Asset Management Council
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Australia

What is Asset Management?

Background

The AM Council's view of asset management is encapsulated in its definition "The life cycle management of physical assets to achieve the stated outputs of the enterprise".

This view is further developed in two models, the first being the Capability Assurance Model and the second the Technologies Model. Combined, the AM Council's Capability Assurance and Technologies Models are intended to provide an overview of asset management and enable the "why, what and how" of asset management to be formally linked to existing engineering, accounting and legal Standards and frameworks.

Both models have been developed by the AM Council.

The information provided below is drawn from two presentations, one given by James (Jim) Kennedy, then National Chair of AM Council, and the other by Peter Kohler (Chairman of Technical Committees for AM Council) to the ICOMS 2008 Conference in Perth. Diagrams are included at key points in the narrative to link the text with the progressively building graphics necessary to a complete explanation.

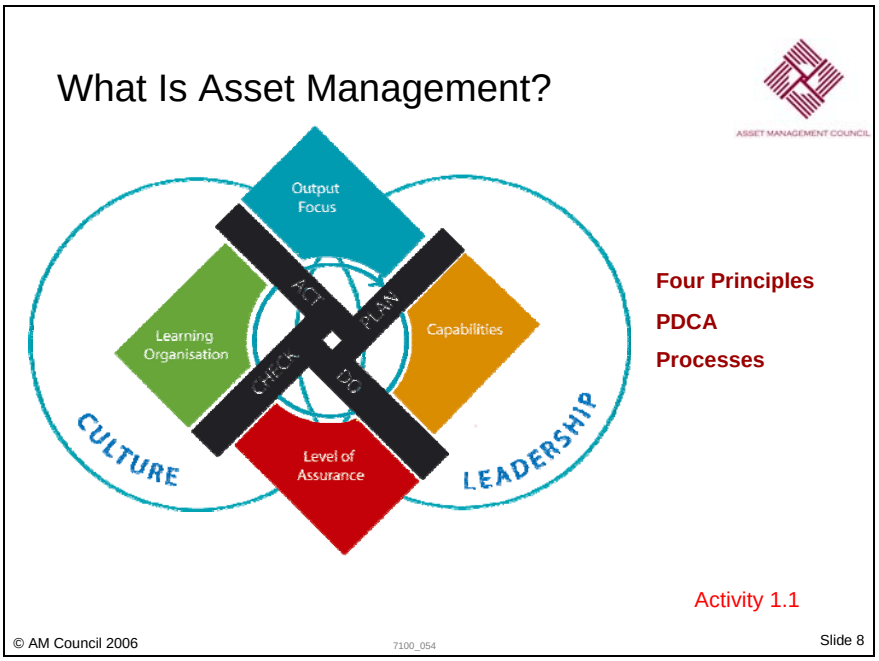


Figure 1 - Capability Assurance

Capability Assurance Model

Before we can talk about any part of the model, one has to ask the question "Why would you have one?" For a number of reasons, but one of the reasons that the AM Council has decided to talk about asset management in terms of a model and described on a piece of paper – a two dimensional piece of paper – is to get our heads around our understanding of not just what is asset management, but a way of thinking about asset management.

So the first model, which we title "Capability Assurance", is effectively asking us to think about asset management in a certain way. One of the strange things about engineering, indeed education systems in general, is that one of the things that doesn't happen to us, is that we're taught about ways of thinking. We often talk about it in terms of different views – and this is kind of philosophical and can seem a bit "soft" for engineering. But philosophy is very important, because it can determine your whole mental mindset. So these couple of slides (the Capability Assurance Model) that you're about to see are actually about adjusting that mental framework in relation to asset management. Sounds a bit esoteric possibly, but come on the journey and we'll see where it goes.

The first thing about asset management is that it's a process. You can see behind me on the screen a Plan, Do, Check, Act process. There's nothing particularly grandiose or deeply insightful about that notion other than it actually is a process; it's not something that just happens – it is a process that has a start and a finish, mid-points

and loops and control loops and all that sort of stuff which we'll talk about later, particularly when Jim starts to talk about a lower level model, the Technologies Model.

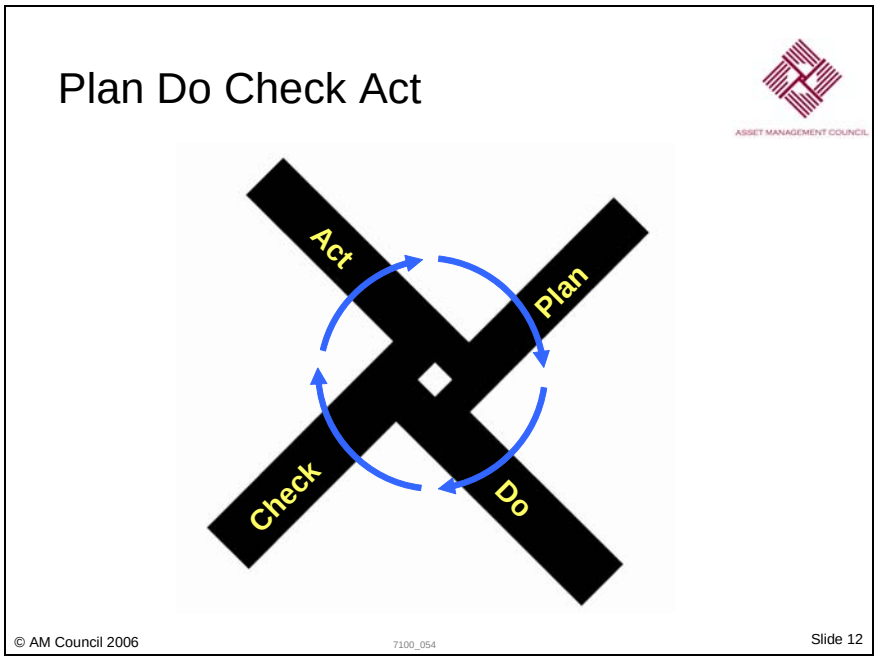


Figure 2 - Asset Management as a Process

The second part of this Capability Assurance Model is the notion of principles. There are four principles which we think underlie asset management. Sometimes we call them pillars – for the purposes of this model, we're calling them principles and the first one that I'd like to talk about briefly is the notion of "Capability", noting that the notion of a "capability" and the notion of an "asset" are different.

