Using EVPM Techniques in Theatre Management of WIES (DRG's) and Healthcare Projects

By:

Raphael M. Düa

Director

Micro Planning International Asia Pacific

10/76 Hotham Street

Traralgon, Victoria, 3844

and

Kathryn James

Unit Manager, Operating Suite

Latrobe Regional Hospital

Traralgon, Victoria, 3844

Presented

At

The First United Kingdom Performance Management Symposium

~ 2 - 4 October 2002, Thistle Hotel, Bristol, United Kingdom ~

Acknowledgement

The authors wish to thank Mr. Stuart Rowley, current Chief Executive Officer of the Mercy Hospital for Women, East Melbourne for his support of our trial when he was Executive Director of the Latrobe Regional Hospital (1997 –2000) and for permission to use the trial for this paper.

Also we wish to thank Dr. David Formby, the Director of Medical Services at Latrobe Regional Hospital (1997 – 2001) for his support and guidance during the development of our ideas.

We would also like to thank Dr Hugo Huygens, general surgeon at the Central Gippsland Base Hospital for his professional guidance and support.

Earned Value Performance Management techniques were first introduced in the late 1960's by the US Department of Defence and in Australia in 1986 for defence projects. It is beginning to spread outside the defence arena and our use of EVPM for the trial was probably a first in the healthcare industry.

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Abstract

The Latrobe Regional Hospital (in the Australian state of Victoria) is an amalgamation of the Traralgon and Moe Hospitals and The Hobson Park Psychiatric Facility. It is a 257-bed facility comprising of medical, surgical, maternity, aged care and psychiatric services. The Operating Suite consists of 4 operating rooms, anaesthetic set up rooms, Day Surgery Facility, Sterile Services and a recovery suite; it is staffed with a full time equivalent of 42 people, over 9000 procedures per annum are carried out. It is shown that a detailed analysis of utilisation, clinical processes and layout of the theatres at the new LRH would facilitate the implementation of efficiencies, which have improved throughput and enhance patient access to the theatre facilities and that these methods could be easily applied to any hospital. .

This paper will discuss how the objective of the research was to see if an improvement in theatre efficiency and patient access to surgical facilities by using Earned Value Performance Methodologies (EVPM) could be established.

It discusses on how a model was established to improve the effective performance measurement of casemix usage of the operating suite using non-traditional healthcare methods.

Currently no operating suite (in the public sector) appears to budget or forecast its annual casemix list in theatre. Lists are cancelled, quite often at short notice and either theatres lie underused as a result or a number of hours of clerical and theatre staff time is expended in trying to fill the shortfall. This leads to a loss of income, under-utilised WIES points, closures of beds because there is no system to forecast how to retrieve the situation.

How casemix is funded via WIES is shown in Appendix 1. A short overview of EVPM is illustrated in Appendix 2 and a more traditional use of EVPM for project management of healthcare projects is shown in Appendix 3.

The initial conclusion of the research is that the use of EVPM can provide a method to manage casemix and deliver improvements in the management of WIES.

Introduction

When writing a paper, it is probably a good notion to introduce the driving force about the reasons for writing it. For some time, we have perceived a need to try to clarify a method of managing the performance of operating theatres. Generally, hospitals in Australia are measured for performance and funding purposes through the use of Casemix.

Casemix has been established as a valuable tool for improving and managing Australia's health care system, since 1988 when it became part of the national health care services agenda as part of the 1988 Medicare Agreements. Increasingly, it is being used for output measurement; resource allocation (ie., funding, paying, and charging); quality improvement; comparative analyses; and the monitoring of trends over time.

Diagnosis Related Groups (DRGs) represent the best-known casemix classification. This classification relates to admitted hospital patients and provides a clinically meaningful way of relating the number and types of patients treated to the resources required.

Under the Casemix system, hospitals are paid based upon the numbers and types of patients they treat, not upon the resources they use. The State of Victoria defines a hospital admitted patient workload in terms of **WIES** (**weighted inlier equivalent separations**).

