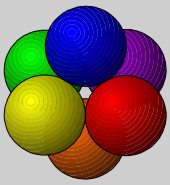


TESSERACT
Management Systems

GUIDELINES

A Basic Guide to Operational Measurement

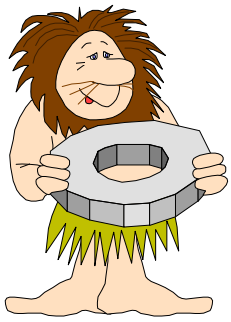
Prepared by:

Mike Clargo

1 INTRODUCTION

Measurement is the heart of systematic management. Without the ability to objectively measure your performance, and how it is changing, all the other tools become unfocussed and subjective, and ultimately difficult to justify.

Measurement is also a very common skill. We learn about it from our earliest years in infant school, and all our technical subjects are founded on it. It is also an ancient skill, perhaps as old as civilisation, for without it building and trading cannot be properly undertaken.



And yet when it comes to measurement in the field of management, we tend to shy away from it, unless it applies to money or the meeting of technical specifications in the products we produce. When it relates to the measurement of operational performance (quality, timeliness, impact of what we do on others…) we generally seem to avoid it.

Part of the reason for this is the politics of measurement - that the knowledge produced somehow shifts the power base in working relationships (for more on the politics of measurement please refer to section 4.2)

But mostly it is that people have difficulty with knowing how to start measuring (and even knowing what to measure), and it is this point that this document sets out to address (with perhaps a faint nod at the point on politics)

This document is intended as a practical guide to developing and implementing operational performance measures in your area of work. It is structured as follows:

- A basic overview of measurement and the who, what when… of it (section 2)
- A simple model for thinking through and selecting measures (section 3)
- A guide to implementing and using the measures (section 4)
- Some tools and techniques to assist you in your work on measures (section 5)

At the end of the day however this is only a guide. It contains only second hand hints and tips. There is no comparison with the experience you will gain from just getting on and developing your own measures.

CONTENTS

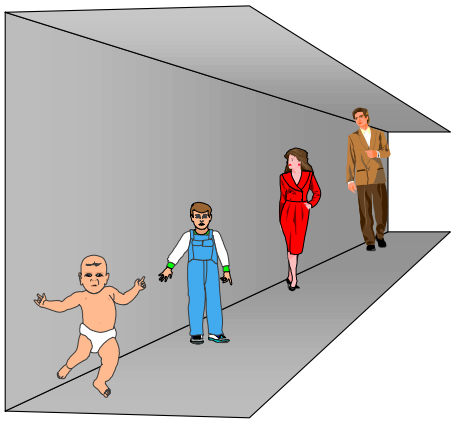
2 OVERVIEW OF MEASUREMENT

What is measured is known. But when you cannot measure something, when you cannot express it in numbers, then your knowledge is of a meagre and unsatisfactory kind.

Lord Kelvin

2.1 Why measure?

On the right is a well-known optical illusion. All the characters in the picture are actually the same height. But our perception tells us something quite different. We are used to seeing adults taller than children. We are used to seeing thinner objects as being taller than more rounded ones. And we are used to the idea that perspective makes objects in the distance seem smaller than they really are.



In short, our frame of reference alters what we see.

Measurement removes that bias. In many senses measurement is blind. It can only see one quality and has no extraneous factors (eg mitigating circumstances, personal preferences or the context of history) to confuse it.

Measurement gives us the bald facts without the bias, and as such serves to challenge our own models of reality. Once we have faced up to the facts we can re-introduce our bias should we so choose, but with a conscious decision rather than a subconscious oversight.

In addition measurement helps develop common understanding. By taking us back to the bald facts we find a datum (a basic point of reference) on which we can agree with our colleagues, before we build on it and introduce our individual prejudices.

And measurement also enables us to see trends at a detail that our perception cannot match, and as such can challenge our underlying optimism and any false sense of security (or insecurity). Measurement can impose on us the responsibility to act in a timely manner.

2.2 What do you measure?

The most commonly heard question on the topic of measurement is almost certainly "What should we measure?" People seem to struggle overbalancing the importance and the feasibility of various measurement options. Some things seem too trivial, some too difficult, and they are worried about partial measures. All too often this leads to paralysis and a net result where no measures are developed.

We can learn a lot about what to measure from other examples of effective measurement around us, and one of the best of these is the car dashboard, and perhaps the biggest lesson we can draw from it is what it doesn't have on it.

For instance, you don't see an indicator for:

Valve wear	Because valve wear changes slowly over time, and the effects of it are not immediately detrimental.
Prop-shaft diameter	Because the prop shaft diameter doesn't alter in practice, and

	there are virtually no recorded instances of it causing damage.
Crash indicator	Because the evidence that a crash has happened is overwhelming and doesn't require corroboration.
Roof lining temperature	Because the roof lining temperature is not materially relevant to any issues of effectiveness, safety, comfort or economy.
Driver fatigue	Because while this is: immediately detrimental; variable; would benefit from corroboration; and can effect safety, comfort and economy – it is just too difficult to measure.

