Northumbria Research Link

Citation: Howarth, Tim and Watson, Paul (2008) Applying project management concepts and tools to built environment research projects. Northumbria Working Paper Series: Interdisciplinary Studies in the Built and Virtual Environment, 1 (2). pp. 159-170. ISSN 1756-2473

Published by: Northumbria University

URL:

This version was downloaded from Northumbria Research Link: https://nrl.northumbria.ac.uk/id/eprint/629/

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: http://nrl.northumbria.ac.uk/policies.html

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

Northumbria University NEWCASTLE

UniversityLibrary

Applying Project Management Concepts and Tools to Built Environment Research Projects

***Paul Watson*[1] *and Tim Howarth*[2]**

ABSTRACT

This paper concerns the issue of Built Environment research students utilising a formal approach for designing and conducting research projects. The authors draw upon their experience of supervising and examining Built Environment research projects at undergraduate and postgraduate levels to critically reflect upon issues faced by researchers. Furthermore, student feedback has been obtained via semi formal interviews.

Within the paper a case is presented for research students in built environment disciplines to adopt and use Project Management concepts and tools in order to exercise better management control of research projects and increase the possibility of bringing the research to a successful conclusion. The works of Phillips and Pugh (2005), Rudestam and Newton (2001) and Delamont et al (1997) support the authors' observations and conclusions that research students would benefit from having a more formalised approach when conducting their research in order to better control and succeed in their research activities.

Keywords: Control Function, Loop Learning, Managing Research, Project Management.

1 Built Environment Division, Sheffield Hallam University, Sheffield, S1 1WB
E-mail: p.a.watson@shu.ac.uk

2 Divison of Construction, School of the Built Environment, Northumbria University, Newcastle upon Tyne NE1 8ST

1.0 INTRODUCTION

For many students the undertaking of a research project can be a daunting and demanding challenge. The authors propose that the approach to this challenge can be facilitated if students are able to perceive the task they face as being a 'project'. Promoting and highlighting the critical similarities between the management *characteristics* of research projects and the characteristics of 'project management' can help here. These similarities are considered to include:

- having a particular purpose which is not normally routine, or, by its nature, is unique;
- setting clearly defined start and end points, a time scale when the deliverables are required to be presented;
- an element of risk, because a project's unique nature touches upon the unknown;
- an element of managing peoples' perceptions and their respective expectations;
- complex activities involving communication issues.

With regard to the process of *undertaking* a project, both project management and a research project have the following in common:

- a set outcome and therefore they are objective orientated, e.g. for research it could the testing of a hypothesis;
- the purpose of creating/ascertaining something new, constructing a new structure or establishing new knowledge;
- the possibility of challenging convention/traditional ways of working or knowledge;
- an element of cross discipline working and/or collaboration;
- a requirement to manage peoples' expectations, these may be the clients or the researchers.

It can be seen that a research project can be considered to possess a number of commonalities with aspects of construction project management. A research project can also be considered to be subject to the same common threats as a construction project, such threats can include:

- poor planning and scheduling of activities and resources;
- over optimistic expectations, by client/researcher;
- a general lack of co-ordination throughout the project;
- a lack of management expertise, and application of management tools/techniques;
- unknown and unforeseen circumstances which occur before and during the project's life cycle.

Thus if the researcher can appreciate that a research project shares great similarities with project management, it becomes possible to address common problems and threats with the methodical application of project management concepts and tools.

Commonly both project management and research projects require a clear focus, As such it is essential to start with clearly defined and agreed objectives for a project, though these may be refined later. This point is corroborated by Rudestam and Newton (2001) who suggest that "...the prelude to conducting a dissertation study is presenting a dissertation proposal.... a research proposal is an action plan that justifies and describes the proposed study."

The setting of realistic deadlines should be conducted; these need to recognise that some delays are inevitable, so it is important for the researcher to employ the concept of 'flexible planning'. "Construct, in conjunction with your supervisor, an overall time plan of the stages of your research. ..this will enable you to locate your research in a [realistic] time frame" (Phillips and Pugh 2005).

