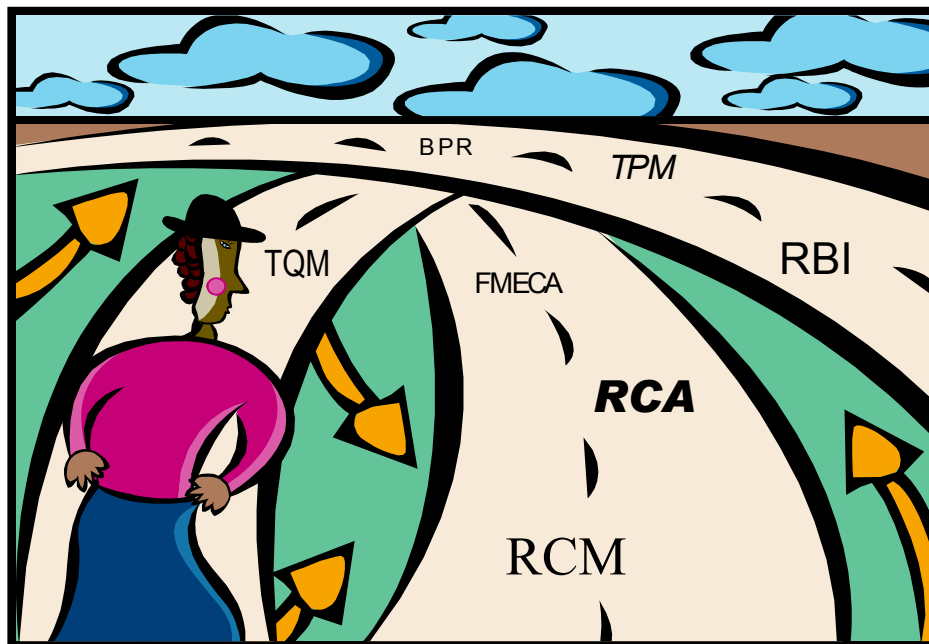


Combining the best bits of RCM, RBI, TPM, TQM, Six-Sigma and other 'solutions'.

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INTRODUCTION

Nobody would deny that the tools in the title of this paper hold potential benefits, and indeed there is plenty of evidence that, *correctly implemented*, each can yield substantial performance improvement. There is, of course, a certain amount of overlap, and each has its strengths and weaknesses. However we are now entering a new phase – how do we integrate these individual 'solutions' and make a sustainable, growing and 'home-owned' suite of best practices? How do we avoid swinging from one 'good idea' to the next, often starting something new before we have even stabilised or exploited the last 'initiative'? How can we build a dynamic routemap – one that builds the right bits of each new development into a single, cumulative improvement programme. Such a vision involves organisation development, education, process design, great communications and outstanding leadership/implementation skills. We need a combination of technical excellence, commercial optimisation (including risks) and good man-management, all at the same time.



The routemap is complex, with constraints imposed by previous experiences, geography, industry, 'culture' and regulatory environment. Yet the overall direction and individual contributions must be clear and widely understood – otherwise we will keep repeating the

cycles of enthusiasm and disillusionment for individual 'solutions'. This paper demonstrates such a route-mapping process, and presents case studies of the latest 'integration thinking'.

What do we mean by 'improvement'?

