12

Performance Measurement, Business Process Reengineering and World Class Manufacturing

P.Bradley, S. Lillis, and D.O'Sullivan
CIMRU
University College, Galway, Ireland
Phone: +353-91-750414, E-Mail: padraig.bradley@ucg.ie

Abstract

In recent years three key topics among business researchers have been Business Process Reengineering (BPR), Performance Measurement (PM) and World Class Manufacturing (WCM). Each topic has received much attention and provided a considerable amount of literature and research results from business commentators. Within the manufacturing domain these three topics have caught the imagination of manufacturing systems designers who strive to continuously improve productivity and efficiency within their individual companies. In this paper, a methodology that incorporates both the design focus of BPR and the implementation focus of WCM is described.

Keywords

Business process reengineering, world class manufacturing, performance measurement.

1 INTRODUCTION

A considerable number of interrelationships and commonalties exist between world class manufacturing (WCM), performance measurement (PM) and business process reengineering (BPR). The latter term is perhaps the more recent approach to be employed in the manufacturing domain. While many of the techniques of BPR are not new to manufacturing, they introduce a fresh look at the way systems can be designed.

This paper proposes a methodology that enables a company to achieve significant improvements in the operation (and results) of the company. This methodology combines both the strong design focus of BPR and the operational focus of WCM. Using this methodology, a set of performance targets for the company are identified (and expressed in terms of performance measures) and these performance targets are then used to guide the remaining activities in the methodology. This paper starts by

G. Doumeingts et al. (eds.), *Modelling Techniques for Business Process Re-engineering and Benchmarking*

introducing the commonalties between BPR and WCM. Then the proposed methodology is described in detail.

2 BPR AND WCM

An important feature of business process reengineering (BPR) is that it focuses attention on the 'design' rather than the 'operation' of manufacturing systems. In this regard, BPR highlights tools which can be used to model processes during a particular design 'approach'. For example, activity modelling is often suggested as a key tool in BPR. Activity modelling is a design tool and tools are a design issue.

World class manufacturing (WCM) on the other hand primarily focuses on how systems operate (Maskell, 1991). While methodologies exist that focus on a 'design' approach, the key strengths of WCM are in showing designers operational processes which maximise efficiency. For example, workteams are often cited as a useful way of organising workers. Team working is about how systems can operate and so workteams are an operational issue.

Performance measurement (PM) is complementary to both the WCM and BPR approaches. By inference it includes the activity of strategic planning. Both the WCM and BPR approaches need goals, and these goals are often set through strategic planning. Strategic planning, by its very name, is concerned with 'strategic' issues such as identifying strategic initiatives, defining performance measures and setting performance targets. The projects which ultimately provide mechanisms for improving the performance measures defined in a strategic plan inevitably begin their life through either WCM or BPR initiatives.

Kaplan (1991) contended that in the context of performance measurement, whatever is measured will improve, and if it is not measured it will not improve. However, if the performance of a change initiative is not measured in terms of radical improvement then the chances of achieving such radical improvements are greatly diminished. With BPR the approach is to highlight the larger possible improvement plans, ignoring the less significant ones, in the hope of achieving quantum leaps in improving current systems/processes. The danger with WCM is that every possible improvement project will be pursued regardless of its magnitude, ultimately leading to a impairment of the overall achievement of improvement plans.

Another theme that is recurrent in many BPR approaches is the presence of information technology as an enabler of solutions (Davenport 1993). In sharp contrast, WCM programmes are commonly opposed to IT driven solutions. This apprehensive attitude emerged as a result of the poor impact on overall company performance of the early MRP II implementations in the late 1970s. It was after this period that WCM emerged. Although IT has become more reliable in recent years WCM practitioners are not as keen as their BPR counterparts to jump to IT as an enabler of performance improvement (McSwiney 1994).

In manufacturing, two groups usually define projects aimed at meeting performance improvement targets. The Information Systems Group within companies is usually set up to design and maintain the company's computer and telecommunications systems. By implication, this includes many processes such as master scheduling, materials requirements planning and design. The Engineering Group, on the other hand, is usually responsible for the design and maintenance of shop floor activities such as flexible manufacturing systems, shop floor control, machine layout and systems design.

The domains for each group are very much defined by their organisational boundaries and, despite the best efforts of some companies, boundaries exist between the two groups which stunt integration and provide gaps where key issues can 'fall between the cracks'.

In terms of this discussion, WCM often provides the impetus for activities within the Engineering Group. While, BPR provides the impetus for activities within the Information Systems Group.