There is a delay in reporting the WIES in the Perioperative area and hospital executive management wanted to be able to measure WIES more quickly than it is done at present. (For a simple overview of WIES, see Appendix 1). It is our contention that the use of the discipline of project management techniques could provide a simple and inexpensive solution. A difficult task, one might say! Especially in the heath care field, where people are trained (asked!) to provide high quality patient care before worrying about the cost of providing it.

With one of us a forty-year veteran in project management as well as a practicing project management consultant, and the other with twenty years as a Perioperative Nurse and Manager we were constantly surprised by the way that hospitals in having to manage and measure a hospital casemix load did not use or indeed have any appropriate tools to actually carry out the task. We believe that we could introduce Project Management methods to the Theatre Environment, but the rest of the world, i.e. Hospitals, universities, students and professional bodies, see project management: as a set of methods, techniques, tools, interacting with others fields – general management, engineering, construction, information systems, etc. - bringing some effective (?) ways of dealing with various sets of problems – from building and launching a new ship to product development through to organizational change. It is a good technique for construction and manufacturing we often hear the health care professional say, but not for us! And we agree, but the problem is that there are no real tools for forecasting, managing and measuring WIES. Because most of the tools, techniques and methods hospitals do use involve the use of a spreadsheet, with the data generally being three to four months out of date. So it is of little use as a management tool. This is where the project management specific paradigm, may provide an innovative approach to the problem. We needed to question whether this was the case and the following is what we did.

The Problem

Casemix is demand driven both externally (doctors organising patients for surgery) and internally (emergencies from Accident & Emergency Departments). DRG will categorize the case and depending on the result a patient is accepted or placed on a waiting list (with perhaps a time penalty). The patient's WIES value depends upon the amount of time they stay in hospital compared to other patients with similar conditions (inlier equivalence) and the relative cost of treating their condition compared to the cost of other illnesses (cost weight or relativity).

Currently no operating suite (in the public sector) appears to budget or forecast its annual casemix list in theatre. Lists are cancelled, quite often at short notice and either theatres lie underused as a result or several hours of clerical and theatre staff time is expended in trying to fill the shortfall. This leads to a loss of income, under-utilised WIES points, closures of beds because there is no system to forecast how to retrieve the situation.

It was anticipated that a detailed analysis of utilisation, clinical processes and layout of the theatres using project management techniques at the new Latrobe Regional Hospital would facilitate the implementation of efficiencies that will improve the theatre throughput and enhance patient access to the theatre facilities.

The objective of the innovation using project management methodologies to theatre planning and utilisation was to improve theatre efficiency and patient access to surgical facilities by using Earned Value Performance Measurement (EVPM), which is a well-known project management technique.

The Innovation

EVPM was initially developed to project manage major defence projects both in Australia and overseas, the application of the methodology to theatre scheduling is both unusual and innovative. For further information on EVPM see Appendix 2.

The model

A benefit in being able to manage WIES would improve an ever-expanding waiting list. To understand WIES value per DRG would enable appropriate case-mix to be identified and prioritised for patients in a pro-active and planned manner.

This would be advantageous to the institution and multi-disciplinary teams involved in optimal patient outcomes. This means the following need to be carried out in preparing the plan

- Calculate the complication percentage per annum
- Calculate WIES per case/per week/per month/per annum
- Category Identification

This methodology was trialled for six out of twelve months in which the WIES management proved effective by achieving targets set by the Victorian Department of Human Services (DHS)

This is demonstrated by the example below: -

In order to develop the model from the available data and to apply EVPM the Theatre Unit Manager generates a typical annual case mix list, having borne in mind the criteria in the items above; the case mix list contains all the data giving Theatre name, Number of Available Sessions, Allocated Surgeon, Procedure Type, Expected Procedure