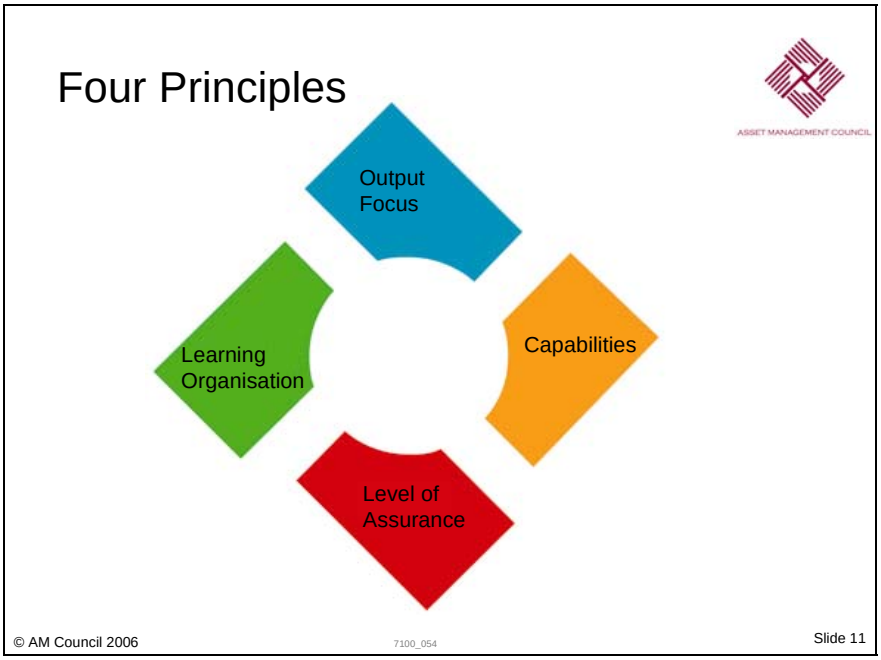


Figure 3 - The Four Principles of Asset Management

Capability

If I asked you, "what is this?" Most of you would answer "A pen". I would then ask, "Why did you say that?" (I now ask Jim to catch the pen) Jim, can you throw it back please? What is it now? A "projectile". So why did you say "pen" in answer to the first question?

You see, it's actually quite an interesting way of looking at things. Asset management isn't about the thing itself (the Asset), it's about what it does for us (the Capability). What it does for us can only be thought of in terms of its context. We choose to call this a "pen" but that sometimes gets in the way of our understanding of what this really is. How many capabilities does this pen have? How many? Well we thought of two. Do you think you can think of another one? What about as a paper weight? Well that's three and on we go. So how many capabilities does an asset have? The answer is "a very large number". Which one we want is actually determined by the context which we've chosen for the asset.

For example, I'm not the cleverest engineer in the world but I've chosen an MTU Diesel engine to act as an anchor for my boat. So every now and again I'm going to throw the diesel engine off the front of the boat. After tying it to the front of the boat, do you think the diesel engine will act as an anchor for my 17 foot dinghy? Of course, it will certainly act as a good anchor, the dinghy with the "anchor" in the water, is certainly going nowhere! Would you think I'm very clever in choosing an MTU diesel engine for that? No. It's probably a very expensive solution. Of course when I ring you and ask you to "Please maintain my anchor?" what do you think the maintainer is going to do? He's going to insist that every 12,000 hours he's will strip and rebuild the engine. Does that make sense? No. So why do you automatically assume when you get a maintenance task from an Original Equipment Manufacturer that it applies to you in your context? You understand the point?

I'm sure I've over-laboured the point now for the notion of a "capability" and in all seriousness every asset has almost an infinite number of capabilities. Which one you choose depends on the performance it has, in the context of use that you want it to have.

Output Focus

The second principle of asset management is "output focus". What I mean by "output focus" is exactly that - any asset has a number of "capabilities" (as we talked about earlier) each with an output. As a result, you might view this asset thing in terms of both it's capability and, associated with that, an output – a measurable output. Okay? So not only do you have its function or capability, but associated with that, you have something that's measurable its output.

How many outputs, or how many things could you measure associated with the capability of "our pen"? Well, quite a few. It might have a performance – 250 miles an hour; it might have a range – 300 miles; it might have a mass or a weight. These are all, depending on the capability, the thing that you want it to do. It's not always a simple statement of one measurable output.

The point of the story of course is that in describing the many "capabilities" of our pen, we would describe an output for each capability, where each output is described in "measurable terms".

Assurance

The third part of our capability assurance model, in terms of the four principles, is "level of assurance".

1928 was a seminal date in the history of the world - you'd all agree! Why haven't you all agreed? It's the day the modern world was created. Why do I say that? Well it's because it was the year quantum mechanics came about. What preceded quantum mechanics? The answer is Newtonian physics. What's the chief characteristic of Newtonian physics? Certainty. What's the chief characteristic of quantum mechanics? Uncertainty or risk.

Uncertainty (other similar words include risk and probability) is actually one of the chief reasons the world is the way it is today. It is the tools of uncertainly, developed over the years since 1928 to tackle risk, actually explain very profoundly, why the modern world is the way it is and in fact it's Peter Kohler's theory that in 100 years time, when they look back upon the world, they'll look back at 1928 and say "See on that date, look what happened to the rest of that century and the years since", because risk is one of those tools that has made a profound difference to the world.

Engineers Australia used to have little stickers, you remember those? What did they say? "Engineers make things happen". I'd like to propose a change to that. "Engineers make the future come true", because the idea behind the plethora of risk based tools actually is that. We wouldn't fly an aircraft, wouldn't fly in an aircraft if we were not reasonably certain that the aircraft will do what we want it to do. Asset management does that. It provides that level of assurance that things will be okay; that the machine will do what we want it to do, deliver the capabilities to the level required by the needed output for the time the capability is needed.

So the notion of "level of assurance" is actually integrated with the notion of an "output". If I said to you, "I'd like you to drive a car between here and Sydney and back again and I'll give you five days to do it" and then I said "Mmm, I just heard Peter Kohler talk. He had this notion of risk or level of uncertainty. Well okay, I want you to drive between here and Sydney in five days and I want you to do it to a level or probability of 70%". And you, as a good asset managers, says "I can do that". I wonder.

Of course, Peter Kohler is quite an interesting guy because he was thinking about the 70 per cent and then ten minutes later he comes back and he says “Oh, you know that 70 per cent? Can you forget that figure? Can you now make it 98 per cent?” Tell me, what would you now do differently? And you would agree at least two things – a lot of things would be different. You’d have to also agree that the resource requirements would be different. As the required level of assurance gets higher, from the 70’s to the 98’s, the 99’s, the 99.999999’s, you would philosophically agree that the required level of resources is getting closer to infinity.