3 THE IMP/BPR METHODOLOGY

The Integrated Manufacturing Systems Design Procedure (IMP) / Business Process Reengineering (BPR) methodology consists of two parts - a theoretical part and an implementable part. The former is developed on a set of ideas about the way BPR projects can be implemented and is beyond the scope of this paper. However, the implementable part of the methodology is designed to facilitate the ideas that emerge from the theoretical part and provides an unambiguous road map for a BPR team in a reengineering project (O'Sullivan 1994).

The IMP/BPR methodology is shown in Figure 1. The IMP/BPR methodology is composed of five distinct steps which can be grouped into three phases, namely: Pre-BPR phase, BPR phase and the Post-BPR phase. The Pre-BPR phase is concerned with identifying a set of performance measures and targets for specific processes. The performance measures and targets that are identified during this phase are related to the strategy of the company and the requirements of the company's customers. The BPR phase is specifically concerned with the design of a new process which meets the requirements specified during the Pre-BPR phase. The Post-BPR phase is concerned with the implementation of the new process that has been designed during the BPR phase.

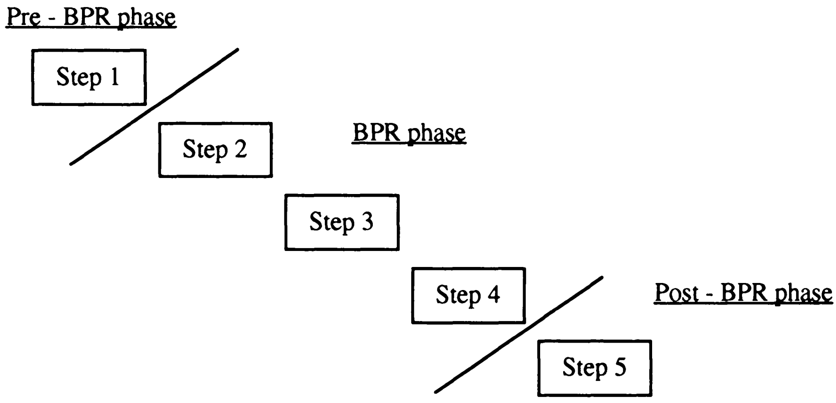

Figure 1 The IMP/BPR Methodology.

The authors contend that the IMP/BPR methodology enables its users to achieve swift, substantial results by making the radical changes in strategic value added business processes. The methodology is designed to be used by reengineering teams in business organisations without tremendous reliance on external BPR consultants. The methodology consists of five steps (see Figure 1), each of which addresses a logical part of the reengineering process. The five steps in the IMP/BPR methodology are as follows:

1. Develop Performance Targets
2. Engage Users and Model Process
3. Analyse System and Models
4. Define Migration Plans
5. Implement BPR Plan

Each of these five steps are now explained in more detail.

Step 1 - Develop Performance Targets

The purpose of the first step of the methodology is to assist the reengineering team in developing a list of goals and targets for the particular process or processes that need to be reengineered. For this to happen there has to be a recognition by senior management of the need to perform a BPR project. This stage is illustrated in Figure 2 below.

Figure 2 Step 1 - Develop Performance Targets.

This activity is controlled by certain attributes within the business organisation that govern the enterprise as a whole. These include the company's business philosophy - 'the way things are done around here', the company's set of guiding principles, driving forces, and ingrained attitudes that help communicate the goals, plans and policies to all employees. Senior management must also identify the critical success factors (CSFs) - those few areas where things must go right for the business to succeed - that are needed to achieve their business objectives.

These critical success factors (CSFs) and the requirements of the company's customers can be used to identify a range of performance targets for the new process or processes. These performance targets are composed of specific performance measures and a target value for the performance measure that the new process should meet. The translation of the CSFs and customer requirements into a set of performance targets can be achieved by using a QFD (Quality Function Deployment) based tool (Bradley, 1995). The performance targets identified can then be used to guide the other steps in the methodology.

In addition to defining the project targets and goals the project leader, reengineering team, process owners, czar and steering committee must also be informed of, and educated about, the methodology, terminology and the tools/techniques used.

Step 2 - Engage Users and Model Process

The goals of the reengineering project become the controlling function in this step of the methodology. By engaging the users we mean identifying both the user and management requirements for the process that is to be reengineered. This step is illustrated in Figure 3 below. The information concerning the management requirements, the user requirements, the systems and process architectures are all identified. These constitute the inputs to the activity. In addition, all the information about the organisation, as it is at this particular moment, is identified. This knowledge is used to model the process and these models of the current system can then be analysed in the next stage.