In project management the aims and objectives have to be linked to the available resources allocated to the project and planning schedules produced. In the case of a research project this phase would be the

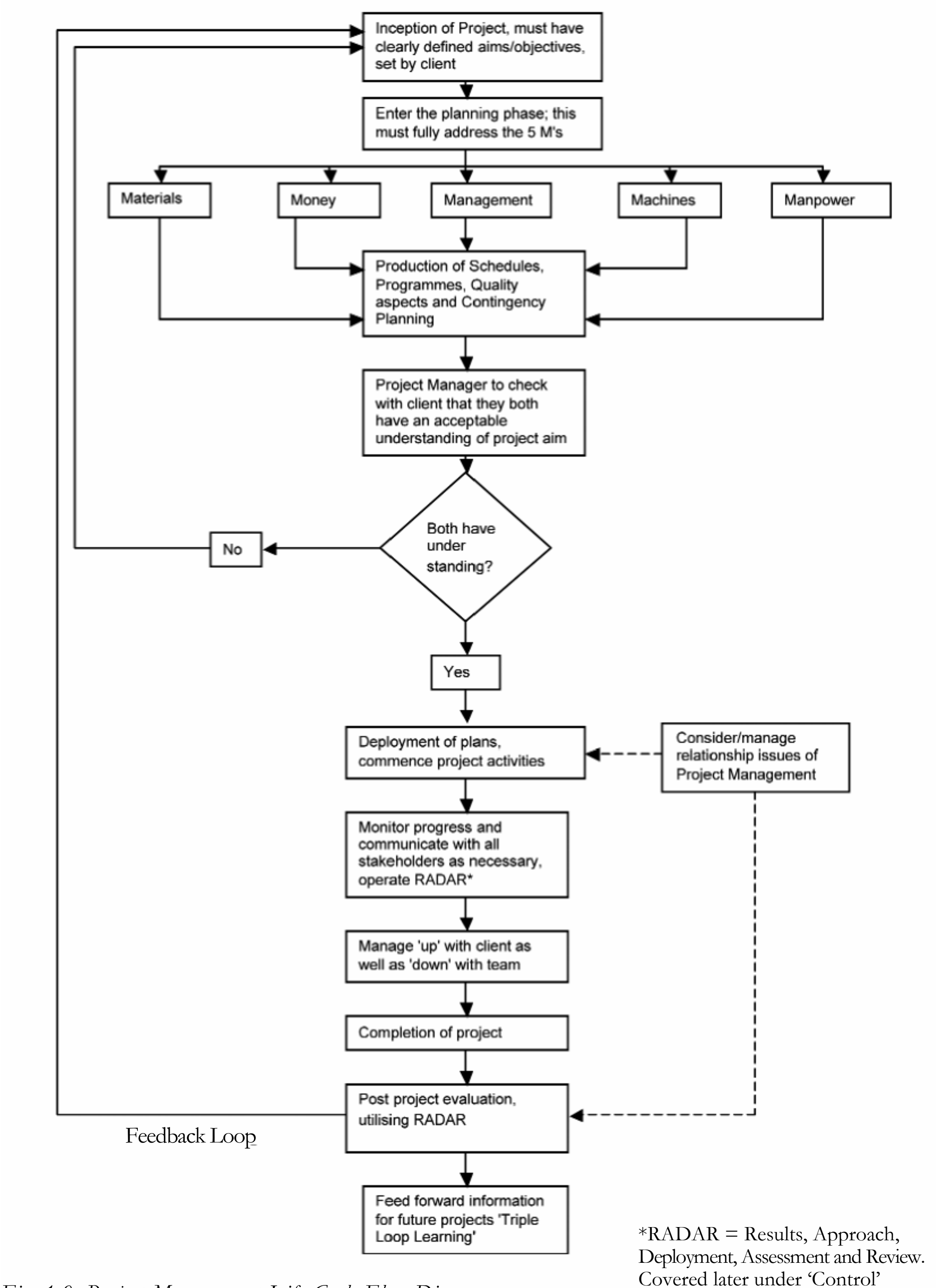


Fig. 1.0, Project Management Life Cycle Flow Diagram

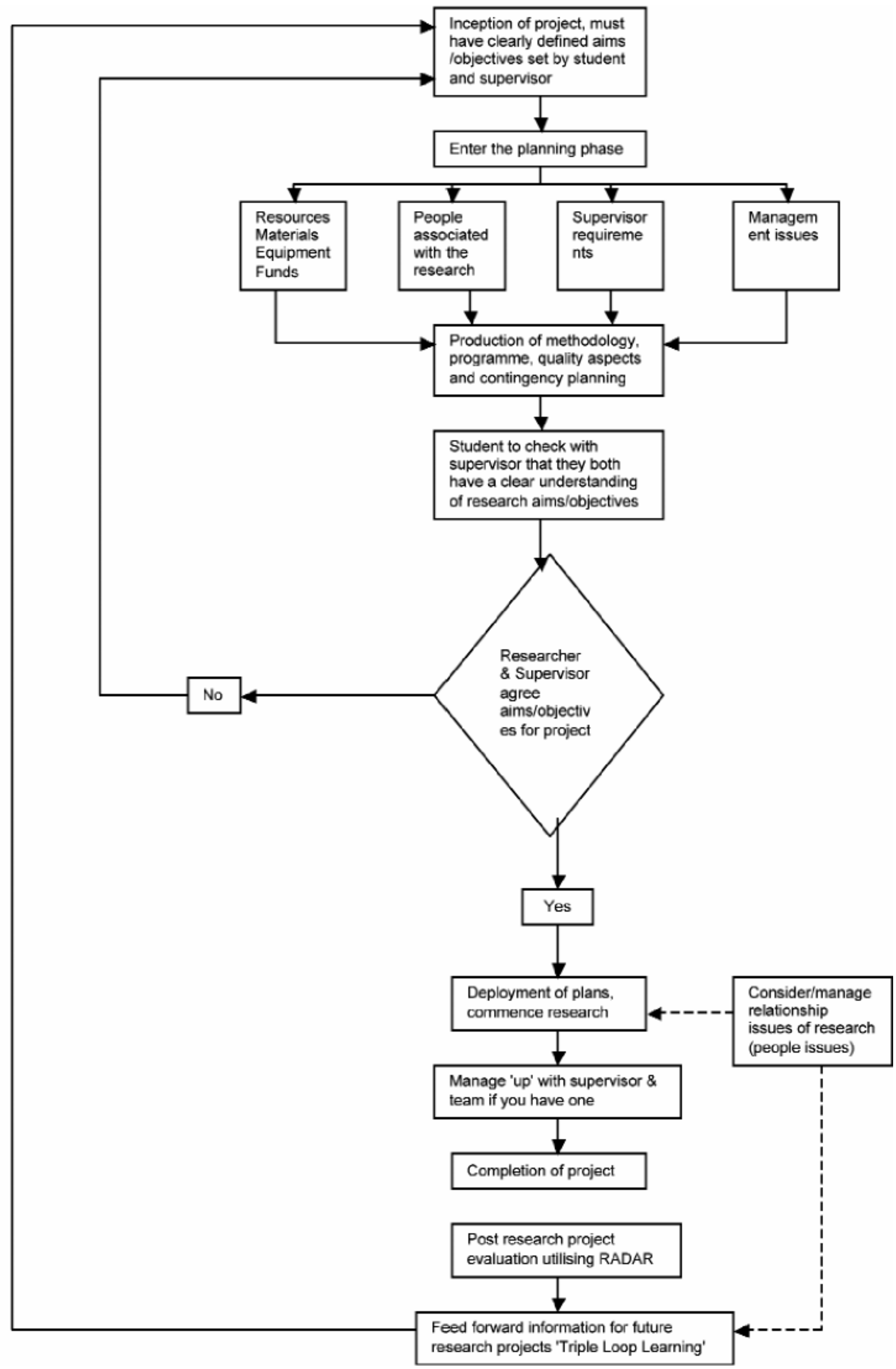


Fig.2.0, Research Project Management Flow Diagram

production "of the research methodology". Delamont *et al* (1997) advocate "...get [from students] an agreed research design, thesis plan and work schedule. These will need regular review [by the research team]". The researcher needs to take time to think through how the project will be 'managed', who will be involved and how to get them to 'engage' with the research. This is the same activity as a Project Manager when considering how they are to manage their team.

2.0 PROJECT LIFE CYCLE

Further to considering the approach to research projects both they and project managers can benefit from considering that the two have definitive 'project life cycles'.

A project life cycle consists of:

- Conception - the start of the research project, this may be an idea leading to the formulation of specific aims and objectives;
- Planning - thinking through and linking the critical phases/activities/ resources required for the successful completion of the project;
- Execution - the implementation phase of the research project, this will involve some re-planning and co-ordinating of activities (flexible planning);
- Closure - completion and writing up of the thesis, linking back to conceptions, aims and objectives.

Having a clear focus and agreed targets/objectives is an essential feature of project management, they are also critical features of a successful research project. Figure 1 presents the project management life cycle as a flow diagram. Figure 2 develops this flow diagram to illustrate the project management of a research project.

If a Built Environment researcher can understand the similarities between project management and managing a research project, they are more likely to avoid the pitfalls of not 'thinking through' all the necessary requirements for the attainment of a successful research project.

