STRATEGIC CAPITAL - A FORMALISM FOR INVESTING IN TECHNOLOGY

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Abstract

Spending decisions in cable today are complex. Long gone are the days of prioritizing OPEX over capital or purchasing via simple volume related discounts. Capital is now under an intense microscope. This paper presents a way to strategically and logically determine the optimal purchase price that will minimize the total cost of ownership, identify ways to drive efficiency into a workforce by identifying the proper division of labor and it will make way for the possibility of technological innovation through a 'creative destruction' process that will enable long-term growth.

INTRODUCTION

Currently, telecommunications service providers face stiff competition with new entrants every day and must search for solutions to the challenges and difficulties of growing revenue as well as margins. They must do this while dealing with the continued high fixed cost of doing business and the multitude of seemingly simultaneous priorities. Additional pressures exist due to operators being evaluated on a free cash flow basis. Under the existing economic climate, more often than not, this pressure is mis-prioritized and translates to demands for lower priced Customer Premises Equipment, or CPE. When this happens, a caustic force is unleashed that actually increases total costs and negates the scientific possibility of technological innovation. Due to the many ramifications of such a decision, the development of an evaluation schema is required.

This paper provides a formalism for a new way to think about how features in equipment that have the potential to translate into lower costs over time can be objectively and agnostically assessed. After this valuation is completed, decisions that optimize performance and lower OPEX can be made at the time of purchase. A specific example used is the consideration of strategic technical investment in CPE diagnostic elements that optimize operational costs by identifying applicable processes and the possibilities for the proper division of labor. It is shown via this formalism that through this type of upfront investment, service providers will reliably identify and improve not only their fiscal position, but also the quality of customer experience and will be well armed for the ever-evolving subscriber/revenue battle. Lower operational costs via these types of strategic technical investments in CPE will be shown to have additional advantages that can be evaluated using the formalism to determine how they would aid in improving capital efficiency and the ability of a cable operator to react even more quickly to new service needs and market forces. Finally, the formalism will provide a mechanism for operators to determine which new features are critical enough in long term cost-benefits to warrant standardization so that all equipment supports the features. A key goal of this formalism is to implement the type of industrial efficiency and quality envisioned by the likes of Frederick W. Taylor and W. Edwards Deming by specifically coupling equipment procurement decisions into a longer-term process of continued technology improvement to enhance the competitive position of cable operators. But another goal is to provide a mechanism for the type of disruptive process of transformation or 'creative destruction' via new equipment and service capabilities that accompanies the kind of radical and rapid innovation that is the force that sustains long-term economic growth.

FINANCIAL PRIORITIZATION

Opinions vary as to where, when and how our current economic climate started, be it deflation, deleveraging, debt accumulation, etc. associated with the housing & financial bubbles. Initially, the economic downturn actually benefited service providers as consumers limited their expenses for activities like going to the movies. The desire for entertainment was still strong so subscribers turned more and more often to home entertainment services. While the concern over the potential for a significant age of deflation was being ignored by the masses, some companies began to feel the real impact to their top and bottom lines. Telecommunication service providers seemed to initially weather the storm, however, as the economy kept declining and lagging, its impact to these providers began. To the credit of the industry, bold changes began happening, but not all the changes were for the betterment of the business in the long term. One example of this is when operators reduced expenses but cut not only the fat, but also the muscle and sometimes into the bone. In the short term, when these changes were looked at in a silo they appeared to be very reasonable; however, when you couple such decisions with being evaluated on a free cash flow basis, some very dangerous things happen. Purchasing organizations are incented to drive prices lower and lower, which in itself is the right intent. The danger is when decisions on capital purchases are based purely on purchase price. When this happens without taking into consideration the 'hidden' costs in operations, the total cost of ownership can far outweigh any purchase price savings. Additionally, technological innovation is stymied and the possibility of the 'creative destruction' process for sustained fiscal growth vanishes. Joseph Schumpeter popularized the idea of 'creative destruction' based on the economic theories of Karl Marx and he believed innovation shifted the powers in a market place by the introduction of new competitors and that 'creative destruction' described the dynamics of industrial change.