Instead, the dashboard is equipped with measures that are important, variable, immediate and reasonably simple to obtain:

	Importance	Variability	Immediacy	Simplicity
Speedometer	Critical to safety and legal issues	Changes frequently during most journeys	Impact of going to fast can be within seconds – eg bend or speed camera	Can be inferred from wheel speed and transmitted through a cable
Odometer (Mileage counter)	Directly affects service mgt. journey mgt. and resale value	Rate of increase varies with speed and use of the car	Within minutes if following directions or days if planning service interval	Can be achieved by a simple counter on the speedometer
Fuel gauge	Essential to avoid breakdowns or wasted visits to petrol station	Variable with use of car, speed, load and mechanical condition	Within hours of last refuelling	Can be estimated from simple device to record height of fuel in tank
Oil pressure warning light	Gives advance warning of severe mechanical damage	Oil pressure can drop rapidly if unit fails or over time with wear	Engine can seize within minutes of a severe drop in oil pressure	Can be detected through a simple sensor fitted in the oil ducts
Lights buzzer	Helps avoid a flat battery due to lights being left on	Occurs commonly on journeys started in dusk and ending in daylight, or rain	Battery can drain down over a period of eight hours	Simple circuit modification to lights and door switch

Please notice however that while the form of measurement is simple, it is not free. These measures cost a reasonable proportion of the value of the car, but the likely consequences of not having them far outweigh the cost of the measure.

The principles remain the same for management measures. When you select what you will measure in your area you should take into consideration:

- The **importance** of that event or performance to the business, to customers, to your operating costs or to your longer term performance (eg people satisfaction, competence etc.)
- The **variability** of your performance in this area. How likely is the performance to change or drift, and over what timescales
- The **immediacy** of the effect of any changes in performance on your ability to supply customers, meet budgets, and maintain your competence (e.g. people, skills and facilities) economically
- The **simplicity** of the measure, and how easy it is to collect and analyse data that gives sufficient indication of any issues

To identify the measures in the first place there are a number of approaches you might take. The first is to take the first three points above and ask them about your department as a whole:

- What is important to our customers, our business, our future?
  (Much of this should be able to be drawn directly from your business plan)
- What aspects of our operation are most variable, most difficult to control?
- What things do we allow to happen that have the most immediate affect on us?

The answers to these questions should set you well on the way to identifying what you should measure.

In developing a complete set of measures it is important to ensure a balance of measures. Your measures should reflect all of the aspects in the first bullet point above: customer service; financial efficiency; people development; and general improvement. This is a concept normally termed the "Balanced Scorecard". A balance of measures will ensure that in pursuing improvement in one measure, in one aspect of your business, that you do not inadvertently mess up other aspects of your business. An example of balanced measures is shown on the left.

Customer Service	**Impact on the Business**
■ Timeliness ■ Accuracy ■ Ease of Use ■ Relationship	■ Value Add ■ Relevance ■ Proactive influence ■ Credibility / Trust
Efficiency	**Develop People & Teams**
■ Budgets ■ Processes ■ Resource Planning ■ Interfaces	■ Knowledge and Skills ■ Attitudes ■ Working Together ■ Business Capability

Some other techniques you might consider are the 'competition question' and polar arguments'. These are described in sections 5.1 and 5.3 respectively.

2.3 Where should you measure?

The easiest things to measure are those things that are the inputs to your departments operation. For this reason they are often the first choice of a department that is new to measurement. (Inputs are information, services and materials that are supplied to your department by others, and some examples can be found in section 5.6.)

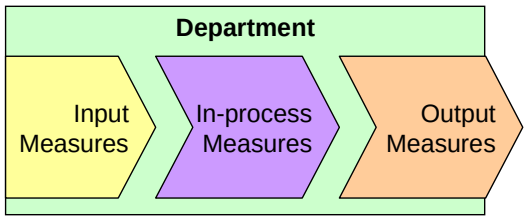
People are often very clear on what they have asked for, and it seems to be human nature to excuse our problems by pointing out how others have let us down. Input measures can easily be defined (against what we asked for), and they carry few political consequences (see section 4.2) for those who are doing the measuring – in other words they are safe.

But who does measuring the inputs improve? And if we all measure the inputs we will end up with a situation where every groups improvement is being driven by a different group – and we know how uncomfortable that can get.

That isn't to say that there isn't a place for input measures, but there are a few other options to consider first.

For example what if our suppliers measured our inputs for us? That would mean they could correct issues before they caused us any problems, and it would save us the trouble of trying to persuade them that there was a problem in the first place.

And perhaps if they used the understanding that measuring our inputs gave, they might identify in process measures that ensured problems were fixed before they even created any delays. In fact if they got really good at that they might not need to measure our inputs, because they would be confident of them, and so would we.



Of course our inputs are their outputs. And this example demonstrates why output measures are often better than input measures – it puts the information (and the ownership) at the point where it is most use in improvement.

Of course, output measures often occur at a point where the problem has already happened, so in many cases they are inferior to in-process measures which assure the end quality, and sometimes help to prevent problems.

