

U.S. Navy Sustainability Management System Program - Practical Application of LCA/M
By Patrick R Vasicek, P.E.
Art Anderson Associates

Introduction

Life Cycle Assessment as a science has been implemented by all kinds of methods from the extreme quantitative, through weighted averaging computational techniques, to the extreme qualitative, including using Qualitative Spatial Reasoning techniques. The results have been interesting, perhaps even promising, but not altogether satisfying. It seems that estimating the true life cycle cost for any given alternative likens itself to the problem of predicting economic trends. If economic trends were mathematically predictable, then everyone would be a millionaire. Accordingly, I don't think anyone would propose that economics could really be predicted through mathematical models. Likewise, life cycle decisions involve a myriad of factors, not many of which are truly quantitative, too many of which are indeterminately qualitative.

Please don't think my critical paragraph above, in any way, discredits the importance of determining life cycle performance of items and systems. In fact, I believe this pursuit to be one of the most important the human race has ever pursued. So important it is that our very survival depends on our finding a satisfactory solution. The sooner we find solutions the better.

Enter the human brain. This unique concoction of bio-molecules, electricity and stuff yet to be understood (perhaps spiritual?) is not a mere computational device. It is also not a mere neural network. This wondrous creation and the body it is connected to form the most powerful problem solving system on the planet. There is no problem big enough, complex enough or terrifying enough to which human beings, as individuals or as groups, could not or would not attempt and probably find a solution.

I offer my introduction to you as an idea that it is very likely that Life- Cycle Assessment and Management are problems fit for the human brain, and no other vehicle will suffice. That makes this whole science of LCA/M very much more than an engineering problem and very much more than a sociological problem. It means that the problem is too fuzzy for math, and not resolvable with machines. I will go one step further and state that the use of mathematical tools to attempt to resolve life cycle decisions only confuses the issue and clouds the real goal. In business terms this also means that a very different type of consultant is required to stimulate proper activity.

The solution in search of a problem

Sustainability is strategic. That is why it costs real money to make it happen. That is why it never happens. Developing strategies takes money away from production. Implementing change also takes away from the bottom line. That's why real change almost never happens. Just open the history book – the human race slides back into the cesspool every so often - always for the same reasons. So far, we have always been able to climb back out of the hole. That doesn't look like a good business strategy to me. Maybe one day, we won't be able to dig our way out.

Sustainability is common sense. What happened to that? We calculated it out of existence – that's what happened to it. The human brain knows better than that. It knows we are

important because of our common sense. It knows we are stupid because of our lack of common sense.

Sustainability is stewardship. That is why we were put unto this earth. No other entity on the planet has the capability to do it. Therefore, we must. It is that simple.

So, Sustainability is the solution. But, what is the problem? The problem is death - death to the little ones, death to the disenfranchised, death to the human race, if we do not wake up in time. A death that is as inevitable as the force of natural law. We do not need to let it happen. If we work together to use the power of innovation, intuition and reasoning, then an amazing turn around can begin to occur. Stewardship is really quite effective and quite rewarding. It is also necessary, even if difficult.

The Problem with Comfort

How does one figure out what is the best life cycle scenario that fits a given system? Math does not work. Dartboards probably won't work. And, another meeting will not resolve it. Like the proverbial carpenter in search of the right device to work the wood, we feel a deep need within our guts for a tool to give us the answer. Hate to disappoint you, but there is no answer, only a challenge - a challenge to match any other challenge, a war to end all wars. And, the enemy is comfort.

Algorithms are comforting. Consultants are comforting. The future is not comforting. Stewardship requires individuals and groups to go outside of their comfort zone. Perhaps even to seek a goal that appears to be a little crazy. I never cease to be amazed at how humans working together as teams, always seem to achieve whatever goal they set for themselves. They don't do this because they are comfortable; they do it because they decide to share the discomfort.

Sustainability Management Systems – A Pilot Program

All of the above sets the stage for a new concept on how to carry out a Life Cycle Assessment and how to actually do LCM. Since the true life cycle impact of any decision is really never known until after, in some cases, long after, implementation, it makes no sense to attempt to calculate it. In fact, since it is rare that anyone actually measures all the required information required to carry out a true LCA, it is doubtful that the Life Cycle Costs are ever known. Quantification makes even less sense in the context of the myriad of other interdependent decisions and variables that determine an organization's move into the future. In fact, any use of mathematics to resolve the sundry of quantitative & qualitative evaluation factors leads to an immensely false feeling of comfort – a comfort to be enjoyed at your own peril.