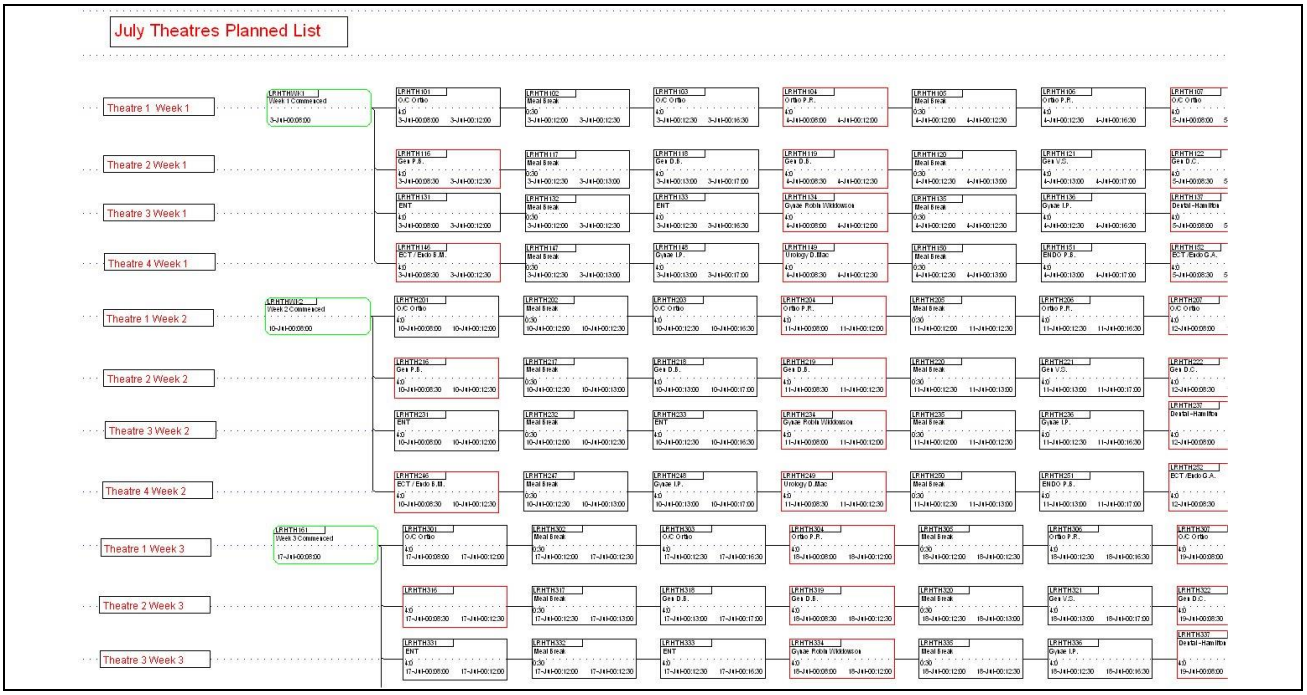

Figure 1 – Critical Path Model of Theatre List

Duration, Number of Staff required etc. This data is converted into a critical path network as shown in Figure 1 above and processed by Micro Planner X-Pert for Windows.

Each procedure on the list is denoted by a simple critical path task, which after analysis will have the attributes of a schedule start and finish time as well as the required resources considered. In addition, the anticipated WIES value for the procedure is also allocated. Thus, it is a simple matter to produce a schedule of all the procedures planned for any time period selected.

Having analysed all the schedule data, the results are archived and the WIES are accumulated to produce the baseline performance schedule. This is shown as an S-curve as illustrated in Figure 2.

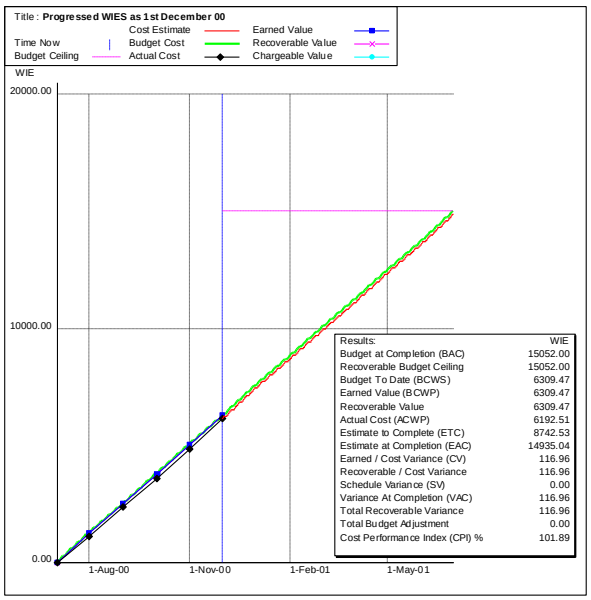

Figure 2 – WIES Performance Baseline

After each day's theatre sessions have been completed, the theatre clerk inputs the actual procedures completed and re-runs the schedule.