So, where do you measure? In practice departments often end up with a balance of measures. But the most forward thinking drive toward in process measures which assure their ultimate quality without too much waste, and drive their supplies to assure their input quality through the suppliers in-process measures. (Examples of in-process measures can be found in section 5.6)

In general the preferred place for measurement is as close to the operation that introduces the important variability as possible. Or if that proves too expensive (disruptive or difficult) to move down stream of the operation to a point where the measures are more economic but where the cost of additional wasted effort is minimal.

2.4 When should you measure?

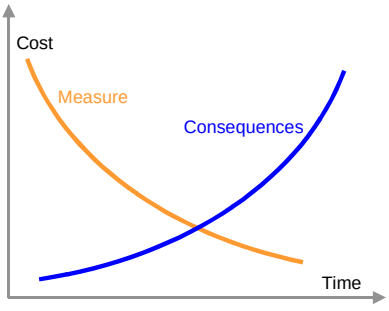
When, or how often, you should measure depends largely on the variability of what you are measuring, and on the economics of the measure.

Things that change only slowly may well benefit from being measured only quarterly or perhaps even annually. Other things, which vary rapidly, may need to be measured on an hour by hour basis in order to maintain control (but in management terms these are very much an exception).

Overall, the frequency of measurement is largely an economic argument based on two values:

- How much does it cost for each cycle of measurement to collect the data, analyse it and review the results?
- How much will it cost if performance goes outside of the expected values, and how likely is it to happen?

Please note that these costs may not all be financial. The overall cost of the first value decreases inversely with the measurement interval eg it costs probably four times as much to collect measures on a weekly basis than it does on a monthly one.



The overall cost of the second one is not linear. It is likely that the probability increases with time, the resulting damage certainly does, and the consequences from disgruntled customers increases with time. When you multiply these together the curve looks more exponential than linear.

Generally it is probably wise to avoid doing the actual maths, but to bear the above in mind when you think through your measurement cycle.

In practice most things are measured and reviewed on a monthly cycle because that is the normal frequency of the meetings schedule in which the measures will be reviewed

and actions decided upon. And there is little point in taking measures if there is no forum to do anything about acting on them.

However, do not be led toward establishing your measurement cycle to match your meeting cycle if it is clearly inappropriate. The converse should be true. Your meeting cycle should be arranged to support the needs of your measurement cycle, after all what is your meeting cycle there for?

2.5 How do you measure?

This is of course a very broad question, and the answer depends very much on what it is you are measuring. However, there is a lot of value in thinking creatively about this question before drifting by default to the idea you first thought of.

Let us take for example the fuel gauge, and think about the options that existed for the automobile designers for measuring the quantity of fuel left in the tank. They could:

- Place the fuel tank on springs and measure the deflection to effectively weigh the fuel
- Place a flowmeter in the tank which recorded the flow of fuel in and out, and displayed the result on a dial
- Place the fuel tank in front of the dashboard and fit a glass panel in it so that the fuel level could be seen
- Measure the noise created by the slosh when the car goes round corners
- Measure the height of the fuel in the tank using a float on the surface of the fuel
- Place a row of switches down the side of the tank that recorded whether they were in contact with the fuel or not
- Pump the fuel continuously between two containers and measure the flow until it stopped

Clearly there are a lot of options, and the designers just picked on one of them, but you can bet that they thought about the others first. The mechanism they selected is not the most accurate, for instance it will give you a false reading if your fuel tank becomes dented. But nor is it the most expensive, and when the false readings become an issue, the mechanic who services your car can look into more detail as to the reason why, without increasing the ongoing cost of measurement.

Before you select a measure to implement, we would recommend that you brainstorm other options first and then select the most appropriate, based on cost and accuracy.

You might also like to consider the following common approaches to measurement:

Logging	Recording key pieces of information, such as time of receipt or observed defects, on a sheet, by the operator of the process. This can be done continuously (which can be very time consuming) or by sampled inspection (see below)
Sampled inspection	Recording measurement data only at specific time intervals, or for every n^{th} event, and assuming this sample is representative of the data as a whole.
Quality checks	Undertaking a full (but probably sampled) inspection of what is produced to review all aspects of its quality against the output specification.
Surveys	Asking questions of the customers about how they perceive

	what you do, and gaining an evaluation of the impact of your output on their operation
Budgetary information	Using data produced by other departments, or automatically, to review your own performance and any issues therein.
Indicators	Indicators are not actually measures of performance, but more like tell-tale signs that largely predictably follow the level of the measure. Eg the number of layers of clothing don't tell you the temperature outside, but overall it is a reasonable indicator.
Review	Going back over past records to gather data on performance. This is most useful in measuring the adherence to agreed ways of working etc.
Mystery shopper	Using members of your own team as customers to assess the performance (sampled) of your process. Or following items through the flow of your process and recording salient data.
Time stamps	Using travelling labels with batches of work that go through your process to record timings and other factors. This tends to be most useful for cycle time measures.
IT based systems	With the increased use of computers, it is possible to develop IT solutions to much of the above. If an automated process is established, costs are greatly reduced in both data gathering and analysis.