By now I hope you would agree that the notion of “level of assurance” is fundamentally a part of an “output”. Talking about the task (driving to Sydney and return), there’s a couple of things that drive our resource requirements. There’s one, the “performance” or “output” of course, because not everything performs at its fully rated output - but the other prime driver of the needed resources is often the “level of assurance” ascribed to that “performance”.

I think I’ve adequately explained that point for the time being at least – I’m happy to take some questions later on the notion of level of assurance.

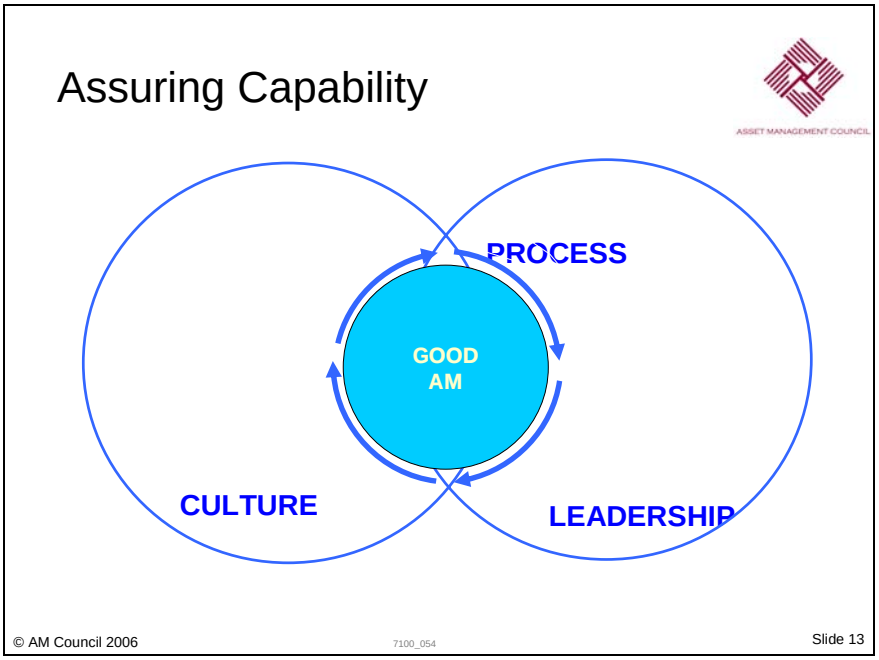


Figure 4 - Supporting Culture and Leadership

Learning Organisation

The fourth principle of asset management in so far as the Asset Management Council is concerned, is a “learning organisation”. This, certainly as far as our Excellence Awards Program is concerned, it’s axiomatic that good asset management organisations have a learning organisation. What do we mean by a learning organisation? An organisation that encourages its people to challenge things. It encourages its people to review.

There’s a transparency of process, a transparency of decision making involved. You could look at it as another view of continuous improvement but this one, continuous improvement, tends to be talked about in terms of a process. What we’re now talking about is a learning organisation in terms of people, their view on their role within the organisation; their view on being able to look at what they’ve been given, challenge what they’ve been given and not feel threatened by the fact that they’ve challenged something. As I said, nearly all good asset management organisations are classified, or should be classified, as a learning organisation.

So those are the four key principles. Where you have a process, underneath that process, the “plan, do, check, act process” all four principles are equally embedded.

Culture and Leadership

As we’ve talked for the last couple of days of this conference, those things don’t happen by themselves or the process doesn’t happen by itself; there are good behaviours involved and without question, in a good asset management organisation, there’s the notion of leadership. Nothing happens without good leadership and leadership doesn’t mean someone at the top barking orders; leadership means that everyone in that organisation is empowered to do the right thing, feels fully involved in the decision making of the organisation, is quite clear in the direction which the organisation is going and shares a common mental model, of the direction of the organisation.

And I have to say from an excellence award perspective, that leadership perspective to the team is again one of the key characteristics of good asset management organisations.

The second part of that good asset management behaviour is culture associated with that leadership framework. Associated with that learning organisation is a culture that supports its people, fully supports its people in terms of knowledge, in terms of learning, in terms of encouraging its people to participate in the decision making process.

What you have now seen and talked about, is what the Asset Management Council believes is "capability assurance". Quickly and just to recap before I invite Jim Kennedy to talk to the next level of decomposition of that model, asset management is a process – a "plan, do, check, act" process. It's underpinned by four key principles namely:

1. Capabilities – what the thing does, outputs of those capabilities;
2. Outputs - how are we going to measure and what values are those capabilities;
3. Level of assurance – there's a risk or a level of uncertainty associated with each capability; and
4. Learning organisation – the people feel and share the values of the company and the processes involved.

Underpinning all of that is good Leadership and a good Culture, a participative culture for the people involved.

I'd now like to ask Jim Kennedy to come back to explain the next level of model, the Technologies Model.

Technologies Model

The model is a 'pseudo' process representing the chief elements of the classic Plan, Do, Check, Act (PDCA) quality process shown as connected yellow boxes (called Competency Areas) running through the "technologies" squares. The Technologies Model links to the overarching Capability Assurance model by representing the closed loop PDCA process at the core of that model.

The term "Technologies Model" was originally intended to emphasise that the model applied many "technologies" where technology is defined as "*a collection of techniques; a particular technological concept; the body of tools and other implements produced by a given society*[1]".

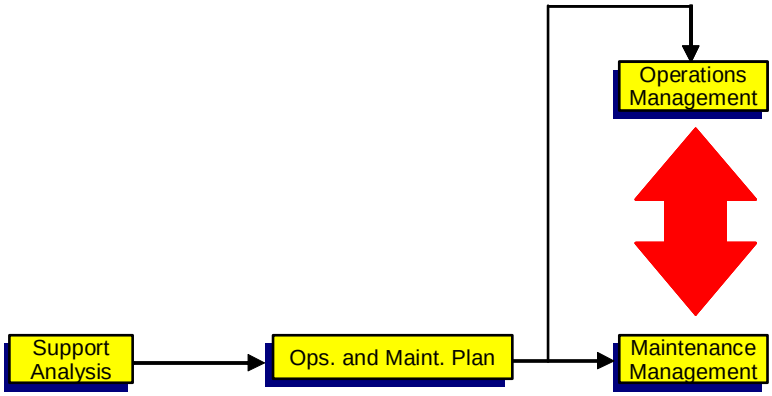
The technologies model is a lifecycle based quality process; that is, a **Plan, Do, Check, Act** or **PDCA** process. However, in explaining the model we are not going to start from the beginning and work from the top down. We will start in the middle and at a point which would be familiar to most involved in physical asset management – that is maintenance and its partner operations. Maintenance and operations is the core of lifecycle management of assets – it's certainly a big budget item for most major asset owning organisations.

