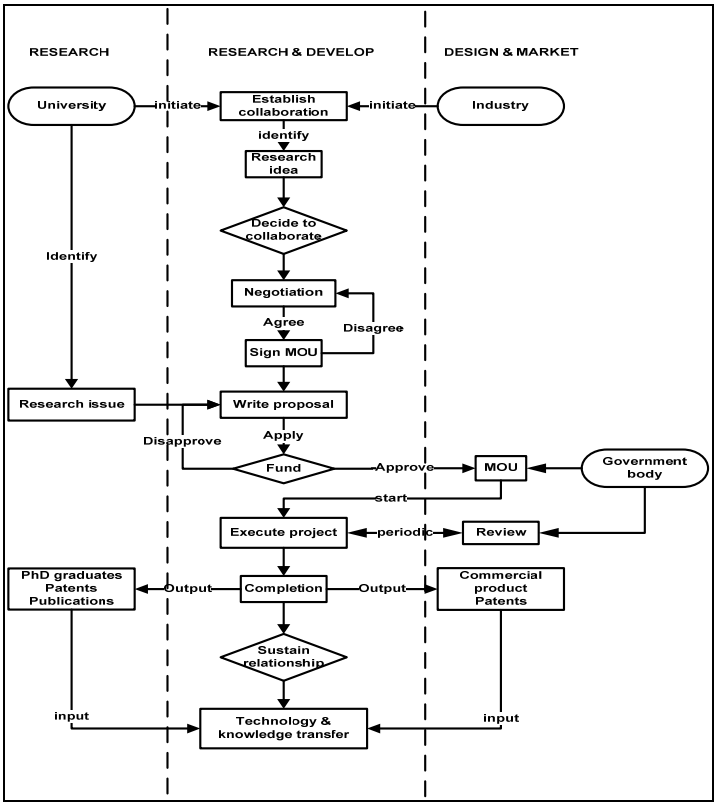

Figure 1: UIC establishment process as described by interviewed respondents

When sourcing for external funds from government bodies, proposals are written and submitted for application. Once the funds are approved it is a requirement that an agreement is drafted with the government body. Projects are then executed and reviewed periodically until completion. The aim of UIC differs greatly. From the government's perspective the outputs expected from the university are PhD graduates, patents and publications; while commercial value oriented products are of course the industry partners' desired outcomes.

2.2 What key elements are needed in the planning process?

No indication of the implementation and utilisation of PMM was given by the interview respondents. Only one industry respondent agreed that there was a need for a methodology as the key element in UIC planning. However, the remaining respondents did identify the need for several elements commonly associated with project planning and PMM. These include:

- Clearly defined project objectives or problems
- Well scheduled and planned timeframe
- Adequate amount of financial support for investment, production, technical etc
- Selecting the right partner and right expert manpower with sufficient capability to sustaining the partnership
- Clearly defined roles and responsibilities amongst project team
- Well planned, leveraged and minimise resource utilisation
- Adoption of a PMM

2.3 What structures are created/adopted to coordinate the collaboration?

The majority of industry respondents indicated their preferences not to adopt any specific approach or structure in the management of collaborative projects. It was also evident that the industry respondents were more responsive to coordinating collaborative tasks via deadlines and milestones. Furthermore, the industry partners viewed regular scheduled meetings and discussions as sufficient vehicles to coordinate the collaboration.

In comparison, the university partners indicated a more practical approach to the coordination of their collaboration through periodic documentation reporting, regular meeting and email discussion to maintain an open communication between partners. These approaches appeared to be appropriate, particularly in such a dynamic project environment. Additionally, university respondents are also dependent on their university research management centre for collating documents and monitoring project progress. Based upon the comments from university respondents', they are required to submit reports to the university research management centre either on monthly, half a year or yearly reports to facilitate performance management.

2.4 Who are the key people involved in the project management? Is there a project manager from each partner? If yes, how has it benefited the collaboration? If not, why?

For the first question, respondents identified several individuals whom are directly involved in the collaboration. These can be classified as researchers, project leader, programme leader, industrial researchers, project sponsor, doctoral students, R&D department and senior management.