2.6 Who does the measuring?

The best person to undertake measurement is often the person best placed to use the data, for the reasons set out in section 2.2.

In any event the person best placed to make use of the data in improving their own performance should be the person driving the gathering and review of the data, and should have full ownership of the results. The more that is done for them and on their behalf, the more difficult ensuring their ownership of the responsibility of facing up to poor results.

Traditionally this has been difficult. Measurement has been seen as a way of 'checking-up' on people, and inappropriate measures have often led to disputes and rejection of the data. The desire on the part of the individual to refute incorrect interpretations, has led to a rejection of all interpretations – a case of throwing the baby out with the bathwater.

Many companies have done much to reverse this, and to encourage individuals and groups to measure their own performance. They have succeeded in this by avoiding external judgement, and focusing instead on the improvement. The epitome of this is perhaps the General Motors-Toyota joint venture where shop floor workers have taken it upon themselves to reintroduce time and motion studies – the very measurement practice that was at the heart of many industrial disputes in the 60's and 70's.
('Return of the Stopwatch', The Economist, 23rd January 1993)

3 THE M.E.A.S.U.R.E. MODEL

He uses statistics as a drunken man uses lamposts - for support rather than illumination

Andrew Lang, Writer

The previous chapter represents a general overview of how to approach operational performance measurement. The purpose of this chapter is to pull the salient points into a clear process for people to work through step-by-step.

The process proposed here uses the word MEASURE as an acronym for the seven steps in the process as follows:

M Determine clearly what your process **MAKES OR MODIFIES**

E Establish the **EFFECT** that your process has on your customers

A Decide your **ASPIRATIONS** for the performance of your process

S Understand the **SUCCESS FACTORS** that are critical to your process

U Identify the major sources of **UNCERTAINTY** and variability in your process

R Determine your options for **RECORDING** the measurement data

E Agree how the data will be **EVALUATED**, in terms of both analysis & response

…and … **EVALUATE** which approaches to take

These steps are explained in more detail in the sections below. In general, the explanation leads toward a fairly rigorous process, but it is also possible to think through the steps in a fairly quick and possibly individual manner by just using the headings. There is nothing wrong with doing this, and it may provide the most expedient way to get started with measurement, providing you are willing to retrace your steps in the more rigorous form should the quick route prove unsuccessful.

Section 5.4 provides a pro-forma to assist with the quick version.

3.1 Make / Modify

What exactly is being produced by your department, area or process, and are there clear definitions and standards for it e.g. dimensions, operation, aesthetics, efficiency, cycle time, safety…?

Can what you do be described in some objective qualitative, or even quantitative manner, in terms of the difference that you make between when you start on something and when you finish it?

And are these definitions and standards useful in measuring conformance?

It is important not to be too narrow in your consideration of this question, and you might consider applying the question to each of your main stakeholders in turn:

- The difference you make to the work that passes through
- The difference you make to the people who pass through
- The difference you make to the resources that pass through

3.2 Effect

What is the effect of what you do on the customer? How is his/her operation affected by your outputs? What value do you add to your customer and how is this manifest?

There is clearly value in this step in discussing this question with your customers directly, and getting a clear fix on the means they use to assess your performance – whether subjectively or objectively.

The key things to focus on are the positive potential your process has for his/her process, but there is also the impact of failure to consider, and how does the customer see this manifest in his/her operation?

Key features of the customers perception are likely to be deviations from expectations: non-conforming, late, unusable, inaccurate, unreliable, complaints, hassles… But it is important to move beyond this to understand the actual implications of these things on his or her process, and on the contingencies they feel they need to put in place to cope with it.

Again, do not be too narrow in your view of your customers.

When you have completed your discussions review the outputs to see if any of these may be useful in measuring quality?

3.3 Aspiration

Are you, and your people, clear on what you want to achieve in your area/process? Are there clear objectives for the performance of your process, or are there clear criteria which would satisfy you that you were doing a competent job?

Unfortunately, in many cases, the objectives of a company or department are not sufficiently well thought out to provide a clear basis for measurement:

"... to be the *leading* producer of ..."

"... to produce the *best* equipment ..."

"... to be the *most successful* company in this area..."

"... to be the *foremost* supplier of ..."

Unfortunately, while these are noble aspirations, it is not at all clear what we mean by "leading", "best", "most successful", "foremost" and they provide no insight into how we would measure our progress toward them.

When we think about our aspirations we need to clearly define the criteria by which we can judge whether they have been met, and the more unambiguous these criteria are, the clearer the means of measuring become.

However the aspirations need to be appropriate to what we do as the box on the left would indicate:

IS "GOOD ENOUGH" GOOD ENOUGH?
What does 99.9% mean?