Many organisations spend billions of dollars on maintenance and operations actions each year. Let's look at what drives this. Firstly, if you're going to do anything, there must be a plan. So, we're going to have an operations and maintenance plan to drive our operations and maintenance functions. The model separates operation and maintenance because in many organisations they vary considerably in their relative sizes and often have quite different cultures. Organisations such as rail have roughly equal numbers of maintenance and operations staff often numbering in the many thousands. Conversely, power plants or electrical supply systems have small operating staffs compared to the total maintenance staffing (either internal or outsourced).

Now, if you're going to have a plan, there needs to be an auditable methodology by which you create it. Operations and maintenance jointly apply the support analysis process to create those plans - it is a joint activity. So where does it come from? It comes from a process called support analysis. Now if you've already got equipment in place and operating, support analysis is how you would determine the content of those two plans given the availability of asset performance information. But preferably such plans should come with the equipment at the time of acquisition. With this ideal in mind let's firstly see why we might create these plans in a new equipment scenario.

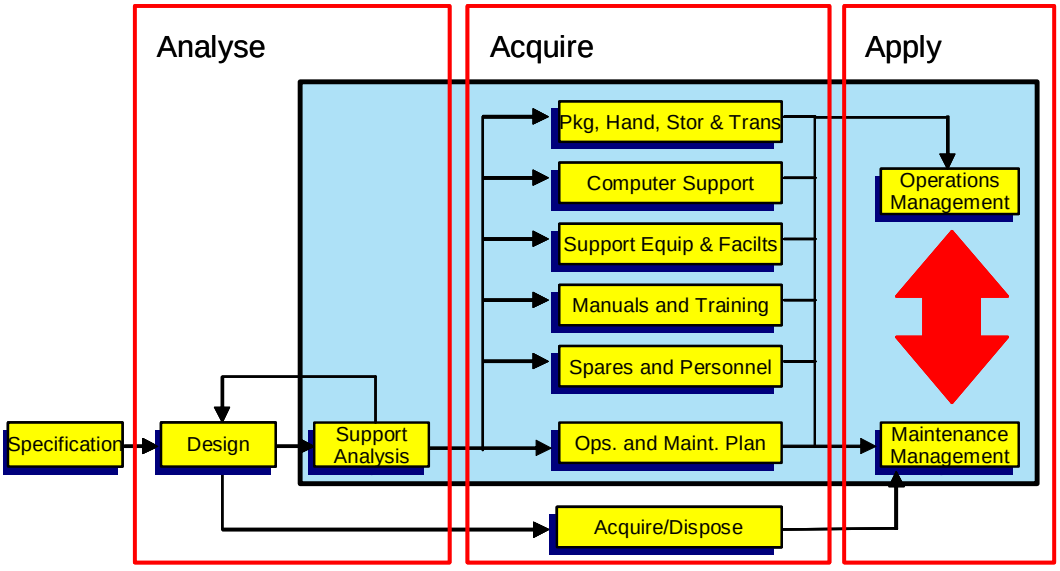
One might well comment that the diagram tells us little about the content plan and that would be true at this stage. However, from a global view such plans should enable us, as a minimum, to properly use the assets within their design envelope and their intended operating environment. They should also describe how best to integrate the various types of necessary maintenance (preventive or corrective) with those operational constraints. Suffice to say that Operations and Maintenance Management is an integrated team effort.

[1] Wikipedia - http://en.wikipedia.org/wiki/Technology



Designing our Support

Our support requirements in the future are the wherewithal that will enable a design solution to achieve its output capability today tomorrow and for the duration of the intended life of the design. That design solution is, of course, driven by a technical specification, a document which most of us are familiar with. Well what does support analysis take on board? And why do we link it back to design? This linkage is what I grew up in the military to understand as Integrated Logistics Support. Now, looking at the list from Spares to PHS&T, the purist might say "Oh, it's moved on a bit from there and we've now got ten instead of nine". Well, me, I'm a bit of an old-fashioned guy and I'm quite happy with the original nine[2] and I can talk to computer support as including technical information sources beyond that contained in operating and maintenance manuals.



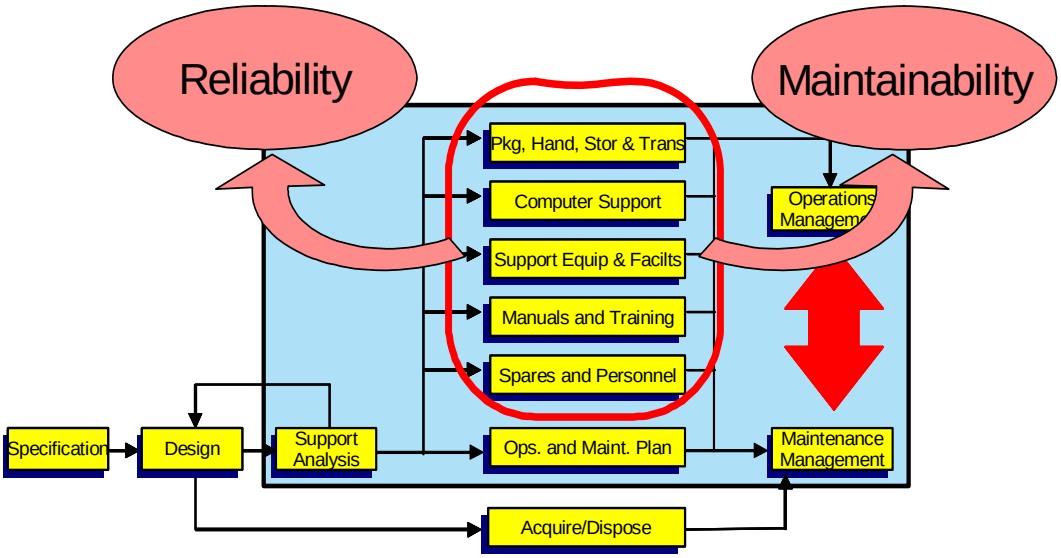
A reason why one defines support as part of doing the design, is that the Operations and Support Analysis action gives us an that understanding of the future cost of ownership. As part of the design process, we are going to try and create a design that has the best life-cycle outcome for the organisation – depending on what that intended end life period might happen to be. And of course this life should be clearly stated in the specifications. That set of individual integrated support elements of spares, people, manuals, training, facilities, support equipment, computer support, packaging, handling, storage and transport are all the things that we are going to spend money on in the future to support that equipment in carrying out its specified function.