If the sessions did not perform according to schedule, then the outstanding work will be rescheduled, and the total performance baseline re-rolled.

If the actual work carried out was exactly as planned, then the theatre will "earn" the number of WEIS points it should have. As time passes the Budget baseline and the Actual curves may move away from each other if the theatre is not performing the planned procedures, or if it is then the curves will be equal.

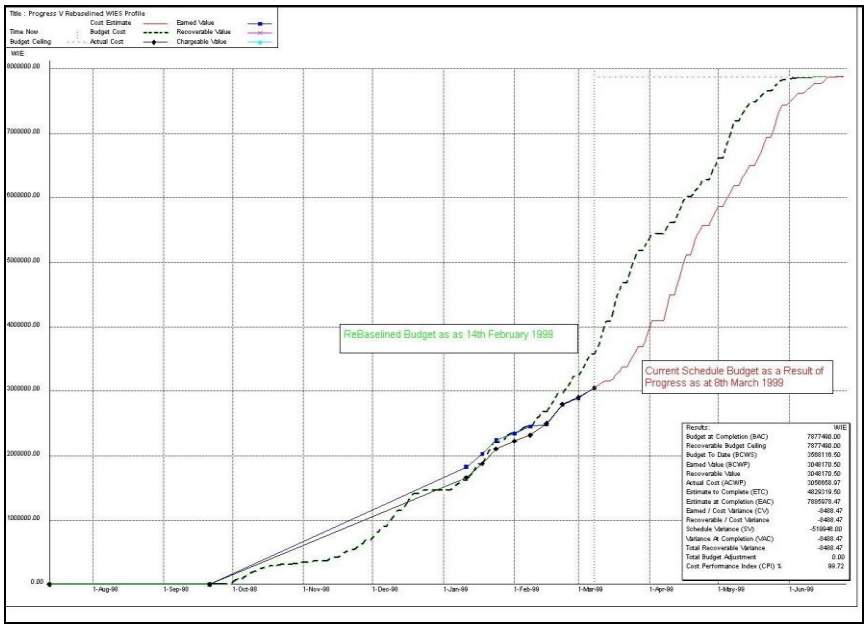

Figure 3 Progress WIES Performance Curve

Figure 3 illustrates the progressed baseline WIES EVPM curve several weeks after start of the trial; the dotted line indicates the original planned usage of WIES and the black line to the left of the vertical dotted line (just past 1 Mar 99) indicates the actual WIES used to date and the black line to the left is the extrapolation of the remaining WIES points from time now forward to the end of the project.

It may be observed the actual usage to date is falling below the original planned number. On looking at the extrapolation on the black line the forecast completion from the report date (the dotted vertical line) is going to fall below the original plan. This means that, OR management will need to look at the remaining case-mix and / or the waiting lists and determine how it can reschedule or add more cases to make up the shortfall. Of course, the process is not quite as simple as that, but for trial we were able to look at previous history and select cases, which would allow the trial to proceed without too many complicated cases having to be scheduled in at short notice.

During the trial using Earned Value Performance Management proved it could provide the theatre manager with an early warning tool that sent out a signal from as little as the 15 percent completion point on an annualised casemix load. This signal allowed the theatre manager to forecast the final required WIES points needed to finish the casemix list load within a narrow range of values. If the final forecasted results are unacceptable to management, steps were taken early to alter the final requirements. The end benefit is that the lists can be completed which may provide the desired health outcomes —if the casemix list management monitors the true cost performance from the beginning of the annual input to the end, the hospital will enjoy better utilisation of the health budget.

Prior to this trial the WIES points if exceeded required a reaction, generally via crisis management to rectify the situation. This meant that overtime increased and excessive WIES occurred. During the trial it was observed that because a proactive environment existed, the overtime decreased and diminished usage of WIES. When an emergency case occurred previously to the trial it meant the cancellation of an elective case. (Day of Management was thus poor, but through the trial, the elective could be rescheduled with little difficulty).