In the USA it would mean:

- Two unsafe landings at O'Hare Airport each day
- 16,000 lost pieces of mail per hour
- 20,000 incorrect drug prescriptions each year
- 500 incorrect surgical operations each week
- 19,000 newborn babies dropped at birth by doctors each year
- 22,000 cheques deducted from the wrong account each hour
- Your heart fails to beat 32,000 times each year

Source - "A Healthy Commitment"
The TQM magazine IFS Publications, June 1991

3.4 Success Factors

Having explored in some depth the criteria by which your customers and your people evaluate the outputs of your area or process, it is now appropriate to consider what aspects of the operation most influence the meeting, or otherwise, of those criteria.

Probably the best way to tackle this is by means of a cause and effect diagram as explained in section 5.2.

The key questions to explore having nominated or identified those success factors are as follows:

- Can their impact be observed before ultimate failure of the 'output'?
- How can the conditions that lead to failure be controlled?
- Do the controls provide an opportunity for measurement?

Exploring the success factors provides the main opportunity for establishing effective in-process measures. In this case, the critical factors could include input measures.

3.5 Uncertainty

In the previous four steps we have done much to identify what is important to our operation (see section 2.1).

This fifth step is concerned with gaining some insight into the variability and immediacy of the outputs and in-process deliverables defined previously.

The key questions we need to ask ourselves is for each of the 'important' things identified above - the success factors, and output quality measures:

- Which are the most uncertain (variable)?
- How do we know?
- What is the nature and cycle of the uncertainty?

Consideration of this last point should provide a clear understanding of the immediacy of any impact generated by variability in the in-process deliverables.

Initially much ground can be covered by debate: involving the more experienced of your group, and some key customers, and exploring the above questions with them.

3.6 Recording

With reference to section 2.1, the previous sections have now enabled us to explore three of the four attributes of good measures.

The next step is to consider the effort that is likely to be involved in developing and establishing an appropriate measure for each of the key outputs and success factors.

Unfortunately, determining the simplicity of measurement can often involve considerable effort in thinking through the options for the design of the measure – effort that may be wasted if the measure is not selected in the final step – Evaluation 2.

For this reason the last steps are used iteratively – undertaking a brief assessment of the ease of recording prior to an initial evaluation, and then working up the recording approach of those that pass this selection prior to a final evaluation.

The initial consideration of how the measure should be recorded would involve the following questions:

- What are the 'obvious' options that exist for gathering the key data?

- How easy is it to record the data that you need for these options? How much effort does it take? / How much will it cost?
- Do current methods for extracting the data exist?
- How confident can you be in the results that will be produced?

Subsequent to an initial evaluation and selection, the measurement concepts that remain can be explored in far more detail using some of the thinking outlined in section 2.5, and then the above questions may be repeated.

3.7 Evaluation 1 (of the data)

Recording the data does not generally constitute valuable measurement. For the measurement to be valuable it needs to be quickly assimilated and the salient points understood. To do this the recorded data needs to be evaluated:

- Spurious or invalid data needs to be weeded out
- The data needs to be formatted in such a way that relevant patterns (or deviations form the same) can be seen quickly. Graphs represent a valid method of doing this
- The formatted data needs to be presented to an individual or body who will evaluate the meaning of the patterns and make decisions about whether any form of intervention is required

This step is about deciding how all of the above will be undertaken in practice.

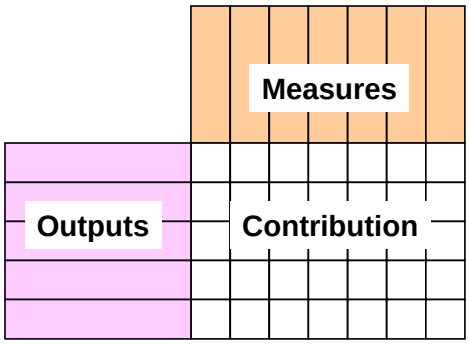
3.8 Evaluation 2 (of your measurement options)

As can be seen from section 3.6, there may well be two cycles of evaluation.

An initial evaluation is most likely to be a matter of weeding out those measures that are impractical or of low value. A matrix similar to that used in section 2.2 would almost certainly help the thinking here.

The next cycle of evaluation is likely to be a slightly more involved process. The first thing to consider is a balance of measures – ensuring that the measures you have identified cover all of the important aspects of the operation.

One way of doing this is to create a matrix, where you would map the critical outputs of your process against the range of measurement options that you have. By plotting how each of the possible measures contributes to an understanding of the outputs, you can see how well the outputs are covered, and where there is duplication



If there is duplication in the measures you have chosen, it may be possible to rationalise your measures. To do this you might consider the selection matrix explained in section 5.5.

4 USING MEASUREMENT

Nothing can have value without being an object of utility

Unknown

This section is intended to provide you with a brief guide on how to get started with measurement:

- How to develop the measures
- How to take the measurement data and ensure it is communicated effectively
- How to use the measurement data to identify problems
- And how to tackle those problems

4.1 Establishing the measures

The previous sections have given an overview of the steps to follow in identifying the measures for your process and/or area. To identify measures is 'simply' a matter of working through the steps in section 3.