Researchers should also be aware that the suggested methodological approach should not be followed blindly. There are certain inherent dangers in application without thinking clearly of the desired outcomes. A researcher has to understand that when conducting research that the outcomes may not always be achievable and therefore an iterative process related to the advocated methodology has to be undertaken.

For example we often talk of triangulation of data analysis in determining the research output, but some times it is not triangulation but crystallisation that is the reality. In crystallisation there is an acceptance that there may not be a definitive end product and things just emerging from the process of investigation. So research success could in fact be the determination that a definitive end product is not possible due to the nature of the research task. However, under normal circumstances the methodology is a valid one.

3.0 RATIONALE FOR HAVING CLEAR RESEARCH AIMS AND OBJECTIVES WIYHIN A PROJECT MANAGEMENT FRAMEWORK

Commonly researchers are concerned with the achievement of aims and objectives within the context of constraints such as time and finances. A research plan can help with the considered allocation and the efficient and effective use of available resources. This plan may take the form of a research methodology, the plan being the method that needs to be deployed in order to achieve/complete the pre-determined aims and objectives. Researchers determine the broad lines of operation, the strategy or general programme, choose the appropriate methods, and sometimes the materials for the most effective and efficient actions. So planning relates to how, when and where research is to be carried out.

To be really effective, planning must be simple, flexible, balanced and based upon accurate information. Planning is an important tool for the researcher, requiring intense application and precise attention to detail. As purported by Cryer (1997) "...as a research student you need to map out some sort of plan for your programme of work ahead... [the plan] can provide a sense of security in that where you are now and where you are going have been thought about and are documented... [the plan is] also something to display to a supervisor."

Having a plan is not an end in itself; the plan is only a starting point in trying to control the research project. A successful researcher has also to engage in the 'Control Function'. After all as noted by Cryer (1997) "Detailed plans inevitably need regular amendment".

The importance of having clear research aims and objectives (and possibly a hypothesis) as a starting point for research planning activity has already been advocated. The activity of undertaking to develop valid research aims and objectives can be modelled into a simple 'feedback loop'.

A key problem associated with conducting research as noted by the students contribution to this paper was in maintaining control of the project. Control cannot be a bolt-on activity it must be inherent form the initial conception of the project. This requires the researcher to be specific about their aims and objectives and this was not always understood by the students in their rush to make progress on their projects. However, even this is not sufficient, and the aims and objectives must be woven together into a holistic representation of the research project. Figure 3 presents a pictorial representation of a dynamic closed loop feedback model. This concept of control is one that is also employed when engaged in construction project management activities.

Control of a research project is exercised by the feedback and feed forward of information upon actual performance when compared with the pre-determined plan; therefore planning and control are very closely linked. Control is the activity which measures deviations from planned activities/objectives and further initiates effective and efficient corrective actions based upon a valid comparative analysis.

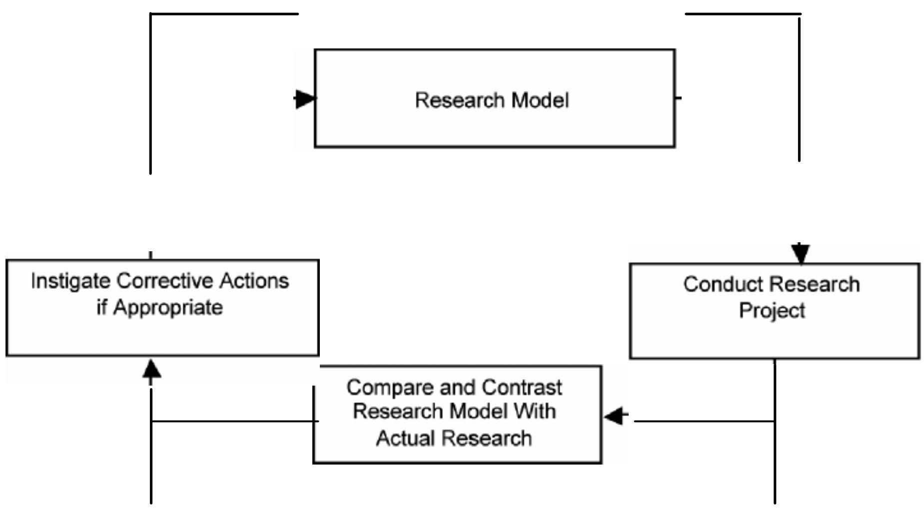


Fig.3.0, Dynamic Closed Loop Feedback Model

(Based upon the Deming Control Cycle as shown in Figure 5.)