These support essentials, which are shown drawn as grouped in boxes for artistic convenience, are each individual and can be calculated for different design solutions. In this way we can select between alternative design solutions that may give us similar sorts of performance but quite different life cycle cost. We need to discriminate between them on this basis of cost. We term this approach integrated support for a good reason.

Now you'll notice that it's bigger than just the provision of that support; it includes three basic processes. Firstly, the analysis process; second, the acquisition process to procure assets, their support and make it available; and thirdly, the application of those acquired resources to achieve the intended system capability. ***Analysis***, determines the required capability, ***acquisition*** buys that capability, maintenance management and operations management, ***apply*** that capability.

[2] Blanchard, B; Logistics Engineering and Management, Prentice Hall, 3rd Edition 1986, Pp 10-11.

Now, integrated support, as you'll notice, has characteristics that affect two major performance aspects of the ownership of equipment. One, how long it stays alive for – often termed as mean time between failure or level of reliability. The second one is when it dies, how long does it stay dead for or maintainability These two design driven performance characteristics of *reliability* and *maintainability* will drive our understanding of the availability of the equipment. But regrettably, all of those support elements affect both reliability AND maintainability. For example, the spares that you procure will affect how often a system dies and when it does die, how long it takes to bring back to life again. If you haven't bought very many spares or they may not be stored close to the item, then your mean down time will be longer. If the spares are of poor quality they may not last as long and your equipment mean time between failure will be shorter. This same influence in fact affects every single one of those support elements – all affect reliability or maintainability in some way.



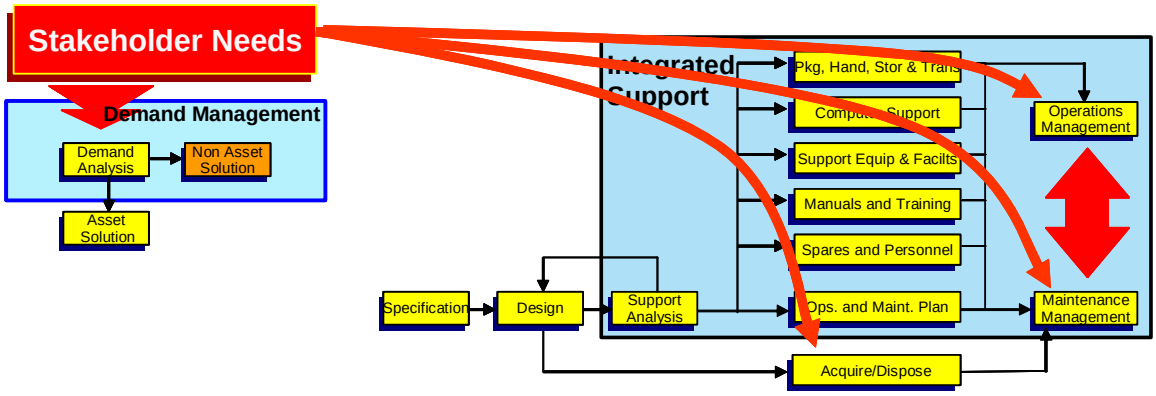
Now the great challenge we face in the support analysis process is, if I only have a certain number of dollars, how do I spread them amongst these support elements which impact on each other, impact on dead time and impact on live time. That is the greatest challenge that we have as engineers and statisticians and data collectors. To analysis our support needs and to work out where do we put our money. That is probably one of the most important parts of this model.

Now the advantage of having all of that information sorted out for the design solution is that when we acquire the asset, we now have enough time to buy the support for it at the same time. It is no good owning an item and you don't have the necessary support because one day, during its life it is likely to fail and you won't have the right spare, you won't have the people, etc.

This integrated approach is intended to assure all support is available on the first day of service so that, on the second day that you own the asset and there is a failure, you have the spare, you have the people, you have the facilities and you have the tools. You have the support necessary to achieve the inherent design capabilities of that equipment. That red circle in the adjacent diagram shows the bounded resource that drives the performance of both your operational function and your maintenance function. Similar support elements relate to operations, for example, operators will need simulators; operators will certainly need manuals and training. They will certainly need people, etc. Not sure about packaging, handling, storage and transport of operators but can get the gist of it. There is a relationship between the support arrangements and the delivery of that operations and maintenance function.

A Reason for Every Action

Okay, let's build the front end of our Technologies Model. So we'll go a bit big picture now and we'll say "Well that's fine, but the great challenge in all of this is, as an organisation, why are we here? Well, in big picture terms we're here to satisfy a variety of stakeholder needs; that is, the output requirements of identified and agreed stakeholder needs". But the key issue about that is really, how, as an asset owner and an asset manager, can we assure ourselves that every single task we do in terms of acquisition, disposal, maintenance and operation is connected to an agreed stakeholder need? Connected transparently (meaning able to be audited) back to a verifiable agreed need and that's the great challenge of asset management. Organisations do many things but they're not always evident nor is the organisation exactly sure why they do them. There are tasks they do which they're not sure what stakeholder need it achieves or assures i.e. is connected to. Now the model tackles that issue in two major ways with its technologies or associated professional disciplines.



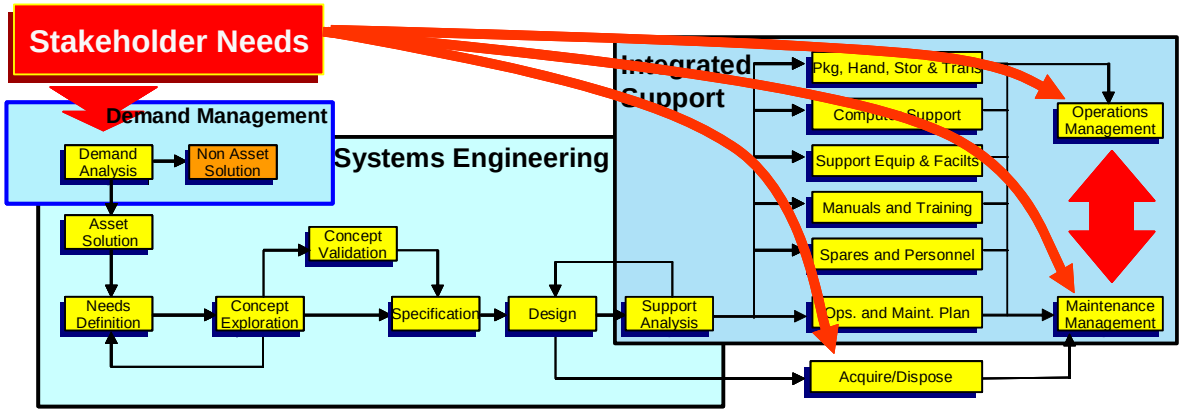
The first is one of Demand Management. Now demand management as a discipline has been around for some time. Australian Governments at the State level have consistently pressed the issues of managing demand for services in the community. For them these stakeholder services in the social agency area had no limit. You can't have too many police, you can't too many teachers, you can't have too many hospitals; people will always ask for more. Water, power and transport might be considered in that same category.