The management of WIES enabled cases to be performed within certain time frames, reasonably and effectively. To further understand the totality of the relationships within OR and the greater healthcare community, figure 4 below, shows the Impact model which was developed "Impact" model was developed.

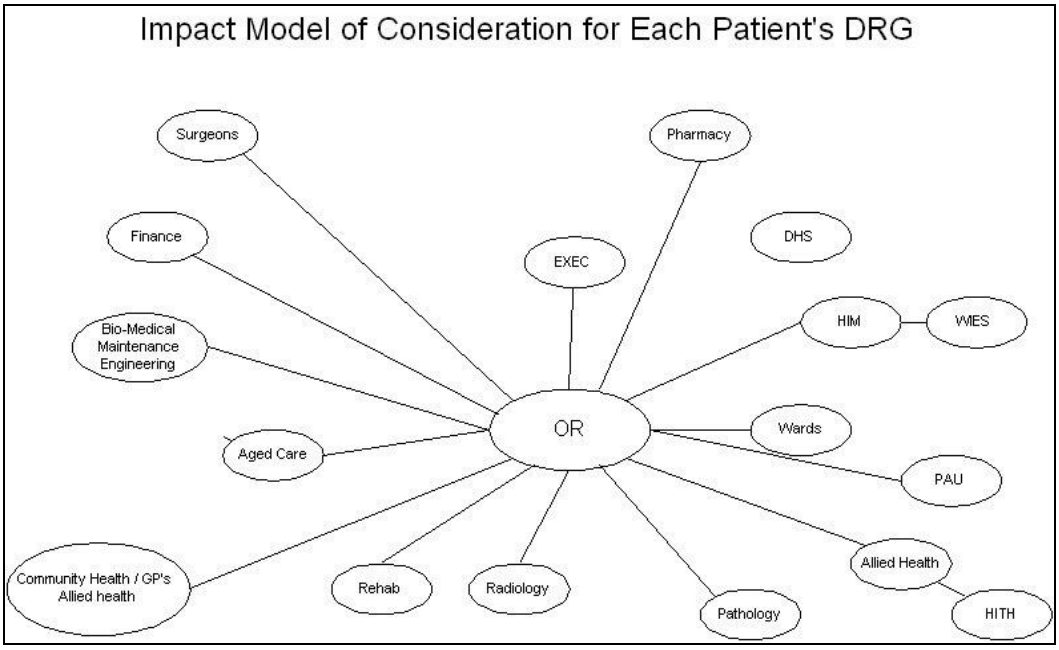

Figure 4 – Impact Model

Evidence Based improvements

Ophthalmology

There has been an improvement in reducing the length of recovery time by day patients who have had an ophthalmology procedure of 30%. Through using perioperative clinical pathways and project management schedule processes the patient is now transferred to second stage recovery, without the need to go through first stage recovery. This reduces the patient average discharge time from approximately ninety minutes to sixty minutes, in other words a 30% improvement.

Waiting Lists

During the year 2000 – 01 the waiting list times were reduced by 18%,

Resource Usage

There was significant reduction in overtime hours in usage of RN's; prior to the trial (1999 –2000) overtime was 554 hrs per annum. In 2000-2001 overrun hours of 487.3 hrs per annum, which is an improvement of 67 hours per annum.

Casemix

In planning casemix, the improvement both through technology and more importantly project management planning, the day surgery admissions increased by 4% (of 8578 cases) thereby freeing up some 343 inpatient beds over the last financial year.

The D.O.S.A. (Date of Surgery Admission) rate has increased to > 90% due to pre-admission assessment, and Rx as deemed necessary prior to admission.

Benchmarking

The next stage of the process of using project management techniques in this environment is to establish a benchmarking study within similar sized hospital, which would provide additional evidence-based material to establish wether or not using EVPM techniques does indeed provide true benefits in the management of WIES

Future Impact on Business

Further funding is required to carry out a study over twelve months to develop management procedures and practices to implement this innovation to ensure that the benefits of EVPM are fully realised. It was suggested that the three sister hospitals take part in the study, ie Ballarat and Bendigo as well as LRH.