In practice, the appointment of a project manager in UIC projects was not considered to be as an important success factor as the available literature would suggest (Gerardi & Wolff 2008; Groman 2006; Matthew & Norgaard 1984). As such universities must commit to training an academic project manager to facilitate the collaborative partnership so to have less dependency on the industry partner (Carboni 1992). With the appointment of an academic project manager, he/she will tailor to the needs and style of the organization (or university) culture (Cooke-Davies & Arzymanow 2003). With that expectation, the academic project manager is required to be flexible, adaptable, a quick learner and a good communicator (Barber 2004) whilst embracing the essential skills of an effective project manager (Schwalbe 2002).

However, findings from respondents indicated there were no physical project manager in practice rather the role is generally taken by the project leader (from university) or project sponsor (from the industry). Commonly these accidental project managers are not given any project management training. In the view of the respondents, this arrangement does not seem to affect the performance of the collaboration. It was believed that because both partners' roles were clearly defined would compensate the formal project management training. However, as the respondent indicated several issues and barriers encountered during the collaboration which basic project management training and documentation could have helped a well trained project manager resolve at least in theory, enhancing the effectiveness of the collaboration.

2.5 Do your UIC adopt a PMM to manage the collaboration?

After an explanation of what constitutes a PMM, all respondents agreed that no formal PMM was used to manage UIC projects. The reasons identified differed between respondents. University respondents were in general, satisfied with their present university management structure in coordinating and monitoring collaborative projects. University respondents also highlighted that their industry partners prefers coordination to be carried out by respective institutions in their own management style and practice. It is evident that industry respondents preferred to retain a degree of flexibility in the management of the collaboration so as not to overburden their own team. Interestingly, one industry respondent expressed their desire to exercise a PMM in their UIC projects.

2.6 If there is a PMM, what should be included in it?

It is apparent from the interview results that none of the industry or university respondents adopt or create their own formal PMM although many elements of a PMM are present. Responses from industry were consistent with literature findings. The following components were suggested to be included in a PMM which are grouped into scalable, effective for the full range of projects (this

is more of a requirement than a component); relationship management, partner matching, project planning, contract management and ethical guidelines.

- **Relationship management**

The importance of managing university-industry relationship can be established via constant communication. Respondents strongly agree that it is important to manage the soft side of UIC. An industry respondent states that they regularly 'inspire each other' as a result they are more committed in retaining their collaborative relationship. Other means of relationship management were through regular visitation from university to the organization and vice versa. Respondents commented that regular meeting facilitates transparency, creating an environment of trust and openness which avoids misunderstandings and distrust among collaborators.

- **Partner matching**

This aspect has been identified as the foremost process for organization to assure successful partnerships but it remains as one of the key obstacles in most collaborations (Holmberg & Cummings 2009; Bierly III & Gallagher 2007). A number of respondents agreed that for successful project it is essential to select the right partners. One university respondent commented that searching for the right partner is both subjective and intuitive. The findings indicate that presently UIC practices in Malaysia lack appropriate partner selection strategies.

- **Project planning**

This component was highlighted by the industry respondents; resource planning is foreseen as an important component to ensure continuity in the collaboration. Manpower and infrastructure forms the two major resources that facilitates R&D collaborations in this work. Respondents also stressed that there must be adequate and permanent supply of manpower to ensure completion of tasks. Another critical element in every project is the issue of financial support. Industry respondent all stressed that without finance 'there is no project to pursue'. As collaboration comprises different stakeholders, there is a need to monitor and control the spending of funds in a more transparent way.

- **Contract management**

The majority of respondents signed a contractual agreement with their partners as a formal procedure to formalise the collaboration. Respondents confirmed that the agreement helps to establish and define the relationship. Results indicated that the respondents sign an agreement prior to the production of the research proposal. Only one university respondent described their collaboration as open ended without contract or commercial interest. However, despite the importance of a legal binding relationship between both partners; the industry respondents inidcated that they have contested the aspect of the contractual agreements as merely written papers which may be easily terminated unless there is an appreciation and commitment in the collaborative relationship.