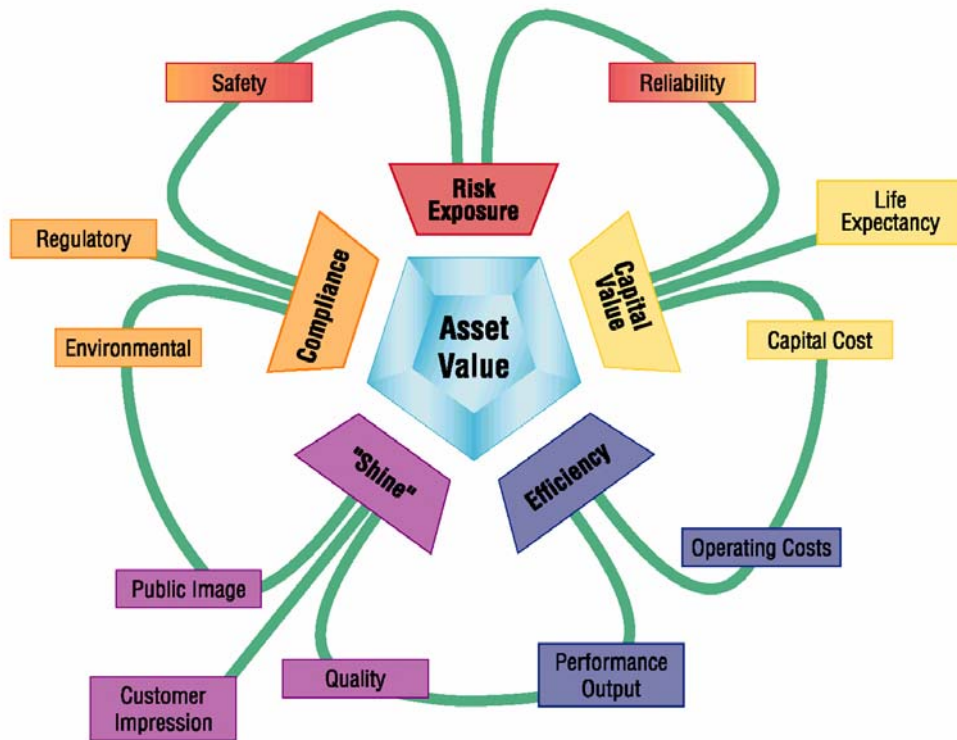
Before we look at the combination and implementation issues, however, we need to step back far enough to check our underlying aims. The business 'vision statement' and 'critical success factors' are rarely clear about such objectives. They merely tend to combine conflicting messages of what is important ("more production", "more safety", "less cost"). Even the widespread enthusiasm for a Balanced Scorecard does not solve this problem – what do we mean by 'balanced'? Greater customer satisfaction can be achieved, at a higher price. Safety can usually be improved if we cut back on production priorities. And greater reliability costs, often both in design/capital investment, and in subsequent maintenance budgets.

Objectives do, therefore, conflict; just as the various business stakeholders have different agendas. To build an integrated and integrating roadmap, and to determine which 'solutions' move us in the right direction, we need to sort out these varied priorities. Fortunately there is an elegant way of doing this – there are only 5 underlying and generic ways of measuring success, and they can be combined in a structured way. They are defined by the questions that need to be asked in order to quantify their significance. Once each is quantified in similar terms of value, they can be used to combine, 'optimise' and balance the various higher manifestations of 'safety', 'performance', 'unit cost' etc.

The 5 natural families of measurable success are:

- Reliability/Risk Management – safety hazards, economic risks, equipment unreliability etc.
- Efficiency – planned operating costs, productivity, quality, input-for-output, market demand
- Longevity – capital losses, depreciation, technology overtake
- Compliance – non-conformance, non-compliance
- 'Shine' factors – intangibles & human perception issues such as public image, customer impression, societal responsibility, employee morale etc.

'Total Business Impact' is the sum of these features, and offers a way of assessing the net merit of any new activity (which may improve some features, at the expense of others). Unfortunately many of the measures involve quantifying *loss* (and lost opportunities), rather than inspiring with any ultimate gain – but the winner of any race is usually he who simply makes the fewest mistakes!