Conclusion

Evidence shown so far is that the impact of this methodology will generate considerable savings in theatre episodes times as well as better bed management and thus provide a financial incentive for hospitals to take it up.

Appendix 1

Casemix Funding in the State of Victoria - Australia

Definitions/Descriptions

Under the Casemix system, hospitals are paid based upon the numbers and types of patients they treat, not upon the resources they use. Victoria defines a hospital's admitted patient workload in terms of **WIES** (**weighted inlier equivalent separations**).

WIES
A patient's WIES value depends upon the amount of time they stay in hospital compared to other patients with similar conditions (inlier equivalence) and the relative cost of treating their condition compared to the cost of other illnesses (cost weight or relativity).

For example,

0.19 WIES is allocated to a same day chemotherapy patient
30.02 WIES is allocated to a liver transplant patient staying 40 days
7.51 WIES is allocated to a liver transplant patient dying after 3 days.

Cost Weights
Cost weights are developed each year based upon the costs of treating individual patients in Victorian public hospitals. Hospitals report the costs of over half a million patients annually. In addition to new cost weights, Department of Human Services (DHS) often makes changes to the WIES in response to industry concerns. Consequently, casemix funding in Victoria has evolved considerably from the relatively simple model introduced in 1993-1994.

Standard Rates
Hospitals/Health Services are funded at standard rates per WIES. Metropolitan hospitals receive $2240 per WIES while country hospitals receive slightly more in recognition of the higher fixed costs of running small hospitals.

Payment Method
Hospitals/Health Services receive a target WIES allocation at the beginning of each year. They are funded for WIES up to, but not in excess of, that target (ie the system is capped).

Since 1993 casemix has expanded to include ambulatory patients in metropolitan hospitals and some large country hospitals (**VACS**). Next year a casemix based funding system (**CRAFT**) will be fully introduced for rehabilitation patients in designated rehabilitation units.

Casemix is augmented by a series of WIES co-payments and specified grants that are not tied to WIES eg Teaching and Research Grants.

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Appendix 2

What is Earned Value Performance Measurement?

Earned Value Performance Measurement (EVPM) is designed to provide Senior Management with an accurate overview of corporate performance. It builds on the information provided by traditional scheduling techniques to plan and measure the overall productivity of a system or a project. EVPM through the Performance Measurement Baseline provides focus on the bottom-line assessment as to whether the plan is being implemented effectively or not and highlights problems at an early stage allowing effective management intervention. It is an objective measurement of how much work has been accomplished on a project.

Earned Value Performance Measurement, Management by Objectives, and Cost Schedule Control Systems are synonymous terms. These terms have been defined in US DODI 5000.2R, BS6079 and Australian Def (AUST) 5655.

Earned Value Performance Measurement is an objective measurement of how much work has been accomplished on a project

Using the earned value performance measurement process, senior management and other members of management can easily compare how much work has been accomplished. It enforces the discipline of planning upon the project manager, as well as the budgeting, resourcing and scheduling of authorised work scope in a time phased plan. This disciplined approach will provide management with the Budgeted Cost of Work Scheduled.

The time-phased plan shows the incremental cost of resources and produces a cumulative cost curve against time and is defined as the Performance Measurement Baseline. As work is progressed and or reported completed it is "earned" using the same selected budget duration or time period. Earned Value compared with the Planned Value provides a work accomplished against plan. Thus any variation between the plan and the actualise is defined as a "Schedule Variance' or a "Cost Variance"

The corporate accounting system should provide an accumulation of actual costs for the project in hand. The Actual Cost of Work Performed is then compared with the Earned value to denote any under or over run to the project.

The Budgeted Cost of Work Scheduled, the Earned Value and Actual Cost of Work Performed provide objective metrics of performance which enable management to carry out trend analysis and evaluate the cost estimate at completion, better known as Estimate at Completion at all levels of the project.

Additional variances are calculated to provide management with a set of cost and time performance metrics to enable them to confidently predict the successful outcome of the project.