But before you do this you might like to consider whether you are looking to measure your department as a whole, or just one specific aspect of it. If it is the latter, then narrow down the Make/Modify questions in section 4.1 to focus only on the outputs of that aspect.

While you can work through the development of measures individually, there is a lot of value in involving other stakeholders (customers, suppliers and staff) in the relevant parts of the process. Apart from the additional quality and breadth of experience they can bring, their involvement will make them more willing to support the implementation of the measures, and to abide by what the measures indicate.

Once the important measures have been selected, the more that can be done to turn over the ownership of the implementation and operation of the measures to the relevant staff, the more likely that they will result in real performance improvements for your business.

4.2 Overcoming the politics

The 'politics' of measurement is partly outlined in section 2.6.

In a pure sense, measures should provide a means for objective understanding and addressing real issues. Measures can be effective in highlighting problems and establishing the responsibility for doing something about them. Measurement information clearly has the power to require people to do things or stop them doing things, it can support people's plans or it can challenge them.

People in companies often seek such power. The ability to successfully gain support for your own schemes, and to disable activities that might challenge them is often the route to recognition and promotion in business. People are therefore often keen to use and exploit (overstate, over-generalise or partially misrepresent) measurement information that supports their arguments, and to dispute or discredit (focus on the limitations, seek out isolated flaws) measurement information that weakens them.

Much can be done to avoid this by ensuring people are clear on their responsibility for measures of their own performance, and by establishing (and enforcing) clear groundrules on how measurement information will, and will not, be used.

4.3 Communicating the salient points

Measurement data is, above all else, boring. Streams of figures are solely the delight of 'Anoraks' and Accountants. The essential ingredient in communicating the salient points of measures is making the data live.

And the best way to do this is to translate the numbers into graphical output: simple bar and line graphs, with trend lines and target performance marked on them, preferably large and in glowing Technicolor.

It is also important that the data is presented in such a way that it is focused on 'seeing scope for improvement' rather than 'proving success'. The purpose of scales, and false zeros on graphs is to enable them to focus on the key message of variability and trend, but it is amazing how managers can use the same features to hide all variability and present only what makes them look good.

There is of course a lot of value in demonstrating success, and in using graphs to spread the recognition that should go with it. But, it is best to seek the kind of success that cannot be hidden in a graph, and to ensure the graph represents real success and not just a manipulation of the data. Even the best fudgers eventually run out of averages.

4.4 Identifying issues

Graphs provide a means to see trend and performance issue quickly. One glance at a graph can tell you whether performance is up or down, and whether the trend line is converging with the target or not.

If your measures are sufficiently economical they should clearly indicate that an issue exists, but probably not give you chapter and verse on the reason for it.

The next step then is to launch some investigation into analysing the trends and performance. This will probably involve getting into more detail through short term measurement and data gathering.

Ideally performance issues should initiate the start of a Problem Solving Discipline which will use clearly defined problem solving tools, eg Pareto and Ishikawa, to break down the problem to its root cause. (These are explained in the Guide to Problem Solving)

An example of such a disciplined process is Tesseract's P.R.O.B.L.E.M. method, which works through the steps as follows:

PROFILE: What exactly is the problem? This is the stage where a full definition of the problem is established

ROOT CAUSES: What could all the possible causes of this problem be? Using data to help establish the probable cause(s)

OPTIONS: What solutions could be adopted to remove the root causes?

BALANCE: Of all the options, which appears to be the best, and which is going to be implemented? And what are our options for implementing an effective solution?

LAUNCH: Having chosen a solution and the means to implement it, how do we manage and support the implementation activity to its successful conclusion?

EVALUATE: With the solution in place, what measures need to be taken to make sure the problem has been solved?

MAINTAIN: How can a 'permanent fix' be established?

4.5 Managing improvement

The worst type of measurement is one that fails to result in improvement. There is little point in gathering any form of data unless you intend to make a conscious decision about what it indicates.

Ensuring improvement is a management task (in fact it should be the management task), and there are a number of questions about the management and use of the measurement data that need to be worked through:

- How should the management meetings review the performance data and how should they be structured to make best use of it?
- How should problem solving teams be established, how should these relate to the departmental management, and how should their progress be supported?
- How should performance data be presented to the meetings?
- How should performance data be used in appraising and managing individual and team performance

5 TOOLS AND TECHNIQUES

The following sections are essentially an appendix to this guide. They describe some tools and techniques that will be useful to you in developing practical measures for your organisation. They are not prescriptive, and you do not have to use them, but they will almost certainly add value to your thinking at some part of the process.

5.1 The competition question

The best people to identify and propose measures are often the people who are working in the areas that are to be measured. Often however when you ask them to suggest measures for their area, they will struggle. Part of the reason for this struggle is psychological, and involves them wrestling with two questions, not one:

- Whether the measurement idea that has occurred to them is a practical and objective means of evaluating the performance of their area
- Whether the measurement idea that has occurred to them is a fair reflection of their own ability, or whether it is potentially misleading

The first question is largely explicit, and although it introduces evaluation of the ideas at a stage earlier than we might want, it is still a useful filter in many cases.