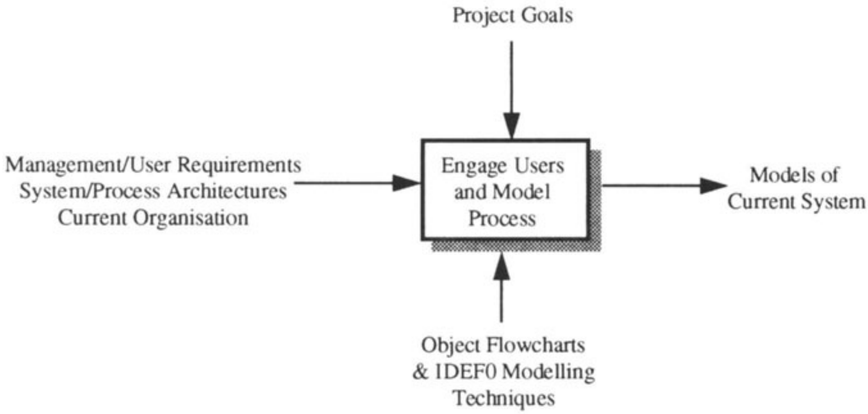

Figure 3 Step 2 - Engage Users and Model Process.

Primarily, in modelling the process, we use *object flowcharts*. The phrase 'a picture tells a thousand words' comes to mind when considering these flowcharts. They basically consist of a number of images or objects holistically depicting the various elements of the process being modelled and the interactions or flows of information between them. Associated with the object flowcharts are a number of rules and procedures that govern how they are to be created. The beauty of these flowcharts is the emphasis on simplicity. They can be created by users of the process who have no expert or detailed knowledge of the generic modelling techniques used by process modellers.

After refining these models through brainstorming sessions, the models can be handed to an experienced process modeller who can then articulate in the form of more complex models the nature, workings, and interactions of the process. In addition to these object flowcharts, the IDEF0 modelling technique is used. Both constitute the mechanisms used in performing this step of the methodology.

Step 3 - Analyse System and Models

The models of the current system, the outputs of step two act as the controlling function of step 3, the analysis of the system and the models. The analysis phase must involve a careful understanding of the current process practices as well as those of benchmarking partners. The desired output of this stage is a list of possible ideas for change for the reengineered process. This stage is illustrated below in Figure 4.

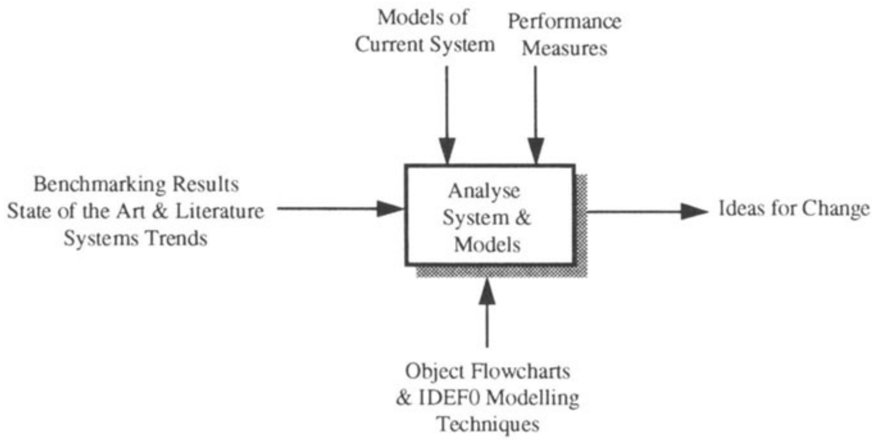

Figure 4 Step 3 - Analyse System and Models.

What is desired is an understanding of internal performance on which to assess the strengths and weaknesses of the company. With results from benchmarking, the systems and process analysts can determine whether or not the benchmarking partner is better, and if so, why and, by how much?, what best practices are they using or anticipate using?, and how can their practices be incorporated into our company. Although the IMP/BPR methodology is designed to be used by reengineering teams without tremendous reliance on external BPR consultants, this step may necessitate some interaction with an individual or a group of individuals accustomed in the area of benchmarking.

Alternatively, the reengineering leaders may decide not to go ahead with a benchmarking program. Instead, they may request the reengineering team to rely on current trends in systems and process architectures based on new state of the art information, recent publications and literature. In any case, the results obtained from the analysis of the models of the reengineered process, combined with either the results obtained by a benchmarking exercise or those obtained from analysis of current trends, will, after careful elaboration give rise to a list of ideas for change.