Combining apparent goals into measurable benefits

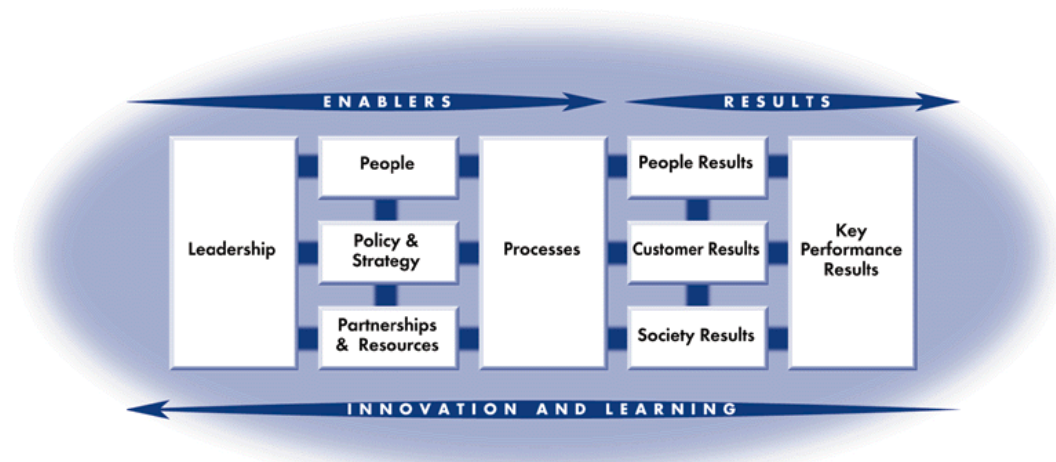
This structure has emerged from the European MACRO project¹ – a multi-industry 5-year collaboration programme that has focussed on quantitative techniques for cost/risk/performance evaluation. The diagram doesn't show all the trade-offs involved (they are handled later – see section 4 below), but it has proven that a 'Total Business Impact' approach can be used to combine and rationalise apparently conflicting pressures. It provides the next stage after Balanced Scorecard – it quantifies what we mean by the best balance.

The Starting Point

The second item needed is a baseline – where the strengths and weakness are today, and what improvements are possible, at what rate, in which area. There are a number of methodologies and 'products' targeting this phase. Most companies have performed audits, benchmarking exercises or 'gap' analysis (with varying degrees of effectiveness). The challenges lie in ensuring adequate, objective coverage, and in balancing peer-group measures (such as the Solomon report) with the deliberate exploration of ideas from other sectors or sources. Of all the structured assessments that have emerged, the Business Excellence model from the European Foundation for Quality Management (EFQM) provides one of the best holistic reviews of existing strengths and weaknesses. Similar to

¹ See website www.twpl.co.uk

the US Malcolm Baldrige award, the EFQM recognises business excellence in any shape or form, and covers both the hard numbers of targetted results, and the 'soft issues' of leadership, human resources, partnerships and societal impact. It is revealing to notice that no oil company has yet won either the US or the European such award for integrated excellence. Perhaps it is time to look at the whole picture and benchmark against non-oil examples of good practices.