Earned Value improves on the "normally used" spend plan concept (budget versus actual incurred cost) by requiring the work in process to be quantified. A major element in the definition of work to be measured is the Work Breakdown Structure

A Work Breakdown Structure (WBS) may be used to segregate the work scope requirements of the program into definable product elements and related services and data. The WBS is a direct representation of the work scope defined in the program statement of work and breaks that work scope into appropriate elements for cost accounting and work authorisation. It is a multi-level hierarchical breakdown that shows how program costs are summarised from the lower elements to the total program level. The extent of decomposition and levels in the WBS will be determined by program management needs and contractual arrangements. How a WBS is actually created is defined in Def (AUST) 5664. Part of the WBS developed during the trial is shown in Figure 5 below

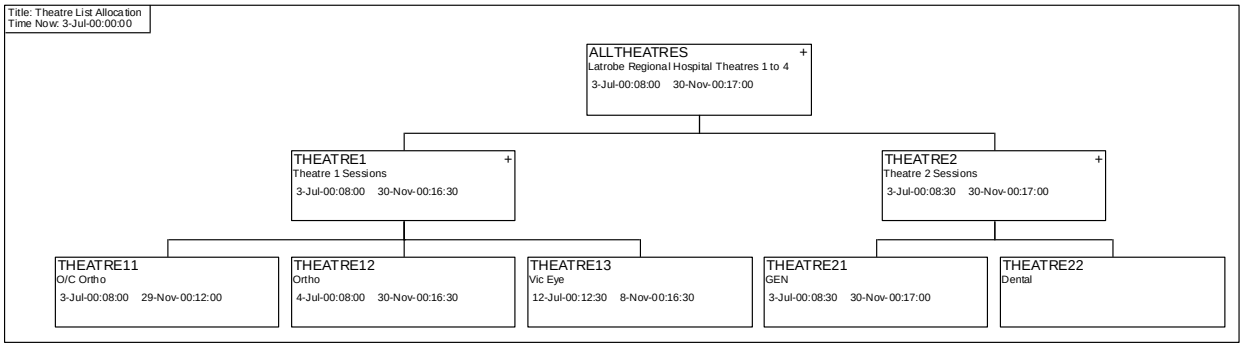

Figure 5 – Part of Theatre Scheduling Work Breakdown Structure

Thus, by implementing the earned value process; management can simply compare how much work has actually been completed against the amount of work planned to be accomplished. Earned Value requires the project manager to plan, budget and schedule the authorised work scope in a time-phased plan. The time phased plan in the form of a critical path network is the incremental "planned value" culminating into a performance measurement baseline. As work is accomplished, it is "earned" using the same selected budget term. Earned Value compared with planned value provides a work accomplished against plan. A variance to the plan is noted as a schedule or cost deviation.

Normally the established accounting system provides accumulation of actual cost for the project. The actual cost is compared with the earned value to indicate a over or under run condition.

Planned Value, Earned Value, and Actual Cost data provides an objective measurement of performance, enabling trend analysis and evaluation of cost estimate at completion within multiple levels of the project.

Earned Value Performance Measurement should be applied to every project where the owners of the final product wish to ensure that the expended resources were used efficiently. On major projects the application of good project management tools will aid in the selection of the right course when managers need to make financial and time allocation decisions.

The key elements of performance measurement are:

1. The measurement of absolute figures or just variance does not give an indication of the current status of the project.
2. The value of the work obtained for the effort and resource consumed is the only true measure of project progress.
3. The use of the WBS allows the project manager to focus on the parts of the project that are showing the greatest deviation. Care should be taken when considering the project. Often large negative deviations in one area are smothered by cumulative small positive deviations in other areas.
4. Performance measures can be used to predict the final success, or otherwise, of the project at completion. Trend analysis is a vital component of the project manager's toolbox.
5. Performance analysis is dependent on the accuracy of the tracking measures used. The only effective progress monitoring system is one in which physical deliverables are accepted against agreed quality criteria.
6. Before implementing EVPM it is important that all members of the project team understand the principles and interpretation of results.
7. Beware of the calculation of the Estimate to Complete (ETC) of a project or task using the reduced formula.
8. The procedural elements required in the implementation are
    - The processes involved in implementing a EVPM system in the hospital sector
        - Developing the Work Breakdown Structure
        - Developing the plan
        - Establishing a resource driven schedule
        - Accounting for various cost types
        - What Earned Value provides