It is expected that the project goals and targets determined in the first step of the methodology will be very ambitious. Therefore, as a precautionary measure, there is the option for the reengineering team to give some feedback to senior management regarding the validity and practicality of the goals and targets based on the analysis of models created. If this feedback contradicts the previously estimated goals and targets, the models and analysis of the current system and process may have to be adjusted and refined accordingly.

Step 4 - Define Migration Plans

After elaborate refinement of the models of the current system, the business organisation will be in a position to initiate the fourth step - the definition of the migration plans from the system/process as it is now, to the proposed new system/process. The stage is be illustrated in figure 5 below.

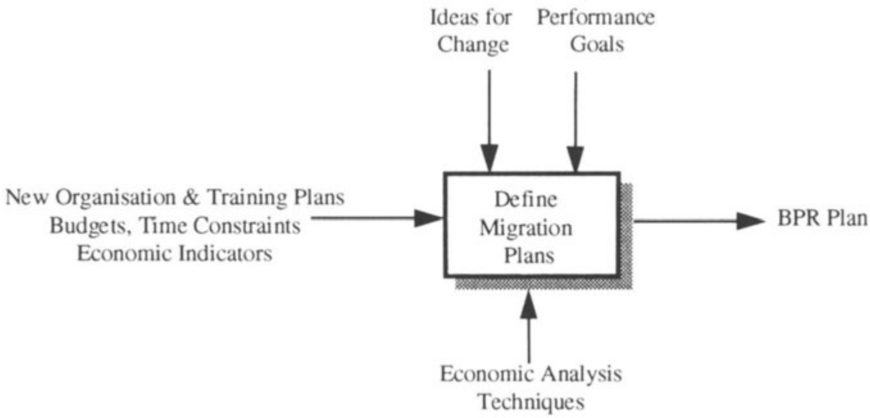

Figure 5 Stage 4 - Define Migration Plans.

The issues that crop up at this stage of the methodology include those that will be necessary in determining the transition of the current process. Using the ideas for change and the performance goals outlined in step one as a guide, issues such as budgets, time constraints, and economic indicators, the reengineering team will be able to develop a BPR plan.

The IMP/BPR methodology boasts a number of economic analysis tools that can aid the reengineering team in their quest for a BPR plan. These tools include cash flow analysis, cost/benefit analysis, and minimal critical specification models. They all coalesce to inform the reengineering team of the budgetary requirements necessary for the proposed reengineering project to succeed. When these requirements become apparent the team will be in a position to define the migration plans.

Step 5 - Implement BPR Plan
The final step in the IMP/BPR methodology is the actual implementation of the BPR plan. This activity is controlled by management approval and the budgets allocated to the project. The step is illustrated in Figure 6 below.

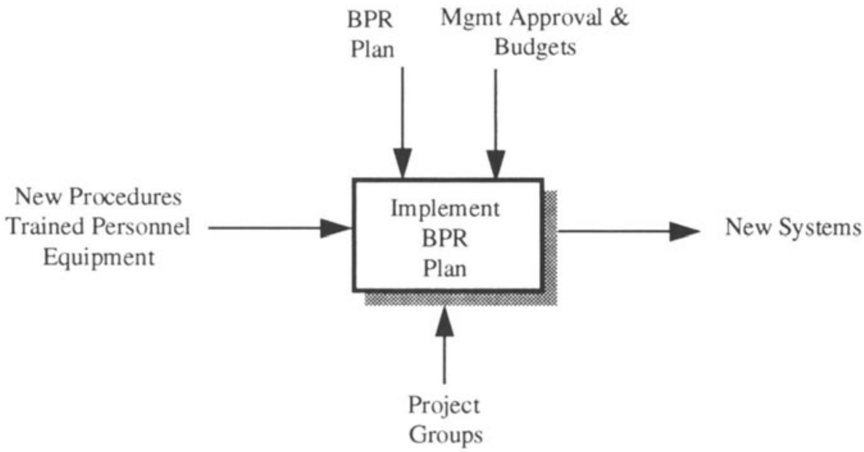

Figure 6 Step 5 - Implement BPR Plan.

Every aspect and requirement envisioned in the migration plans for the systems and processes are realised by the creation of new improved procedures for performing work. Along with these plans, trained personnel with be required to implement these procedures. In addition, the possibility of incorporating new equipment into the new system/process must be addressed. These factors eventually contribute to the creation of a new reengineering system/process with the onus on the project group to install and configure this system/process to the existing manufacturing system.