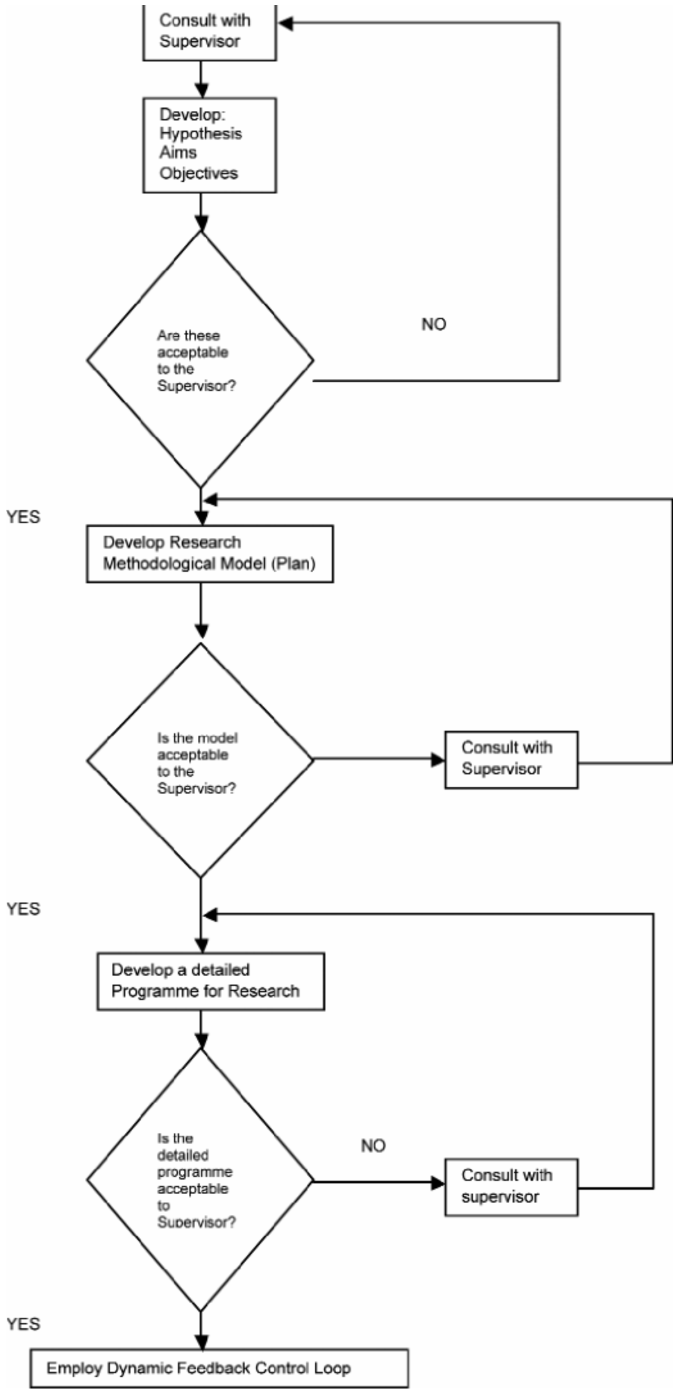


Fig4.0, Flow Diagram of Research Development

The use of the above model (figure 3.) can empower the researcher to monitor the progress of their research and if necessary instigate a corrective action procedure in order to ensure a successful outcome.

In applying the Dynamic Closed Loop Feedback Control mechanism a researcher must understand two important concepts; Cycle time and quality of information. Cycle time refers to the duration of time taken for the information to circulate around the loop. Cycle times must be as short as possible and the control mechanism should be applied at frequent appropriate intervals.

The second Concept relates to the 'Quality' of information circulating within the loop. Poor quality information circulating rapidly is of little value to the researcher. If the researcher has good quality information circulating rapidly and frequently, there can be efficient and effective control of the research project.