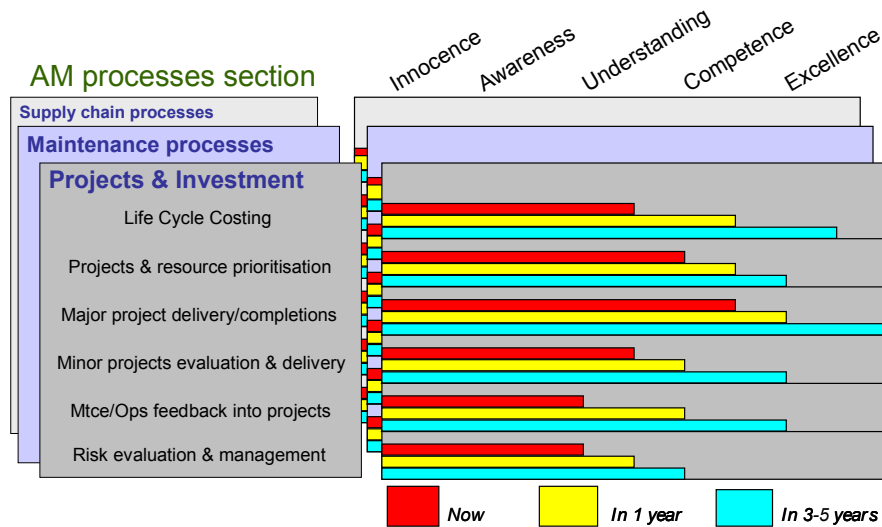


EFQM Excellence Model – assessment structure²

We have been involved, during the last 12-18 months, in adapting the EFQM assessment to an industrial Asset Management flavour. Not only that, but we have recognised that merely assessing the existing baseline is not enough – we need to look at the rates of improvement that might be possible in each area, and the business impact of such potential improvements. So we have created, piloted and refined an "Interactive Assessment" – a methodology that not only reviews current status across the sections of the Business Excellence model, but also tests (interactive) the capacity to move forward, in both the short- (12 months) and long-term (3-5 years). These potential improvement rates are also quantified into two corresponding incentives, both expressed as \$\$/year total business impact:

- and \sum (12 month improvement possibilities)
- and \sum (3-5 year improvement possibilities)

² See www.efqm.org



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Interactive Assessment – example from summary results

One key and regular learning point that has already become apparent from this process is the importance of linking the two timescales together – the 'quick wins' (which every organisation has) *must be used to pay for* the slower and usually greater improvements associated with changes in behaviour, culture and underlying processes.

How to make the improvements, with which methodologies?

There are three ways of approaching this step:

1. do what everyone else is doing (your friends in XYZ company are 'doing RBI' so you had better get on the bandwagon too)
2. look at what is out there and see which fits the local need best (e.g. RCM, TPM, TQM, RBI etc)
3. look at where the gaps/opportunities are and construct a combination of improvements from various sources, and give the initiative a title (e.g. "integrated asset management" or "operational reliability")

Clearly I am advocating the third route – I have seen too many companies imitating each other (often poorly, with a general 'levelling' effect) and too many 'packaged solutions' come and go (we 'did TQM' in the 1970's, Business Process Reengineering in the '80's, now we are looking at TPM). In the 'latest solution' thinking, there tends to be a cycle of initial enthusiasm, first signs of success, then the volume/sustainability issues cut in and time/cost implications hit home – so inertia, disaffection and "what's next?" become the dominant feelings.

However, a do-it-yourself kit for customised performance improvement does not exist (yet?). The best we can do is know what components can be extracted from which

sources, and their individual strengths and weaknesses – so we can assemble a viable combination. The following is a slightly cynical summary of some of the most popular 'packages'.

Reliability Centred Maintenance (RCM)

RCM, coming from the civil airline industry, gives us some logic 'rules' for determining what type of maintenance is appropriate, based on failure mechanisms and consequences. It is particularly suited to complex plant where there are lots of failure modes- it provides a consistent navigation path with logical 'pigeon holes' for predictive, preventive, detective (failure-finding) and mitigation actions. However it treats each failure mode individually and may miss some important combinational effects (it is *reliability*-centred, so misses tasks to extend life, or raise efficiency etc.). There is plenty of debate on the various flavours (the need for criticality-prioritisation, the viability of 'streamlining', the need to analyse all equipment etc), but the core value of RCM is undeniable: it is a concise summary of the questions that need to be asked in order to determine what type of maintenance is likely to be appropriate. Note the 'likely' – it fails to determine if the solution is the most cost effective option (sometimes an 80% solution at just 50% of the cost will be better than a total solution at great expense). Also, the majority of RCM pilot studies during the '80-90's were not fully implemented or sustained, probably due to the temporary enthusiasms described above (they lost impetus, became unfocussed/unwieldy/ 'too expensive' or were 'displaced by other priorities'). It seems that RCM programmes need some aspects of TPM (see below) to survive and deliver their full potential...

Risk Based Inspection (RBI)

RBI provides a systematic criticality assessment of static equipment, and the choice of appropriate condition monitoring methods. Coming from the American Petroleum Institute's Recommended Practice, it is heavily hydrocarbon processing-focussed (corrosion & other deterioration mechanisms, vessel and pipe materials characteristics etc), but cross-industry variants are already appearing. It's strengths lie in the systematic nature of the survey, the 'probability x consequence' view of criticality, and the mass of technical data available on corrosion rates, materials properties and inspection methods. It is notably weak, however, in determining how much to spend on the inspections/ condition monitoring (where cost/benefit/risk trade-off must be considered), and in pointing to alternative risk-treatment options (where RCM is strong).