In my efforts to weave LCA/M techniques into a Pilot program to implement a Sustainability Management System for the U.S. Navy, I found the seeds of an idea for a new method for establishing an optimal life cycle scenario for a given set of operational parameters. The method begins with a typical environmental aspects/impacts analysis carried out per ISO 14001. Environmental impacts are like sins, they are ever present and are not new concepts. They have existed since man lit his first fire. In other words, these are things that are pervasively known throughout an organization already. It is not too hard to figure out an organization's impacts. Environmental impacts translate to waste (mass & energy) and negative impacts on quality of life and productivity. These wastes and negative impacts are directly proportional to

our stupidity. To those of you who take offense to my use of the word, stupidity, I will point out that recognition of our own stupidity is the first step towards excellence.

Most sustainability models and definitions drive one to conclude that the overall sustainability goal should lead us to zero waste and zero negative impacts. Now, neither of these may be feasible nor good business decisions in the current state of affairs. It is another artifact of our enemy, comfort, that we feel that goals need to be achievable or feasible. Heaven forbid that, in today's risk-averse culture, we should set a goal that we do not and probably could not achieve! For sure, when we aim at mediocrity, we generally get something less than that. As we continue to shoot lower and lower, eventually we only aim at our feet.

"Lofty goals" is a term I picked up as our team struggled with a method for implementing sustainability in a systematic way. Lofty goals are somewhere between "zero waste, zero negative impact" and mediocrity. Some would call them "stretch" goals. They consider reasonable constraints, but are not necessarily limited by those constraints. An example set of Lofty sustainability goals is shown below:

1. Reduce traffic congestion and **Air emissions by 85%** by 2025
2. Reduce Impacts to Marine Mammals and Endangered Species from training without a reduction in training activity
3. Reduce stationary source **air emissions by 85%** by 2025
4. Sustain **all activities** on all installations **using renewable energy** sources and generate all electricity on each site by 2025
5. **All facilities** adhere to the **LEED Platinum standard** for sustainable facilities by 2025
6. Cycle all material use to achieve **ZERO net waste** by 2025
7. Obtain healthy, resilient regional lands and water that support training, ecosystem, cultural, and economic values by 2025
8. Recover **all listed and candidate federal species** on all Properties in the region
9. Cascade water use to achieve **ZERO discharge of wastewaters** by 2025
10. At all installations reduce **potable water consumption by 75%** by 2025
11. The Navy contributes **no pollutants to Groundwater** and has remediated all contaminated groundwater by 2025
12. Develop an effective **regional aquifer and watershed management** program by 2015

While the mix of goals is obviously tuned to the impacts of a specific region, and the functions carried out within that region, one can see that there is a great degree of universality built into these goals. Also, it is key to remember that these goals only constitute a starting point. Sustainability is a journey, not a destination. The same is true for Life Cycle Costs.

Where' s the Beef?

Notice that very real life cycle decisions have been made in assembling the above goals. However, the proof is in the pudding. All of these goals require significant financial/resource outlays over time in order for progress to be made. A fatal flaw, no? Isn't this seemingly good initiative destined to go the way of all previous seemingly good initiatives within government?

Politics plays an important role in moving a large (actually, any) organization towards goal achievement. So does measurement. Neither of these factors is synergistic toward each

other. In other words, political gain is rarely affected through proper measurement of results and accountability makes politicians very nervous. Don't worry, it is not hopeless.

Political direction exists, whether we are aware of it or not. If one is seeking to invoke significant change, then it pays to pay attention to the political winds. In the case of our pilot initiative, we were fortunate to seize on a connection to a statewide program to implement sustainability. This caused an alignment of senior management within the region toward the concepts of sustainability. No real change can occur without such alignment. Senior management wields the purse strings, and all change eventually equates to major reallocation of resources.