The second question is often far from explicit and may even be subconscious in some cases. It arises from a fear of suggesting a measure that may be misinterpreted, with no recognition of the circumstances surrounding it, and claiming validity because it was suggested by the people themselves.

The second question can be quite disabling. It is a very important question for those who may be judged by the measure, and it is a very complex question, with lots of 'ifs' and 'buts' and based on difficult concepts like 'trust'.

The problem arises because the people may feel that by suggesting measures they are making an implicit contract to be evaluated against them.

One way round this is 'The Competition Question', see right, which clearly separates the logical search for practical measures from the contract to have them applied 'to us'.

It works by asking the group for their expert opinion on how they would seek to evaluate three other areas, very similar to their own, but clearly 'not them'. By doing this they can comfortably develop a logical model of appropriate criteria, knowing that they have not accepted that the criteria apply to their 'special' situation. Then separately they can discuss and agree whether the same criteria could be used to evaluate their own area, with all the caveats and considerations that requires.

THE COMPETITION

A hypothetical exercise

There has been a competition to determine the best Operations group in the retail industry. You didn't apply because you have been asked to judge the eventual winners.

The remaining contenders are Waitrose, Safeway, Tesco & Asda, all of which have Operations groups structured in the same way as yourselves (?!). Your job is to select, objectively, which is the best.

You can spend as much time as you wish, see what you want, talk to anyone, and do anything you need to reach a fair conclusion.

What criteria will you use to determine "The Best"?

Having developed a comprehensive set of criteria, then the group can be brought round to thinking of the criteria as the basis for measuring their own area by considering that if the criteria they have proposed are important enough to use in determining the "best", then:

- They must be important
- They must be variable

- They must be observable

And if the above is all true...

- They must be a key measure of process health
- They must require management

And that change in them is an indicator of the quality of that management!

5.2 Cause and effect diagrams

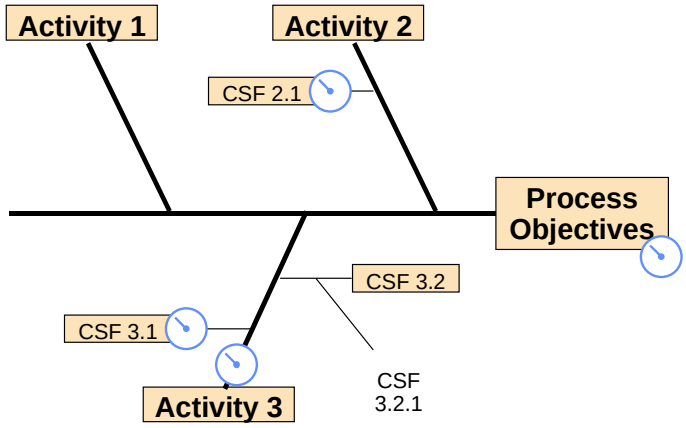
Cause and effect diagrams are an excellent way of looking at the critical factors which lead to a successful, or a failed, output, and thereby for identifying possible in-process measures.

The Cause and Effect Diagram (also known as a 'Fishbone Diagram' or 'Ishikawa Diagram') is a technique for clearly presenting a brainstormed list of possible causes having an effect on a particular situation.

The technique is usually used in a team situation, but can be effectively used by an individual, to begin to break down an end result into the potential sources and reasons for it occurring.

Steps:

1. Place a short phrase describing the ideal outcome of your process in a box on the extreme right of the diagram and draw one line pointing into this box. (If using A1 flipchart remember to use it in landscape orientation!)
2. Decide on the activities that determine the outcome (are key to the result) of the process, placing these in boxes above and below the line, but some distance from it. Then connect the cause boxes to the main line with slanting lines.



3. Brainstorm the possible factors that are critical to achieving the process objectives within each activity. Try not to be too narrow, and ensure you consider time and cost objectives as well as quality.
4. Identify, through discussion or data collection, those that most need measurement due to their importance and variability

The final diagram should give you plenty of ideas for in-process measures. A variation on this exercise is to produce the diagram form the negative perspective – listing all the potential failings in the head of the diagram, and writing down possible causes against the activities

5.3 Polar Arguments

Another way of clarifying possible measures is to explore the variability of some aspect of your business, and the good and bad impacts it may have. So, for instance, if you were wanting to develop measures for the Human Resources function, you would

explore the impact of a good Human Resource function on a business, and of a particularly poor one.

The contrast between the two lists should provide a reasonable guide for output measures for the Human Resources process. See below:

What would a company look, feel & work like if its Human Resource function…

…worked really well?	…worked particularly poorly?
Happy people	Discontent
Low turnover	Waves of people leaving
Leaving for more senior roles	Leaving for similar roles
Competence growth	Steady or declining competence
Lots of ideas	Few suggestions
…	…

This exercise works in a similar way to the Competition Question, but is slightly more conventional, and easier to use with individuals.

5.4 Selection Matrix

The selection matrix is an objective means to select a few comprehensive and practical measures from a larger list (eg one produced from the exercise above).