4 MODELLING TOOLS

There has been a considerable amount of discussion from various commentators regarding the most suitable tools to be used in carrying out BPR in a manufacturing environment. In general these tools have centred around technical modelling tools such as data flow diagramming and simulation. In the approach proposed in this paper cognisance is taken firstly of the socio technical nature of design and secondly regarding the type of people involved in the design process.

Revisiting Figure 1 it can be seen that the Pre-BPR phase is primarily a strategic planning activity and carried out by a manufacturing strategist. In this regard Pre-BPR is an activity which takes place among senior managers using time horizons of up to five years. The tool recommended in this phase is a simple QFD based matrix planning tool. At the other end of the diagram the post-BPR phase is about project implementation. Some projects will be IT based and so various specialists will be selected to design solutions using tools such as Data Flow Diagramming and Entity

Relationship. Other projects may be process based and so other specialists may use tools such as simulation, group technology and queuing theory.

The core IMP/BPR activity and the one which integrates the strategic planning phase and implementation phase requires high level technical and social modelling tools. These tools must be useful not only to the systems analysts but equally to users managers and other staff - all of whom are to be 'engaged' in the design process. In this regard tools such as IDEFo, simple Object Flowcharts, User Requirements Matrices, Organisation and Skills charts are appropriate.

It is the view of the authors that many BPR toolkits fail to meet the real requirements of BPR or WCM implementation because they fail to distinguish between the requirements of the strategist (Pre-BPR), specialist (Post-BPR) and consequently integrator and user (BPR).

5 CONCLUSIONS

Many commonalties and interrelationships exist between WCM and BPR approaches. Performance measurement is complementary to both of these approaches. We have seen that the five step IMP/BPR methodology combines these commonalties with the strong design focus attributed to BPR and the operational focus of WCM, leading initially to the identification of a set of performance targets for an organisation which can be used to guide the remaining steps in the methodology. Even though BPR projects are extremely arduous to take on, and up to 70% end in failure (Hammer, 1993), this should not deter organisations from initiating them. A good methodology provides a road map for reengineering, enabling organisations to select the most appropriate destination and then to find the best route to get there. Without a good methodology reengineering projects run the risk of failing due to the same mistakes that have been encountered in recent years, thus contributing further to the already towering failure rate of reengineering projects. To reduce the risk of failure dramatically organisations need a good methodology - the IMP/BPR methodology is one such methodology.

6 REFERENCES

Bradley, P., Molloy O., (1995) *A QFD Performance Measurement Tool*, presented at the CIM at Work Conference, Eindhoven, Holland.

Davenport, T.H., (1993) *Process Innovation - Reengineering Work Through Information Technology*, Ernst & Young, USA.

Hammer, M., Champy, J., (1993) *Reengineering the Corporation-A Manifesto for Business Revolution*, Nicholas Brealey, London.

Kaplan, R.S., Murdock, L. (1991) *Core Process Redesign*, McKinsley Quarterly, Summer Edition.

McSwiney, J.A. (1994) *BPR for Small and Medium Sized Manufacturing Enterprises*, MBA Thesis, University College Galway, Ireland.

Manganelli, R.L., Klein, M.M. (1994) *The Reengineering Handbook - A Step by Step Guide to Business Transformation*, American Management Association, New York.

Maskell, B.H, (1991) *Performance Measurement for World Class Manufacturing - A Model for American Companies*, Productivity Press, Inc., Massachusetts.

O'Sullivan, D., (1994) *Manufacturing Systems Redesign - Creating the Integrated Manufacturing Environment*, PTR Prentice Hall, New Jersey.

7 BIOGRAPHY

Padraig Bradley is a Senior Research Engineer in the Computer Integrated Manufacturing Research Unit (CIMRU) at University College Galway, Ireland. He has obtained a Bachelor and Masters degree in Engineering from University College Galway. His research interests lie in the areas of manufacturing systems, business process reengineering and performance measurement.

Shane Lillis is a research engineer in the Computer Integrated Manufacturing Research Unit (CIMRU) at University College Galway. He was conferred in 1994 with a Bachelor of Engineering degree in Industrial Engineering and Information Systems, and is currently completing his thesis as a requirement for an M.Eng.Sc degree which will be completed in June of this year. His research interest lie in the areas of business process reengineering, process modelling and supply chain management.

Dr. David O'Sullivan is lecturer and research manager at University College, Galway (UCG), Ireland and a successful manufacturing consultant. David has a number of publications including a recent book entitled 'Manufacturing Systems Redesign' published by Prentice Hall. David has been honoured with the prestigious 'Outstanding Young Manufacturing Engineer of the Year' award by the Society of Manufacturing Engineers (USA) for his contributions to manufacturing industry.