- **Ethical guidelines**

A university respondent reported that the PMM should also constitute ethical guidance for university researchers. It was suggested that guidelines should

be provided by the university administrators and should include elements such as selection of project types, researcher ethics, the conduct of work and financial management. It should however, be noted that personnel in university research management centres are not typically experts in such areas and thus the PMM should provide guidance for these actors to structure such advisories. University respondent stated such guideline will benefits university researchers in many aspects.

2.7 How is the progress of the collaboration monitored and controlled?

Respondents agreed that in order to effectively monitor and control progress, it is important to foster open and transparent communication channels between partners. By doing so, they are kept informed of everything that takes place within the collaboration. All respondents' perceived communication should be carried out with clarity, completeness and in a concise manner in order to maintain and enhance the relationship, trust and confidence between the partners.

Approximately, half of the respondents commented that their practices in producing reports such as progress report, weekly report or even daily reports helps to keep track of the project. Others produce milestone report, technical report and financial reports. The majority produces reports using milestones reporting in order to receive the next payment from the funding body. Although documentation are generated mainly for archiving, in reality there is less of a requirement to produce lengthy reports between partners. For instance, an industry respondent commented that it is unnecessary to produce lengthy reports as long as the project sponsor/owner is aware of project progress through regular emailing, online discussion and meetings.

2.8 How collaboration performance is measured?

As a result of the collaboration, two types of outcome were constantly expressed by both university and industry respondents. These have been grouped into tangible and intangible outcomes.

- **Tangible outcome;** such as paper publications, new findings and solutions by university researchers are the normal deliverable expected from the academicians. University researchers also view collaboration as a strategy to generate more doctoral graduates with industrial exposure to meet the market needs.
- **Intangible outcome**; such as knowledge development, validation of findings, satisfactions of research output or solution to the specific problems. Industry partners view collaboration as a means of accessing higher value technology to their product at the same time increasing their product commercial values and competitiveness in the market.

Despite the fact that collaboration are heavily emphasised by all respondents, they did not provide any specified response to this question. Findings

revealed that there are no indications of performance measurement conducted by the organization to assess its outcomes or direct involvement of institutions in measuring the performance of the collaboration outcome. This dyad view was consistently identified from the interviews. The response from this question denotes that this area is still understudied in the market (Yee et al. 2009).

Conclusions

In view of the above discussion and finding, a basic structure of a PMM to assist the management of UIC projects has been conceptualised. The structure of the PMM is based on leveraging leading project management best practices (Chin et al., 2010) and examination of the processes involved in UIC research environment and findings discussed in this paper. The basic structure of the PMM is divided into 4 modules outlined with thorough processes of initiating, planning, executing, controlling and closing of projects with selected toolkits and templates for implementation. The PMM will be designed as a guidebook to provide a systematic approach to assist and support the planning and management of UIC research projects in the Malaysia market. Embedded within the PMM is a flexible structure to enable university and industry players to customize the available approaches, tools and templates readily accessible in the guidebook to fit to their project size, complexity, objectives and requirements. Below is the outline of each module with its associated key objectives, activities and outputs.

Module 1: Initiation

The objective of this module is to generate potential idea and to set up the project.

Key objectives:

- To identify the unique purpose of the project
- To define the project objectives, goals and mission
- To identify potential collaborative partners
- To develop a project initiation document
- To write up an agreement and obtain approval to initiate the project planning module

Key activities:

- Develop a project proposal to set the objectives and purpose
- Collaborative partners are assessed based on a list of criteria
- A project initiation document (PID) is produced which provides a high level plan of the project, a description of the project, objectives, scope of work, deliverables, approaches and constraints.
- Project manager and team members need to be recruited and a project organization structure is created. Project stakeholders are identified and roles and responsibilities are assigned.
- A kick off meeting between partners is held to clarify the project scope, requirements and expectations from each partner e.g. schedule, budget, quality, roles and responsibilities, reporting plan etc. This also strengthens communications channels.