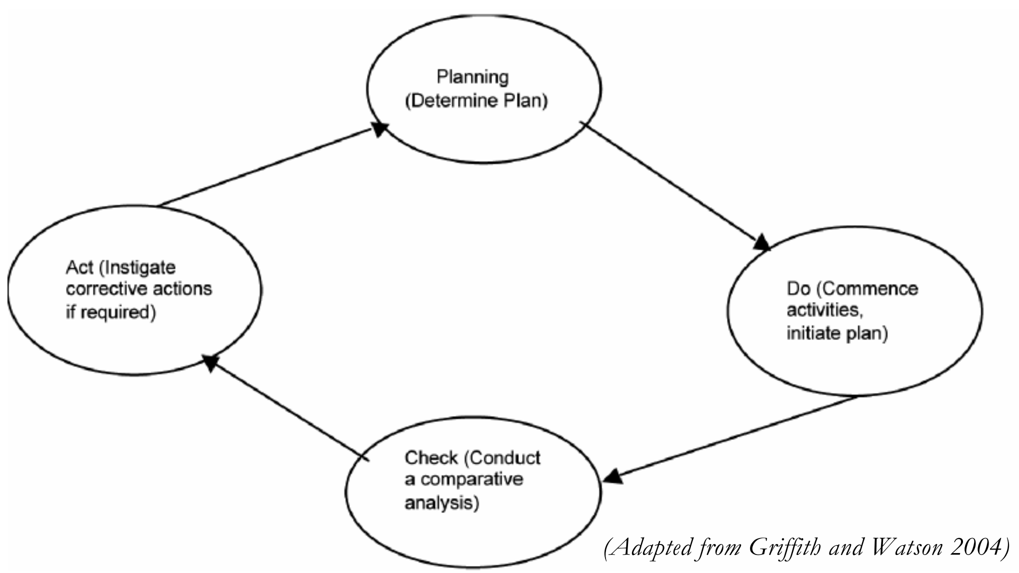
When undertaking to develop a planned and controlled research project with clear aims and objectives, effective communication between researcher and supervisor is necessary. Figure 4 provides a flow diagram of the research development process.

4.0 MAINTAINING CONTROL OF THE RESEARCH PROJECT

4.1 Control Cycles

Deming's concept of the 'Plan, Do, Check and Act (PDCA) control cycle' can be utilised to inform and define the control cycle of a research project. Figure 5 illustrates that PDCA is a continuous process that can be applied to any research or construction project. It involves establishing the project objectives and then determining the appropriate methods of reaching the set goals (Plan), implementing the Plan (Do), checking the effects of the implementation by comparing the actual results with the Plan (Check) and taking any appropriate corrective action (Act).

Phillips and Pugh (2005) state that: the student should plan "to monitor [your] overall progress, and thus motivate yourself to continue on course." The monitoring phase in a research project translates to being the check or comparative analysis aspect of the Plan, Do, Check and Act cycle.



(Adapted from Griffith and Watson 2004)

Fig5. 0, Deming Dynamic Loop Control Cycle

4.2 Maintaining Control of the Project

In relation to a research project the PDCA approach involves the following:

- Plan: Identify needs and expectations, set strategic objectives, or research aims and objectives;
- Do: Deploy and operate processes, or commence research project activities;
- Check: Collect performance results and monitor and measure the processes, review and analyse, compare research results with research plan;
- Act: Continually improve processes and performance, based upon comparative analysis and if required instigate control functions.

The information contained within the control loop must:

- present results in a consistent, readily understood and useful manner,
- represent appropriate and valid time periods for instigating effective actions;
- be available in time for effective decisions to be taken;
- divert the minimum energies from primary functions, consider the 'Law of Diminishing Returns' and associated 'Opportunity Costs';
- clearly demonstrate the deviations from the pre-determined plan.

The application of the PDCA cycle to research projects can be further enhanced through use of 'continuous loop learning'. There are three types to consider: single-loop; double-loop; and triple-loop learning. It was evident from student feedback that they did not realise that control was also linked to learning from the experience and hence engaging with enhancement.

4.3 Single Loop Learning

Argyris and Schon (1974) developed the concept of single and double loop learning. Single loop is defined as when an organisation, team or individual responds to changes in their internal and external environment (or for example a deviation from a set plan) by detecting and correcting errors in order to maintain the central features of a plan and/or strategy.

In considering 'learning' Argyris (1996) cites Dahlgoard (2004) and suggests that errors are mismatches between the intention and what actually happens (the results). However, Argyris argues that discovering an error is not in itself learning and that learning only occurs when the discovery or insight is followed by action. From this view point, learning requires the taking of an action or actions. In this way incremental, imitative learning methods such as benchmarking and best practice are examples of single loop learning with learning decisions being based solely on observations. Critically Stata (1998) argues that learning has not really taken place until it has been reflected in changed behaviour, skills and attitudes. In recognising this, it is possible to enhance the single loop model (illustrated in figure 5) by introducing a 'thinking' phase' at the check stage of the process. The introduction of this thinking phase develops the model into double loop learning, as illustrated in figure 6.