In order not to limit a new age of industry pioneers, a methodology is needed to holistically evaluate purchasing decisions that will lead to the most strategic investments in capital possible. A formalism is presented here that identifies a new parameter called Optimal Purchase Price, which takes into account a wide array of considerations one could use when negotiating equipment purchases, whether that be with a vendor or with the purchasing department within their own company. This prescription for strategic capital purchases leverages a Total Cost of Ownership, or TCO, approach and is not a Cost Benefit Analysis. Performance differences between pieces of equipment should be evaluated relative to the importance to the purchaser. This formalism looks at capital investments from concept to test to deployment to operational integration to trouble resolution to future proofing.

OPTIMAL PURCHASE PRICE

To begin to define the Optimal Purchase Price or OPP, a base upon which can be built is required. That base is the traditional, actual purchase price that an operator would pay for a given piece of equipment. While this paper does consider equipment throughout the network, from the national distribution centers through the backbone, headends, hubs and HFC plant, the predominate evaluation comes from Customer Premises Equipment, or CPE.

Traditionally, the purchase price is evaluated on a Return on Investment, or ROI, basis. ROI is a function of base purchase price, BPP, average revenue per unit, ARPU, and average expense per unit, AEPU. Essentially it is the time period that operational cash flow takes to recover the capital purchase, usually expressed in a number of months.

$$\mathrm{ROI} = \frac{\mathrm{BPP}}{\mathrm{ARPU} - \mathrm{AEPU}} \qquad (1)$$

For the purpose of this formalism, a normalized payback can be considered. One characterization of this is seen in Figure 3.1.

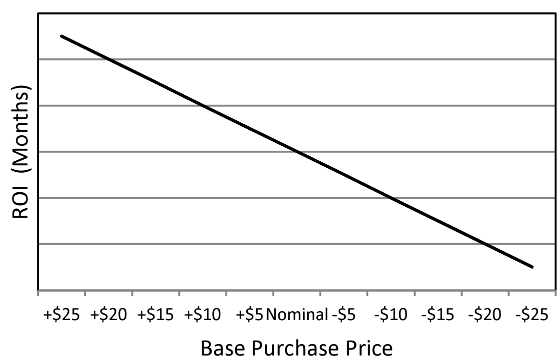

Figure 1

This curve is linear but it certainly has multiple Purchase Price Factors, or PPFs, which can influence it non-linearly such as PPF_1 which accounts for equipment volume discounting or other price influencing factors. Another adjustment that can be made on the base optimal purchase price is differential pricing for multiple organizations or PPF_2. One example of this is sometimes referred to as most favored nation pricing. For a given operator PPF_2 is ignored, but is a valuable tool for a comprehensive analysis across multiple perspectives.

Once the base OPP is established, the incremental components of total cost factors must be defined and evaluated.

<u>Pre-Deployment Test Cost</u>

Before the operational cost impacts of a deployed device can be considered, an evaluation of Pre-deployment Test Costs or PTC must be made. These apriori considerations include:

- Software, firmware and hardware related costs that come from issues that are identified in lab or field trial evaluations and require new versions prior to deployment. Each of these costs has a related scale factor based on the likelihood of needing multiple revisions. Software typically requires 10-20 times more revisions than hardware or firmware.
- Lab testing costs which encompass lab setup, test, evaluation, post analysis, tear down and personnel costs, whether performed internally or externally to a given operator.
- Field trial expenses including training, planning, trial management, field and customer care resources, increases in calls and truck rolls as well as tangential components to account for costs due to customer dissatisfaction and poor press.

$$\mathrm{PTC} = \sum_{i,j,k}^{n} (SF_{SW} * Sw_i + SF_{FW} * Fw_j + SF_{HW} * Hw_k) \quad (2)$$

Each component has built into it the number of resources in the lab, field and management of the project, the associated costs for these resources and the time it takes to resolve the issues that have been identified.