So, Demand Management is intended to establish sound relationships with stakeholders and push back against an infinite level of expectations and matching demand. Inevitably the solution to managing demands is not necessarily just one or the other of the two options shown. While Governments would like our services to be delivered by asset-less arrangements, the reality is that most services are delivered through a balanced combination of both asset and non-asset solutions.

The second is Systems Engineering which is a discipline that teaches us how to achieve that balance. Thus we have at the very core of this Technologies Model, a connecting tissue of Systems Engineering connecting stakeholder needs at the front end of the model to the ALL asset related tasks required to assure agreed service capabilities.

Engineering the System

Systems Engineering is a very well documented and very well standardised process. Be it Electronics Industry Association 632[3] or IEEE 1220 or all have one major thing in common. They state their objectives as the "translation of a set of stakeholder requirements to a balanced and verified solution". Balanced by lifecycle costs and verified by checking that in your design solution, your specification is achieved layer by layer as you break it down into systems and sub-systems has been checked and the numbers required measured and achieved.



You will notice that the Technologies Model steps through the classic Systems Engineering arrangements of firstly; define your needs, establish a concept of how you're going to deliver it, have feedback loops so that as you learn and as you check outcomes you can revisit your needs and re-negotiate their essentiality. From there you move through to Specification – but not until you pass through a process of Concept Validation to remove high risk that may be evident in the conceptual solution. Examples of high risk are; tasks that you've never done before; materials that are unfamiliar, processes that are not normally practiced in your organisation.

Having established a technical specification suitable for acquisition, we can now flow through that other set of actions in this integrated support area which, like systems engineering, has standards that define how it's done,

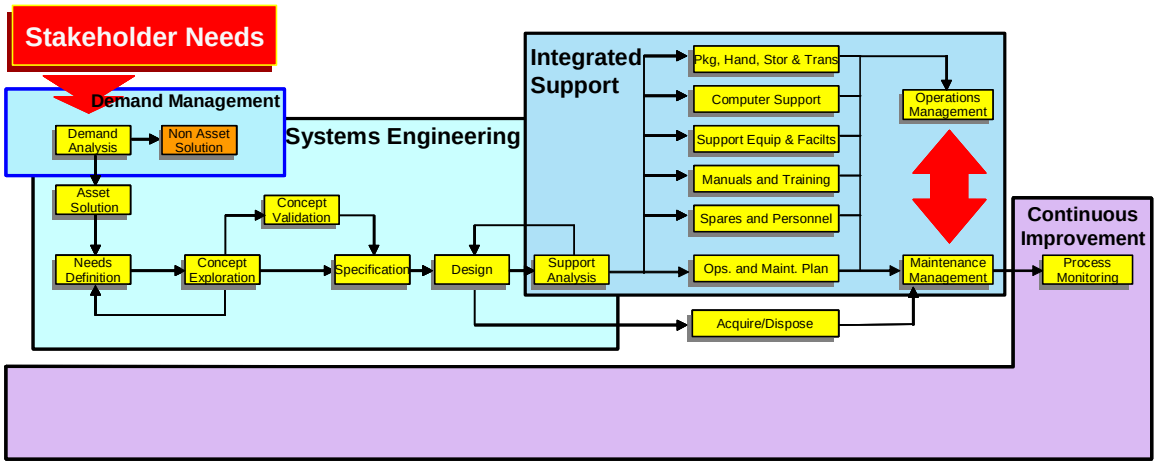
[3] Electronic Industries Association EIA 632

you could go the military route if you are game, with an equivalent to US Military standard 1388[4] or you may pick one of the more commercial type definitions of how to do standards as put out by IC. How to do integrated support as put out by IC. Either way, you can't come out of that process with a set of assets and a set of support connected to maintenance management and operations management that acts in concern with each other and that large red arrow reflects the way in which organisations must connect these two things together so they behave as a team.

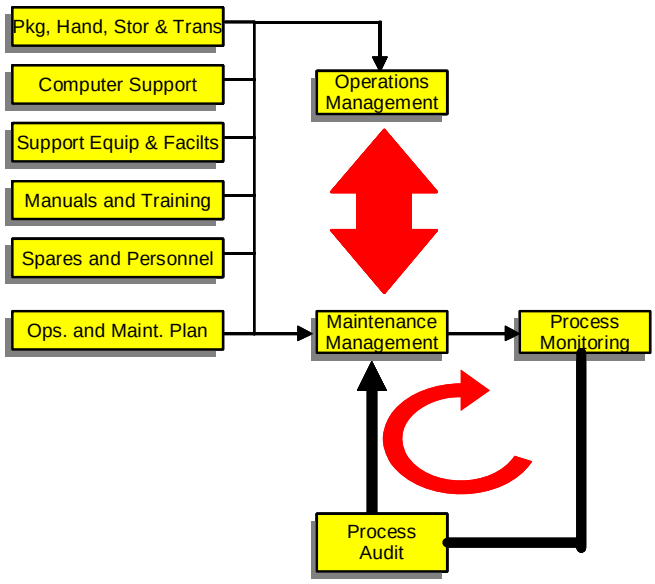
In my youth; when I graduated, some of my first work was on a flight line in the Royal Australian Air Force with Mirage fighters and to me, that intimate relationship between the pilot as the operator who understood that aircraft and the maintenance team that looked after it was almost symbiotic. No pilot would ever think of not telling the ground crew exactly what was wrong with the aircraft, often in great detail, when they returned from their mission. This was a normal thing for me, but the 'real' world is not always like that, and this model reflects the essentiality of the operations and maintenance functions working as a team. A recent excellence award (AMEA) judging noted the connection between their maintenance organisation and their operations organisation. They were twinned – they thought together, worked together and solved issues together.

Continuously Improving

We've now reached a point in the model where we have identified our stakeholders, polled their needs; translated those business needs into a specification and established a design solution. We have also established a support solution and we're using it in operations and maintenance.