- A contractual agreement is written and agreed

Key outputs:

- Project proposal
- Project initiation document (PID)
- Selected collaborative partner
- Contractual agreement

Module 2: Planning

This module is the main component of the PMM and covers project planning such as schedule, budget, resources, issues, risk, communication and quality planning. The output from Module 1 will contribute as input to this module.

Key objectives:

- To develop an activity schedule
- To identify project resources and budget
- To document and track issues arising in the project
- To identify, plan and response to risk and uncertainties in the project
- To the communication and information distribution channel
- To identify and assure quality target meets stakeholders expectations

Key activities:

- Break down project activities into manageable work packages
- Sequence and schedule all activities using a Gantt chart
- Create a resource plan and estimate budget for procurement
- Create an issue management plan to document identified issues in the project
- Create a risk plan to mitigate and control risks in the project
- Create a communication plan to identify who, what and how to distribute information throughout project life cycle
- Create a quality plan to identify acceptable criteria and standards

Key outputs:

- Work breakdown structure (WBS) and WBS dictionary
- Project schedule (Gantt chart)
- Resource plan
- Budgetary plan (baseline)
- Issue management plan
- Risk plan and risk log
- Communication plan
- Quality plan and quality log

Module 3: Execution & monitoring

Completion of project planning documents and approval from stakeholders will initiate the execution and development of the project. This module is critical because the project manager needs to constantly control and monitor project performances to ensure it meets the expectations of all stakeholders. The monitoring process begins when the project starts and continues until it ends.

Key objectives:

- To ensure each project objective is delivered as planned
- To coordinate the completion of all tasks within schedule and budget
- To monitor change requests and minimise impact on project scope, schedule and budget
- To keep track of project progress against plans through performance reporting
- Take corrective action against changes as recommended by collaborative agents committee

Key activities:

- Conduct meetings to monitor and track project progress
- Document project performance through minutes, progress report and progress log
- Document change requests and monitor execution in the change of plan
- Perform activity review gate at the completion of each activity in a module
- Perform module review gate at the completion of each module
- To iterative the above activities until all project objectives are delivered

Key outputs:

- Project minutes
- Project progress report
- Progress log checklist
- Change request plan and request log

Module 4: Closing

The closing module includes measuring the deliverables of a collaborative project, documenting lesson learned and project archives, official acceptance signoff and handover of final product by/to stakeholders. This module is also important to determine as to whether the collaboration can be sustained.

Key objectives:

- To identify and measure collaborative performance
- To document lesson learned from project experience
- To gain acceptance of the completion of all project work
- To signoff and handover to stakeholders to close the project
- To sustain relationship for future partnership

Key activities:

- To measure the collaborative performance indicators in terms of four perspectives; financial, customer, internal processes and learning and innovation growth
- To create lesson learned report for future project reference
- To update and archive all scope of work completed and variances of project performances in the end project report
- Prepare formal acceptance for signoff and handover of project

Key outputs:

- Collaborative performance measurement indicators
- Lesson learned report
- End project report
- Signoff and handover of project

While the actual structure of the PMM is being evaluated and reviewed by university, industry and project management experts. The qualitative research findings presented here are intended to provide an insight understanding from a dyadic view on the processes, issues and practices allied with project management practices. This research highlights to university-industry on how to embark in designing a PMM for use in their own perspective environment and scope of project.