Total Productive Maintenance (TPM)

TPM encourages 'attention to detail', shared responsibility with operators, and an holistic 'Overall Equipment Effectiveness' view. Emerging from the Japanese automotive industry, it has largely transformed the 'responsibility' culture of the manufacturing sector. Stimulating 'autonomous maintenance' (getting the operators to do the obvious diagnosis and first-line maintenance actions), cleanliness and 'right first time', it changes attitudes and delivers many of the 'quick wins'. It falters, however, on the specific tools needed to determine which tasks are worth doing in the first place (again, where RCM is strong), and in the consideration of risk (the low probability, big consequence events) and equipment life expectancy (short-term versus long-term horizons).

Total Quality Management (TQM) and Six-Sigma (6-σ)

These are old, proven and thoroughly respected bundles of 'continuous improvement' techniques. From Deming, via Japan, and from Motorola respectively, TPM and 6-σ are the push for quality in processes, in client-focus and in teamwork. They work through multi-disciplined quality circles and improvement activities, and are excellent catalysts for communication, clearly-focussed objectives and fact-based decision-making. However they lack 'teeth' – the rule-sets and tools to link diagnosis of a problem to the best solution, and the right amount of that solution. Again, like TPM, they are good for revealing the quick win opportunities and, if supplemented by appropriate tools, form a valuable culture framework for sustainable continuous improvement.

Root Cause Analysis

This covers a family of methodologies for investigating anything from major single incidents to the repetitive equipment failures. Most companies have procedures for the former, but few have really 'cracked' the establishment of a "why?" culture – where employees routinely drill down to the underlying causes of observed problems in order to solve them 'properly'. The basic methodologies are excellent for the fact-based consideration of quick win opportunities. However the sustained habit is difficult to establish and maintain without the enablers of motivation, recognition and a continuous improvement culture.

Alliances & Outsourcing

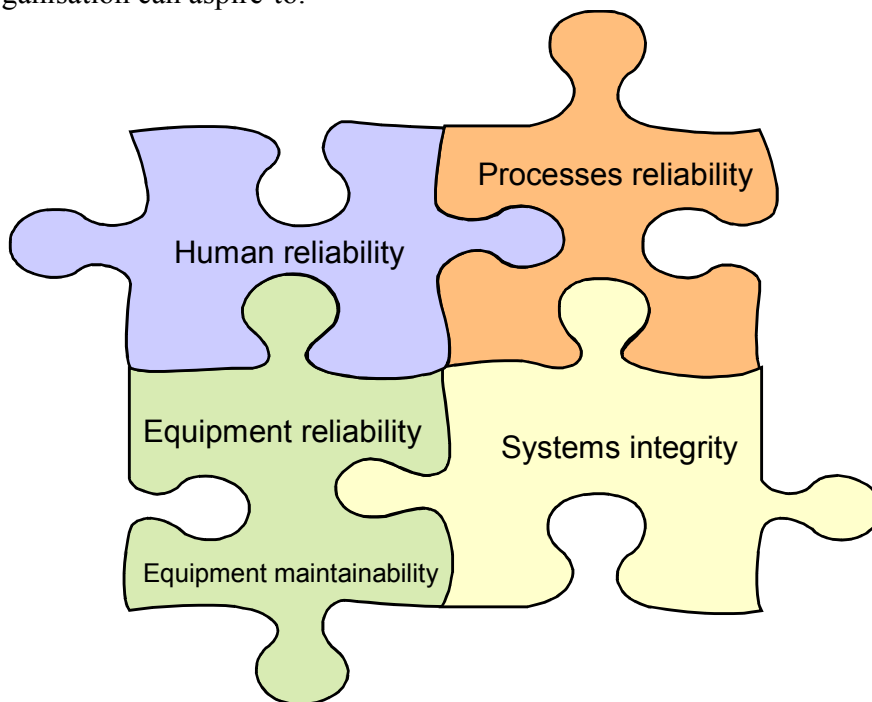
These are grouped only because they usually involve external corporate relations. In fact they apply equally to internal service-client relations, but the popular current versions are focussed on company associations and alignments. Open-book accounting, aligned goals, shared risk/reward schemes and team-working feature on the menu, yet the cases of real success are still sadly few. If the necessary trust is not maintained (usually dependant upon key individuals and their relationships), the companies involved tend to revert to type, reflecting underlying conflicts of interest and short-termism.