Did we get it right? Well, probably not. A whole set of assumptions were made during the design process. People used them in calculations without clearly understanding an outcome. The world might have changed between the establishment of the requirements and the delivery of the systems. It's their actual usage that gives us information that enables us to verify these things we have done; these things we have asked people to do. So we establish at the back end, the beginnings of the feedback loop. We started by capturing the process monitoring of what is going on in the delivery of those operations and maintenance arrangements. We then feed it back and there are a series of loops in the model that are critical; they're not accidental – they are critical in sequence and in structure.



The first one is actually quite evident to most people. ***Are we doing what we said we would do***? That audit process that checks what people are actually doing in the operations and maintenance work space is what they in the organisation agreed that they would do. The detail of all these tasks and their frequency is defined by the various Operations and Maintenance Plans. The resources for these plans are defined in the integrated support box (i.e. Spares, Personnel, Training etc) and shown in the diagram as the drivers of the Maintenance

[4] US Military Standard 1388-1 and 2, Logistic Support Analysis and LSA Record.

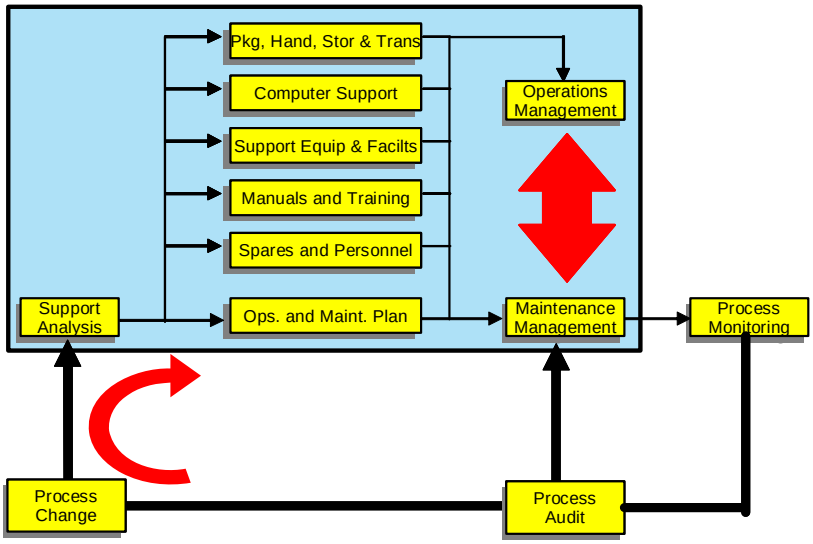
and Operations Management functions

Regrettably in the world at large, that is often not the case. People don't always follow the integrated support arrangements that have been established for them. They don't read manuals. I mean, I always do that myself when I start opening a box with presents, or whatever. I read the instructions and start using it – yes, obviously that's not the case. Often people do things without reading instructions and using manuals.

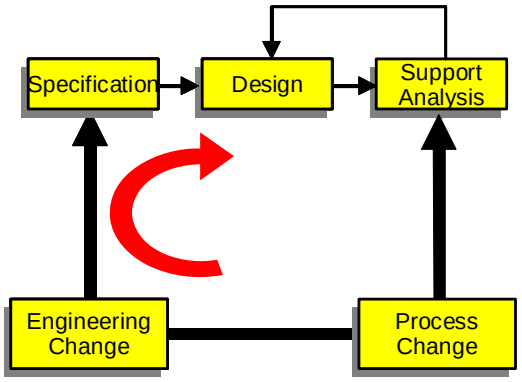
People become common and familiar with the things they do and often intended change doesn't reach them. But if, for some reason or other, people are not doing what they are meant to do in this space, the rest of the assurance loops – in terms of improvement – is likely to be worthless because it's the information that's collected and created in this first loop that enables us to work out "have we asked people to do the right thing?"

And that leads us to the next loop – where we take the information collected from doing operations and maintenance and we feed it back into the support analysis process and we work out "***Did we ask these people to do the right thing?"***

We may find that they have discovered that our mean time between failures is not the one that we put into the calculations; we used estimates from international databases and failure rates from other companies and test programs, but the reality of our operations is different. What we can now do is, with greater confidence; go back into those support analyses, change our maintenance operations and likely change our operating activities as well.



The range and quality of asset and task related information we collect as we deliver our operations and maintenance will determine the quality of our support analysis decisions and consequently the quality of our operations and maintenance plan. If our culture does not support an open and honest approach to what our staff do and what information they collect.



When we have the support area sorted out, we can then move on to the next one, which basically is "Do I have the right asset - have squeezed everything out of this existing asset configuration that I have. I now, if I want to improve my processes cost effectively – I now need to change the asset itself". I revisit the specification and I create a new one.

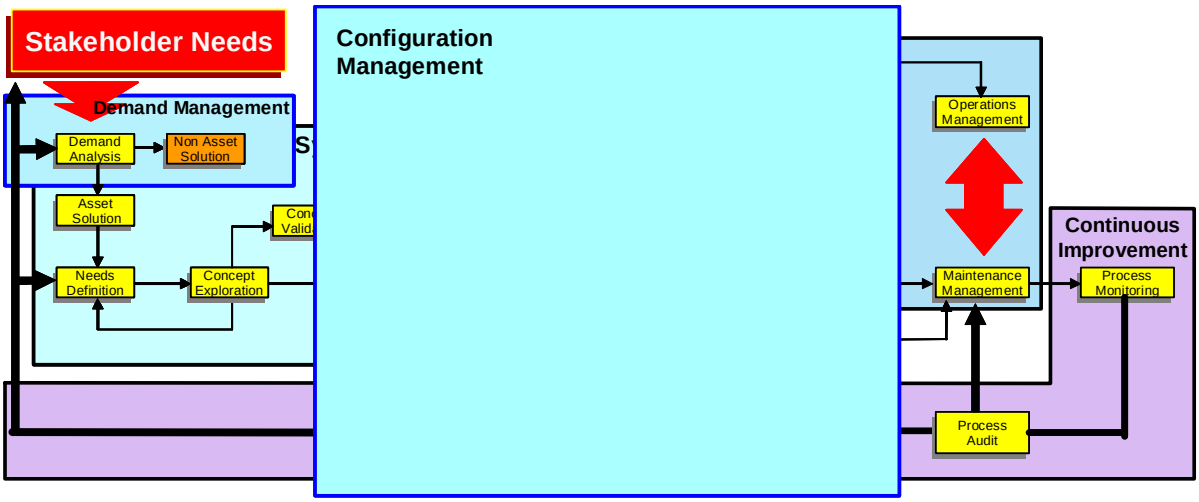
Now I don't just go and get something – a model off the shelf or something quick to go through this; I go back through the process again. I go back through a design process that considers the life cycle costs etc. So the loop goes back around through again and verifies that that a configuration change solution is appropriate.