4.4 Double Loop Learning

Here an organisation's, team's or individual's norms, policies, assumptions and past actions are critically examined in order to inform new learning (Argyris and Schon 1974). Inevitably, such actions involve 'thinking' about the deviations from the plan, and what actions should be taken and learning from the experience. Whilst in 'Single Loop Learning' people's decisions are based solely upon observations, when applying 'Double Loop Learning' decisions are based upon both 'observation' and 'thinking'.

4.5 Triple Loop Learning (as embedded in RADAR)

Triple Loop Learning incorporates a reflection phase to support or improve the thinking phase and improve the decision making process, and can lead to more efficient and effective actions being taken. Thus double and triple loop learning can be described as generatitive learning.

In order to employ the concept and practice of triple loop learning, a researcher must start with a prescribed plan or methodology and undertake to continually monitor such plans against actual progression and results and furthermore think and reflect upon any deviations before instigating actions. This should be done in consultation with a supervisor and will involve a process of "conflictual questioning". Engstrom (2001) notes that this is not a barrier to learning, but can lead to sharper and more focused questioning of results and possible resulting actions. One approach to engaging the researcher with triple loop learning is to apply and utilise RADAR.

4.6 Results, Approach, Deployment, Assessment and Review (RADAR)

At the heart of the European Foundation for Quality Management Excellence Model (EFQM, EM) lies a specific logic and this is known as RADAR. It consists of the following elements - Results, Approach, Deployment, Assessment and Review.

EFQM's RADAR model mechanism is related to Deming's continuous improvement philosophy of Plan, Do, Think and Act. Importantly, the RADAR process is driven by self-assessment. Thus the application of 'RADAR' and hence 'Triple Loop Learning' involves:

Determining the results that one is aiming for, in research terms this could be the testing of the hypothesis, completion of aims and objectives;

The next phase is to 'plan' and develop and integrated set of sound 'Approaches'. This would be the research methodology or plan, set to deliver the required 'Results';

The next phase is to 'Deploy' the approaches established during the 'Approaches' phase, i.e. the implementation of the methodology or plan;

The final phase that engages in triple loop learning is the 'Assessment and Review' phase. Here the researcher is assessing and reviewing the results obtained set against original 'Results'. This will be based upon monitoring and analysis of the results achieved and ongoing learning activities;

Finally, to identify, prioritise, plan and implement improvements where and when required.

RADAR can enable the researcher to establish whether the approaches used were appropriate for the attainment of the set results. It could well be that the approaches were not in fact the correct ones for achieving the set aims and objectives. Figure 6 provides a pictorial representation of the Plan, Do, Think and Act cycle linked to the Triple Loop Learning of RADAR. If the researcher employs the concept of RADAR they will have a systematic and controlled approach to the achievement of a successful outcome to their Built Environment research project.

4.7 Developing and managing the draft thesis

The application of triple-loop learning is beneficial to development and management of the draft thesis. The concept instils a mind-set of thinking, planning, monitoring, acting and reflecting throughout the whole process. Thus, it applies a personal dynamic approach to a creative activity where self-motivation and effort are significant resources in delivering a successful outcome. Although the researcher will be liaising with supervisors on an ongoing basis, the task of writing any piece of work is essentially an individual one and, for the most part, undertaken in isolation. The researcher therefore has to be self-reliant, developing a structure to the thesis which is individual yet within the academic and intellectual parameters set for the task. The ability to plan, act and reflect must become intrinsic to the researcher's approach and activities. The task of delivering the thesis from its conception to conclusion should be seen as 'a project' which, as stated earlier, must be actively managed. The first step in developing and managing the draft thesis is to create an 'outline structure' which will form the skeleton of the written work.