Super-bundles

Many companies have recognised the need for a multi-threaded improvement plan. Experiences in implementing many technical solutions have revealed the importance of the human factors – winning the hearts and minds. So larger vision programmes have emerged, effectively adding the change management factors onto the introduction of one or more decision methodologies. In some cases these represent fundamental rebuilding of the company's organisation structure, procedures, performance measures and education programme. Examples of these include

- introduction of a major work management, accounting and information system
- Operational Reliability initiative
- Asset Management corporate realignment

In reality these are just super-bundles of the tools, methodologies and organisational enablers. However they do provide good examples of the integration challenges, and the need to combine components from several sources. For example, an Operational Reliability programme may involve problem identification (Root Cause Analysis), quantification (including Lost Opportunity costing), prioritisation (Criticality Analysis), proactive strategy tools such as RBI and RCM, and culture change, continuous improvement and 'ownership' elements (from TPM and/or TQM). As reliability forms a large part of Total Business Impact, such initiatives have great scope and can form the backbone for ongoing continuous improvement. They also hold the advantage of having an inspiring title – "Operational Reliability" describes a desirable state, something the whole organisation can aspire-to.



Parts of the Operational Reliability jigsaw

Asset Management

This term is increasingly being used to describe the holistic, integrated nature of the improvements, ranging from structural reorganisation (into asset owner, asset manager and service provider views), greater links between budget authority and performance accountability, whole life cycle decision-making and risk management. This seems to be the frontier zone at present – where the world leaders are achieving the greatest improvement steps. There is at least one Masters Degree³ programme in the subject now, and the professional Institute of Asset Management⁴ has swelling member numbers and some major corporate patrons.

³ see <http://univation.rgu.org>

⁴ see <http://www.iam-uk.org>

Some organisations still regard Asset Management as merely the enhanced (business-focussed) maintenance of infrastructure. However, organisations such as Shell, BP and the UK power and water utilities have recognised that Asset Management is what they do – it is the central core to their business, and an holistic view of all aspects of performance and appropriate enablers is required.

Despite its uninspiring title (merely 'managing the assets' implies competence rather than excellence), Asset Management does have the advantage of covering the whole picture – all sorts of assets, and all the parts of Total Business Impact. It has moved from a term used to describe financial services, to the value-for-money sought from physical infrastructure, workforce and their skills, data, knowledge and other intellectual property. It recognises the interdependencies, and provides a flexible (necessarily customised) structure for introducing component 'solutions'. In short, it is the basis for the necessary routemap.

Conclusions

There is plenty to do, and there are plenty of benefits to be obtained. New technology and methodologies are not the limiting factors: the challenges lie in sustainable implementation and in integration of conflicting priorities and messages. Fortunately the concept of Total Business Impact has proven to be a valuable method for prioritising and de-conflicting the component improvements. The routemapping process certainly needs a baseline, and some quantified assessment of the scope for improvement in each area – the EFQM/Interactive Assessment can provide this. The gaps revealed, and the appropriate solutions, can be grouped into 'quick win' and longer-term (often culture change) elements, and the short-term gains are needed to pay for, to retain focus on, and to reinforce confidence in the long term goals (where the big prizes lie). Designing and facilitating a customised routemap is not easy, but the components are well known and proven. We can expect to see increasing examples of successful integrated Asset Management – and the impact has already proven to be phenomenal.

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