References

1. Barbara, B. (2008), "The power of partnership", *Community College Journal*, 79(2), p. 10.
2. Barber, E. (2004). "Benchmarking the management of projects: a review of current thinking", *International Journal of Project Management*, 22(4), pp. 301-307.
3. Barnes, T.A., Pashy I.R. & Gibbons A.M. (2000). "Collaborative R&D projects: a framework for effective management", in *International Conference on Management of Innovation Technology*, IEEE, pp. 210-216.
4. Barnes, T.A., Pashy I.R. & Gibbons A.M. (2002), "Effective universities-industry interaction: a multi-case evaluation of collaborative R&D projects", *European Management Journal*, 20(3), pp. 272-285.
5. Bierly III, P.E. & Gallagher, S. (2007), "Explaining alliance partner selection: fit, trust and strategic expediency", *Long Range Planning*, 40(2), pp. 134-153.
6. Bryman, A. (2004). *Social research methods*, Oxford University Press, UK.
7. Carboni, R.A. (1992) *Planning and managing industry-university research collaborations*, Quorum Books, US.
8. Casey, J. (2004). "Developing harmonious university-industry partnership", *University of Dayton Law Review*, 30(2).
9. Chin, C.M.M. & Spowage, A.C. (2008) "A project methodology for managing university - industry innovative R&D collaborative project", *ISPIM Innovation Symposium - Managing Innovation in a Connected World*.
10. Chin, C.M.M., Yap, E.H. & Spowage, A.C. (2010), "Reviewing leading project management practices", *PM World Today*, vol. II, no. XI.
11. Cooke-Davies, T.J. & Arzymanow, A (2003). "The maturity of project management in different industries: An investigation into variations between project management models", *International Journal of Project Management*, 21(6), pp. 471-478.

12. Davenport, S., Davies, J. & Grimes, C. (1999) "Collaborative research programmes: building trust from difference", *Technovation*, 19, pp. 31-40.
13. Dyer, J.H., Powell, B.C., Sakakibara, M & Wang, A.J. (2006), *Determinants of success in R&D alliances*, National Institute of Standards and Technology, Technology Administration, US Department of Commerce, Advanced Technology Program, US[6 September 2008].
14. Erno-Kjolhede, E. (2000), *Project management theory and the management of research projects*.
15. Gerardi, D & Wolff, N. (2008), "Working together: a corrections academic partnership that works", *Equal Opportunities International*, 27(2), pp. 148-160.
16. Ghani, N. (1991). "European collaborative research projects", *Engineering Management Journal*, 1(2), pp. 63-70.
17. Glaser, B.G. & Strauss, A.L. (1967), *The discovery of grounded theory: Strategies for qualitative research*, Aldine Publishing, Chicago, US.
18. Groman, M. (2006). *A model of best practices for project management strategies in an Administrative Computing System implementation in higher education*, Nova Southern University.
19. Harris, T. (2007). *Collaborative research & development project - a practical guide*, Springer-Verlag.
20. Holmberg, S.R. & Cummings, J.L. (2009). "Building successful strategic alliances: strategic process and analytical tool for selecting partner industries and firms", *Long Range Planning* 42(2), pp. 164-193.
21. Huljenic, D, Desic, S. & Matjasevic, M. (2005). "Project management in research projects", in *8th International Conference on Telecommunications – ConTEL*, Zagreb, Croatia, pp. 663-669.
22. Lasker, R.D., Weiss, E.S. & Miller, R. (2001). "Partnership synergy: a practical framework for studying and strengthening the collaborative advantage", *The Milbank Quarterly*, vol. 79, no. 2.
23. Matthew, J.N. & Norgaard, R. (1984), *Managing the partnership between higher education and industry*, National Center for Higher Education Management Systems, Colorado, US.
24. Rohrbeck, R. & Arnold, H.M (2006), 'Making university-industry collaboration work - a case study on the Deutsche Telekom Laboratories contrasted with findings in literature', *ISPIM Annual Conference – Network for Innovation*.
25. Schwalbe, K. (2002), *Information Technology Project Management*, Second edn, Course Technology, Florence, US.
26. THE, *Times Higher Education- QS World University Rankings 2009*, Times Higher Education (THE). Available from: <http://www.timeshighere ducation.co.uk/Rankings2009-Top200.html>. [29 Dec].
27. Vyas, N.M., Shelburn, W.L. & Rogers, D.C. (1995). "An analysis of strategic alliances: forms, functions and framework", *Journal of Business & Industrial Marketing*, 10(3), pp. 47-60.

28. Weck, M. (2006), "Knowledge creation and exploitation in collaborative R&D project: lesson learned on success factors", *Knowledge & Process Management*, 13(4), pp. 252-263.
29. Yee, S.V., Chong, A.L. & Abas, Z. (2009). "Strategic collaborative success factors and sustainability indicators of academia industry collaboration: case studies of two universities in Malaysia", *Journal of the World Universities Forum*, 2(1).