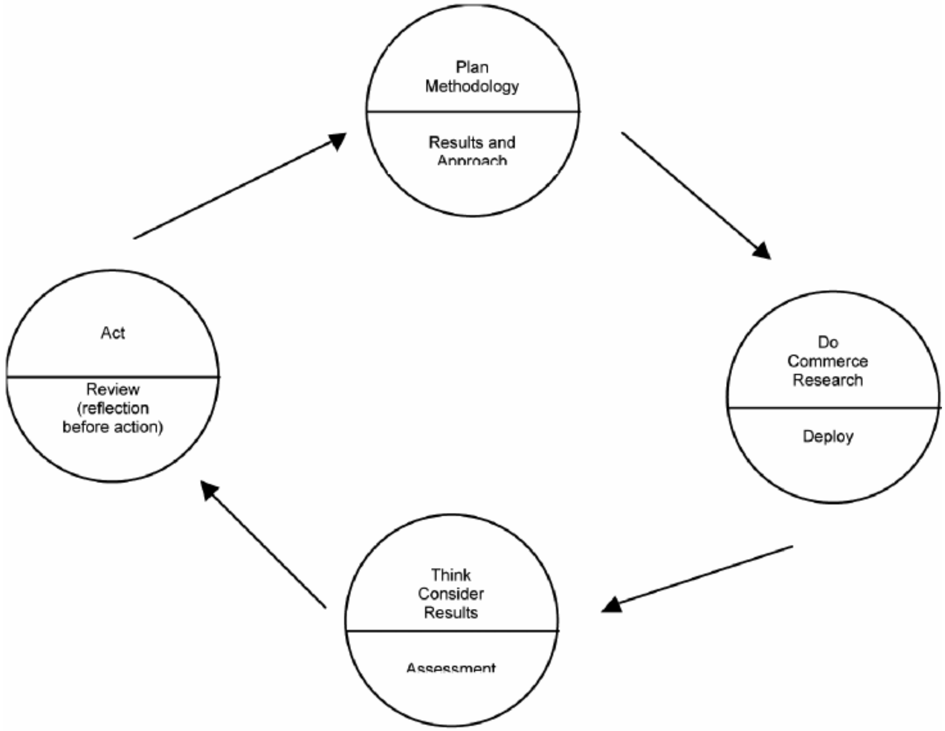


Fig 6.0, Matching of Plan, Do, Think and Act Cycle to RADAR

5.0 CONCLUSION

The process of managing a thesis is dynamic, self-led and involves the adoption of the 'triple-loop' learning process. This requires Built Environment researchers to engage in a continuous cycle of planning, doing, checking, thinking and acting. In this way, researchers are able to systematically decide on a required course of action, monitor their progress and motivate themselves to continue on course. Moreover, it helps Built Environment researchers to engage in the task of managing their thesis as a project, with clearly defined goals, resource use and outcomes. It is clear that the ability to develop and deliver a successful thesis can significantly benefit from the deployment of sound project management concepts and tools and Figure 2 provides a very useful flow diagram for guiding the researcher through the process.

6.0 REFERENCES

Argyris, C., and Schon, D,A., (1974) *Theory in Practice: Increasing Professional Effectiveness*, San Francisco, Jossey Bass.

Dahlgaord, S,M,P., (2004) *Perspectives on Learning in a Literature Review*, European Quality 2 (1), pp 033-047.

Delamont, S., Atkinson, P., and Parry, O., (1997) *Supervising the PhD: A Guide to Success*, The Society for Research into Higher Education and Open University Press.

Easterby-Smith, M., Thorpe, R., & Lowe, A., (1991) *Management Research: An Introduction*, Sage London.

Engstrom, Y., (2001) *Expansive Learning at Work: Towards and Activity Theoretical Reconceptualization* [online], Journal of Education and Work, 14(1), pp 133-156, available from: EBSCO Business Source Premier - Database [accessed 5th November 2004].

Fellows, R,F., and Liu, A., (1997) *Research Methods for Construction*. Blackwell.

Gill, J., (1986) *Research As Action: An Experiment in Utilising the Social Sciences*, in Heller F. (1986) *The Use and Abuse of Social Science*, Sage London.

Gill, J. and Johnson, P. (1997) *Research Methods for Managers*. Chapman Publishing.

Griffith, A., and Watson, P., (2004) *Construction Management: Principles and Practice*, Palgrave Macmillan.

Phillips, E, M., and Pugh, D, S., (2005) *How to Get a PhD: A Handbook for Students and their Supervisors 4th Edition*, Open University Press, McGraw-Hill Education.

Rudestam, K, E., and Newton, R, R., (2001) *Surviving Your Dissertation: A Comprehensive Guide to Content and Processes 2nd Edition*, Sage Publications.

Naoum, S, G., (1998) *Dissertation Research and Writing for Construction Students*. Butterworth- Heinemann.

Reason, P., and Rowan, J., (1981) *Human Enquiry: A Sourcebook of New Paradigm Research*, Whiley: London.

Stata, R., (1989) *Organisational Learning - The Key to Management Innovation*, Sloan Management Review, Spring.