Configuration Management

I've now said the magic words – "Configuration Management". Certainly the AM Council and my own impressions are that this is likely the most poorly applied technology in most organisations. They do not formally manage the functional and physical configurations of their asset systems.

Configuration Management is the guardian of the entry into the asset management game. It guards the gate through which the functional requirements flow into Specifications from Needs Analysis and Concept Exploration. It knows that if you change the functional requirements for a system it is likely that you will change possibly the design and likely, the support requirements so therefore one needs to check and say "these are the implications. Do I still want to make this change? Is it a worthwhile thing to do?"

Configuration is often viewed by people as the physical structure. Not so. The international standard EIA 649[5] consensus standard for configuration management is virtually the world standard. It's eliminated the well-known military standard – MIL Standard 973[6]; and is more substantial than ISO 10007[7]. What it says is that there are two primary configurations. Yes, there's the physical, but there's also the functional. An item has a functional configuration that needs managing as well as a physical. Additionally, what that Standard says is that there is a set of Derived Information associated with that configuration.



Derived configuration information is of course your Integrated Support information. That is, your maintenance plan, your manuals, your training – because a configuration variation changes the functional or it changes the physical it will inevitably impact on the derived or 'supporting' information. The EIA Standard brings all three together in a process block called "Managing Configuration". Good CM is critical to any organisation. Many major infrastructure accidents have been found to have configuration management issues as a root cause. It is a major driver of major incidents and major losses across many organisations

Completing the Circle

We can now move on and we close the loop again, back through the deciding requirements at the front end. This now gets a bit political and organisations have different structures for how they handle these inputs. Have our stakeholders changed? What are the key asset related risks we must manage? Do we need an asset solution? Are our Needs Definitions correct? Does it match our stakeholder's expectations and how they want us to deliver capability? Are we delivering triple bottom line outcomes?

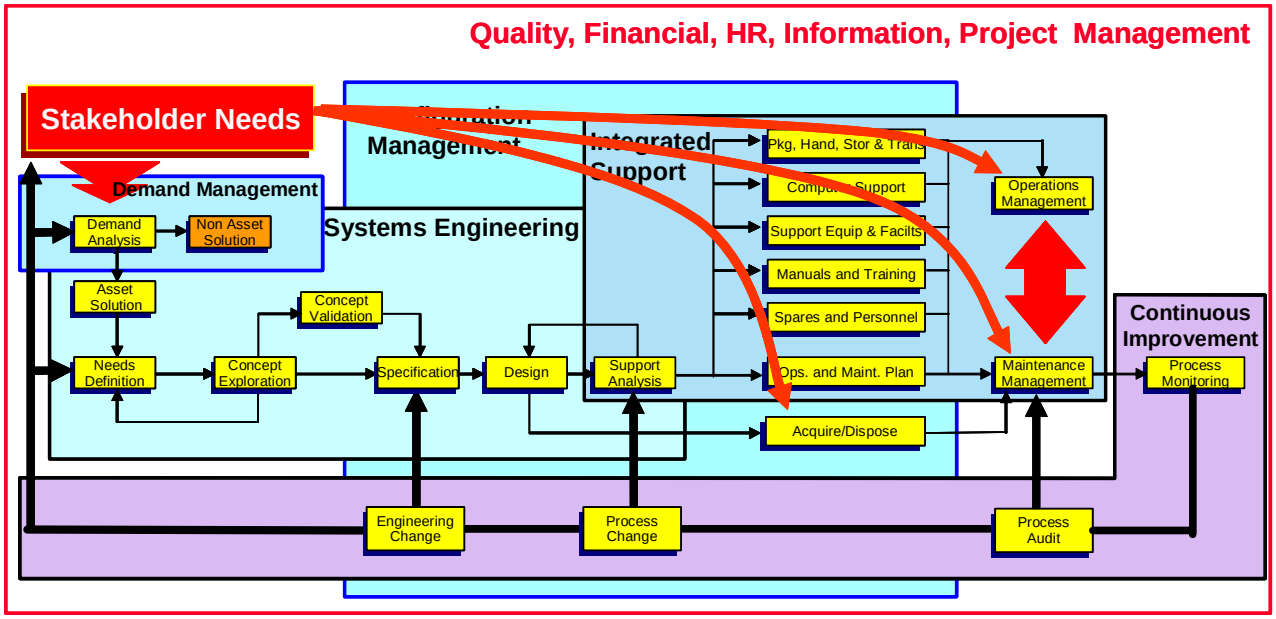
We can revisit demand analysis; we may bring in new laws to stop people using as much water, our decreased pressure to keep our water pipes lasting longer; we may push back on demands for better services or press for lesser services. We establish strong relationships with stakeholders and develop sound negotiating approaches to communicate openly and honestly with stakeholders. We may revisit our solutions and look at existing non-asset and asset solutions given changes in technology over time. And finally, we may revisit our stakeholders. Do we know who they are really? Do we know what think and do and what they want?

So we've now gone full circle. Starting with stakeholders, managing their demand and establishing relationships through this concept of demand management using well known practices and standards for systems engineering, integrated support, the integration of operations and maintenance management in an optimal way and finally, such great techniques as root cause analysis and dare I say it 6 Sigma, ISO/IEC 3937 Risk Analysis techniques– and other ways in which we can assure ourselves that we are closing the loop on the performance of our existing asset. But there's more.

[5] Electronic Industries Association

[6]

[7]



We have defined only the technical process through the centre of Asset Management, we have to wrap it up with some global processes that apply to all aspects of the PDCA process. In our model, have included Quality Management, Project Management, Information Management, Financial Management and other global management techniques that all have to manage the systemic core process.

Summary

So let's look at if we can block it through – we're going back to the plan, do, check, act process and as you can see, this model exhibits that as a characteristic. We have at the front define the need, design the solution, implement that solution, sustain that solution and improve that solution. Plan, do, check and then loop back around again and act on what we have discovered. This is that circle of the Technology's Model that makes up the windmill at the centre of the Asset Management Capability Assurance Model.

It is likely this model will grow and change over time as it has since it first saw the light of day in 1991 and has morphed a few times and I'm sure it will morph yet again as Asset Management evolves into an accepted and essential profession in modern society.

At this stage I'll say, thank you for the opportunity to present these models to you and so I'll hand over to the MC.