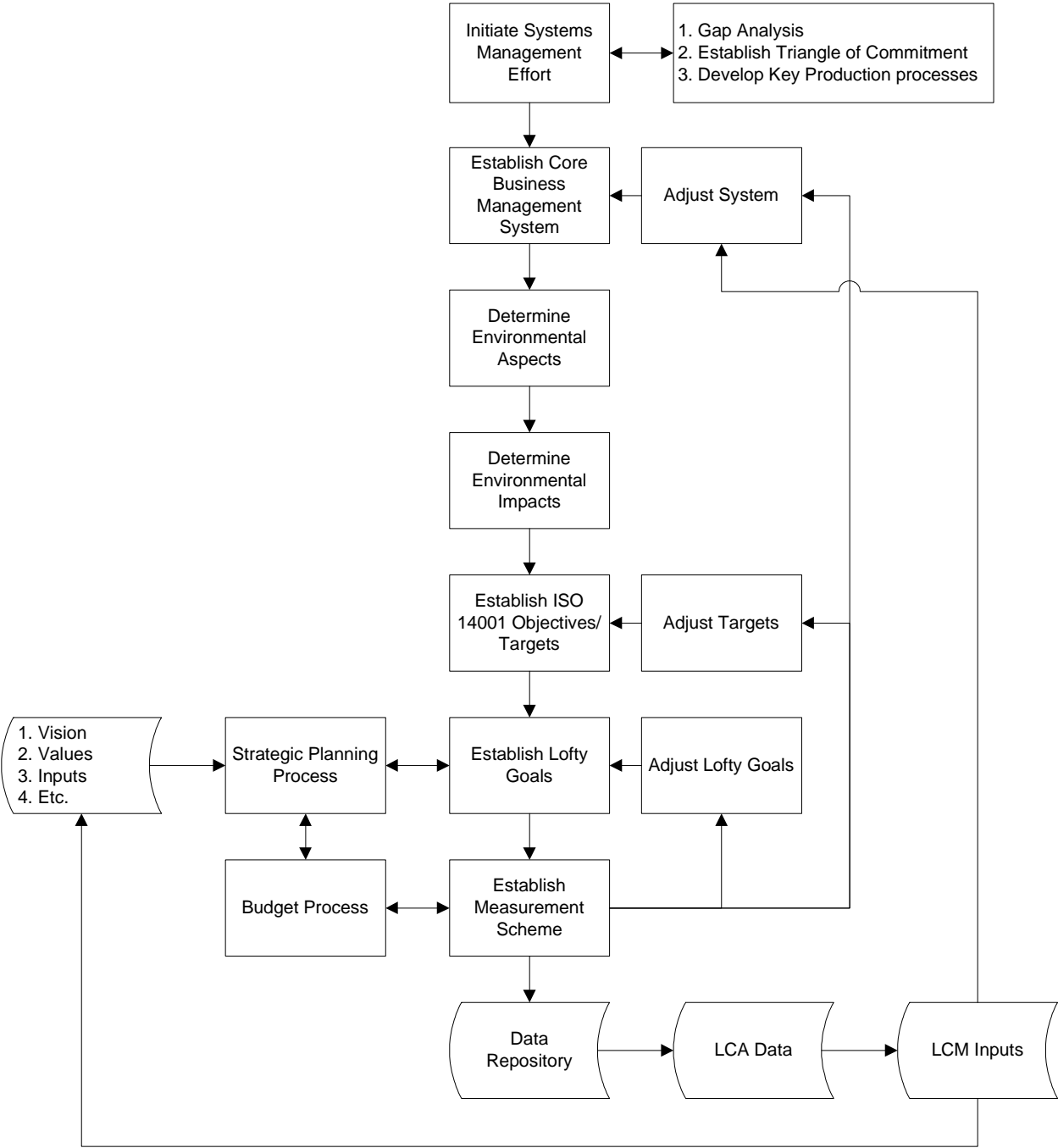
What happens next is crucial. A set of ISO 14001-like annual objectives and targets must be developed to establish a pathway toward achievement of the lofty goals. Top-down support can be leveraged to alter the allocation of funds in the ongoing budget cycle to support these annual targets. A regimen of metrics must be developed which are tied to the annual objectives and targets (part of an ISO 14001-like business management system). Early successes in achievement of these objectives can then raise the level of attention to the importance of the systems management components necessary to sustain improvements. An incremental move towards systems management approaches begins to occur. This can be further sustained by achievement of more difficult intermediate objectives and targets. All this represents is a way to begin a spiral upward on the sustainability scale.

The life cycle costs of any given product, system or whatever, become known via the measurement effort that takes place during progressing of the goals. This makes it possible to make better decisions on how to modify the goals to better match reality and to ensure the organization continues to meet mission/business plan requirements. What this does is to cause organizations to actually use their strategic planning effort and life cycle costing information to manage future risks and seize future opportunities.

The LCA/M and Sustainability Relationship Map

The process I describe above is not complex, but I don't want to give the impression that it is trivial by covering it so briefly in only a few paragraphs. To carry out LCA using the techniques I am proposing involves using the entire organization, including its inputs, to optimize its life cycle posture. It involves changing the management culture as well as the organizational goals. As I stated in the beginning of this paper, I believe that there is no other way to even get close to the optimum life cycle answer. Below is a flow chart that summarizes these concepts:

LCA/M & Sustainability Relationship Map



Conclusion.

The stakes are high. Time is running short. There is much, much money to be made. And, no one need be left behind. Our planet is a village, of sorts. We take care of our village, especially our people. LCA/M is a tool we can use to help us discern if we are making incremental steps toward sustainable cost effectiveness and quality of life. LCA/M, as a tool, is anti-mathematical because it is time-dependent and a variable that is truly independent of knowable influences. The humans in our village, any village that we pick, have the problem-solving ability, through the power of their relationships, to solve the life cycle optimization problem. They also can work together to build a sustainable planet, one that is worth living on. These same people also have the power to ignore the obvious signals and allow our civilization to degrade again, perhaps to extinction. Tough choice.