- Work progress
- Relationship of planned cost and schedule to actual achievement
- Valid, timely, auditable results
- Basis for Estimate at Complete (EAC)
- Summaries developed at the lowest practical WBS level
- Cost and Schedule Earned Value
- The metrics required to measure project progress and status are:
- Planning Package schedule status
- Budget at Completion
- Budgeted Cost of Work Scheduled or Budgeted Cost of WIES Scheduled
- Budgeted Cost of Work Performed or Budget Cost of WIES Performed
- Actual Cost of Work Performed or Actual Cost of WIES Performed
- Estimate at Completion
- Estimate to Completion

9. For cost/performance measurement to work certain systems must exist. They are:
    - A time-based plan, ie a schedule
    - A work breakdown structure
    - A costs collection system
    - An objective method of assessing progress
    - A responsibility/authority matrix

Appendix 3 Earned Value at the new Latrobe Regional Hospital

The impact of Earned Value Performance Measurement as Project Management Tool on an organisation's competitive capability has not normally been a benefit in the HealthCare services sector. The ability to muddle through a project using “me-too" products has placed a major premium on HealthCare providers’ abilities to develop the support infrastructure to enable new government program initiatives to be taken rapidly from development to delivery.

The Australian Federal and State Governments’ push in cost reduction processes, led to a growing appreciation of the need for a project management culture as business-critical care projects have come increasingly under the spotlight -- a process accentuated by legislation-driven systems demands.

According to its senior executive management, the use of project management disciplines aided by effective project management software played a significant part in the successful opening of the new Latrobe Regional Hospital five weeks ahead of schedule and on budget.

The go ahead to start building the new Latrobe Regional Hospital was given in 1996 and, from the beginning, all efforts were directed contractually towards an opening date of 1st September 1998. Under Executive Director Stuart Rowley, the construction of the new LRH was a greenfield start-up operation. A major complication was that at the same time the old LRH hospital had to continue operations and convert from a public hospital management to a privately managed public hospital management model. All this occurring across three campuses up to 25 km apart, with the new site located within the same area, without impacting the existing budgets.

A relationship was established with many of the Heads of Department in the old LRH who then delegated unit managers to form “working parties” to cover all the aspects of the relocation of the old hospital and all its services from three campuses to the new campus. All this work had to be carried out in addition to regular duties.

Considerable executive management energy was focused on hitting the contract date target and every part of the project was evaluated according to its Criticality to the readiness and ability to open on time. Regular "go - no go" reviews with all the working parties were also conducted, this ensured that all of the staff involved with the project knew what was occurring with the project as well as what was expected of them. Extensive training sessions in the use of Earned Value were also given and formed an important part of the project plan.

Consequences

"At start-up we were well equipped technologically and able to develop a positive project earned value-based culture. The emphasis on good project management using earned value undoubtedly contributed to the team working and a "can-do" attitude amongst staff," says Stuart Rowley.

Establishment Project Office (EPO)

A four-person project office was set up to specifically provide project management expertise to all the hospital staff and to develop an earned value culture. It was the focal point for the various inter-relationships between the owner, the builder, sub-contractors, equipment vendors and the various government departments and specifically utilised the methodologies as espoused in the PMBOK.

Success

"A major factor in the successful opening of the new hospital " Stuart Rowley explained, "was the early implementation of quality project management processes and standards especially the use of Earned Value."

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The old LRH initial priorities were to make the initial high-level plans more robust and, crucially, to validate planned expenditure and expected dates.

Benefits

According to Stuart Rowley, the development of a project management and earned value culture via the EPO brought significant benefits to LRH. The primary one being the defined involvement of all parties (users and developers alike) in the planning and budgeting process - they were actively encouraged to challenge the assumptions on which the plans were based.

Appendix 4

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Appendix 5

Some Light Reading:- a short bibliography of useful EVPM Literature

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Notes :- To find out more about EVPM methods and other useful links visit http://www.mpi.com.au/evpm.asp