It works by listing all of the measures that you are considering, against the criteria from section 2.2, and any other criteria that you feel are relevant in your situation, and then ranking the measures against how they score on these criteria.

Typically you might use a range of 0-3, where the values represented the following situations:

Score	**Importance**	**Variability**	**Immediacy**	**Simplicity**
0	Trivial	Static	Long term	Impossible
1	Significant	Some	Medium term	Difficult
2	Important	Variable	Short term	Moderate
3	Critical	Erratic	Very short term	Easy

By reviewing each of the measures against this scale and multiplying the figures in the final column, the relative values of the measures can be assessed before selection.

Measure	Import'ce	Variability	Immediacy	Simplicity	Product
Customer Survey	3	2	1	2	12
Measure 2	1	3	3	0	0
…					

5.5 The M.E.A.S.U.R.E. sheet

The M.E.A.S.U.R.E. sheet is a simple pro-forma or aide-memoir to assist individuals or small groups to work through the steps of section 3. It is shown over the page:

Make / Modify

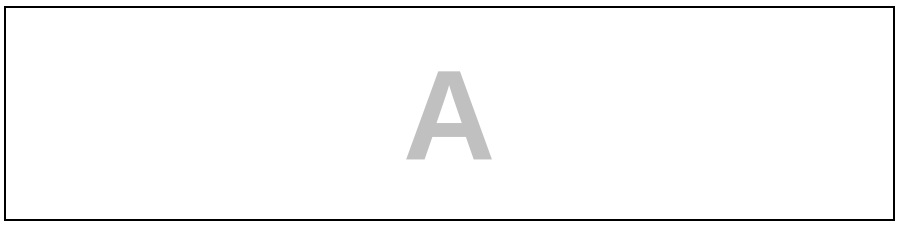
What exactly is being produced by this process, and are there clear definitions and standards for it e.g. dimensions, operation, aesthetics, efficiency, cycle time, safety…?

Effect

What is the effect that this process has on the customer? How is his/her operation affected by your outputs? What value do you add to your customer and how is this manifest?

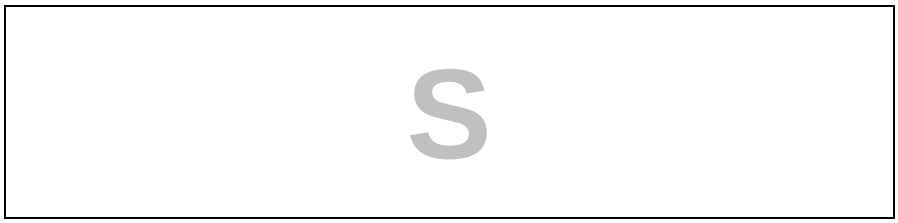
Aspiration

Are there clear objectives for the performance of this process, or are there clear criteria which would satisfy you that you were doing a competent job?



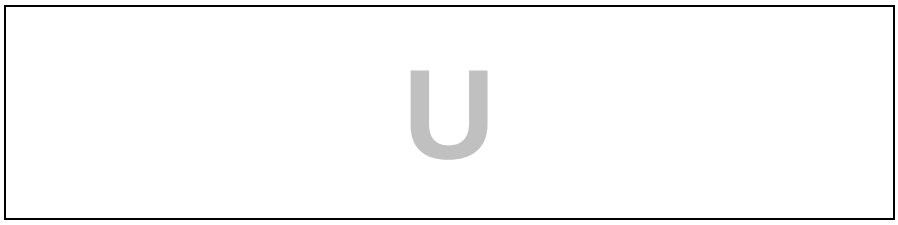
Success Factors

What are the success factors that are critical to this process - what aspects of the process most influence the meeting, or otherwise, of its objectives?



Uncertainty

What are the major sources of uncertainty and variability in your process, and how are they manifest?



Recording

What do you need to do to develop and establish appropriate measures for your process, based on the above?

Evaluation

How should the measurement data be presented to management? Evaluate which approaches to take, and how they are to be woven into your management cycle

5.6 Example Measures

The following list is far from exhaustive, and is intended only to stimulate the readers thinking on how these might be interpreted or adapted into measures in their own department

Input Measures

Timeliness of incoming materials/information (actual date versus requested date)

Quality of incoming materials/information (number of errors)

Cost of incoming materials/information (rate of change %/£)

Process Measures

Activity cycle time (minutes to complete an activity once started)

Average wait time (minutes materials or information is held in queues)

Number of handoffs (average number of people a piece of work passes through)

Quality levels (% average deviation from the ideal for various critical parameters)

Error levels (%age activities that result in an error)

Rework levels (%age time of rework activity to correct errors)

Downtime (% time skills or facilities are unavailable for use)

Output Measures

Delivery accuracy (time of delivery against requested/desired delivery)

Output quality (% level of defects in delivered information/materials)

Customer satisfaction (customer perception of service against defined criteria)

Complaints (level of customer complaints)

Total value add per period (output performance in £)

Budget performance (% deviation from budgeted finances)

People satisfaction (employee perception of department against defined criteria)