<u>Cost of Deployment</u>

Once a piece of equipment has made it through the lab and field trial hurdles, deployment begins. Operators use multiple strategies for deploying new hardware, firmware and/or software. Deployments could start from a few friendly users to a small market with limited deployment, all the way up to a national or company-wide roll out. There have been numerous situations where small deployments did not identify operational issues until an appropriate level of scale was met. As such a fiscal evaluation of deploying new technology must be used. The Cost of Deployment, or COD, is proposed and is a major component of OPP.

The most influential factor in COD is the increase in trouble rate. This increase has been shown to add a significant cost to doing business. When a piece of equipment from a new supplier is introduced into the field, the customer-reported trouble rate can increase, CRT_i, as much as 30 percentage3032733840 points. There are numerous cost drivers when this happens such as: increased calls into customer care, CC_c, increased truck rolls, TR_c, both valid and in error (traditionally 10-15% of all trouble calls into customer care translate into a truck roll in error) and resources on the team that manages the tickets being worked, TM_c.

$$COD = f(CRT_{i,}, CRT_t) * (TR_c + CC_c + TM_c) \quad (3)$$

Pick a dollar figure for a call into care, a truck roll and a hourly labor rate and you will see how significant this parameter can be. But that is just the beginning as this is a problem that just keeps on giving. There is a major influence on all of these expense increases, namely, the time it takes to get the customer-reported trouble rate back down to normal levels.

As seen in Figure 2 below, getting back to the normal trouble rate can take 18 months and with new technology or product introduction this can be even longer.

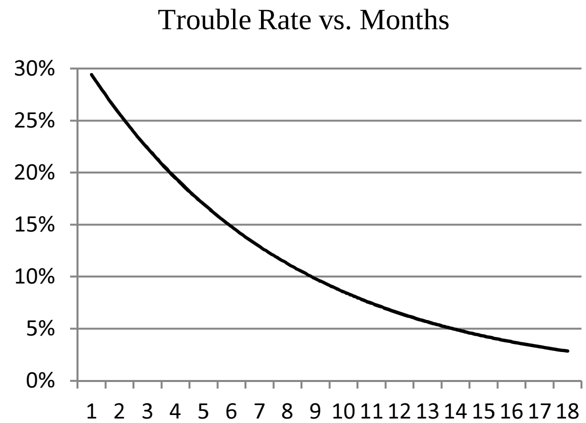

Figure 2

Equipment Combo Factors & Locale Weight

As mentioned in the introduction of OPP, the major focus of this paper is on CPE even though there are other network equipment influences (NEF) built into the formulation. Equipment Combination Factors, or ECF, take into consideration what services can be enabled on a given piece of CPE and what actual services a customer is paying for on that CPE, this is referred to as CPE_F. For example the lowest ECF components are stand-alone set top boxes and cable modems. Just above that are home gateways, WiFi enabled modems and eMTAs. Additional weighting is applied to devices that carry critical services like lifeline voice and home security, CPE_w. This is reflected in the matrix operation to determine ECF.

$$ECF = [CPE_F] * [CPE_W] + f(NEF) \quad (4)$$

The location of the equipment being deployed also has an impact on the overall total cost that needs to be considered and is reflected in this analysis as ELF. Factors considered in ELF include every locale where equipment could be deployed (EDL) from the home through the HFC network to the backbone and into national data centers. The degree of influence that errors associated with new deployment have on the customer population is weighted appropriately (EWF). This weighting function is proportional to the number of subs potentially impacted by it and a characteristic function of the device itself.

$$\mathrm{EWF} = f(\mathrm{device}) * \sum_{i=1}^{n} (\mathrm{subs})_i \quad (5)$$

The functional combination of these two elements provides the overall equipment locale weight, which can be seen in Figure 3.

$$\mathrm{ELW} = f(\mathrm{EDL}, \mathrm{EWF}) \quad (6)$$

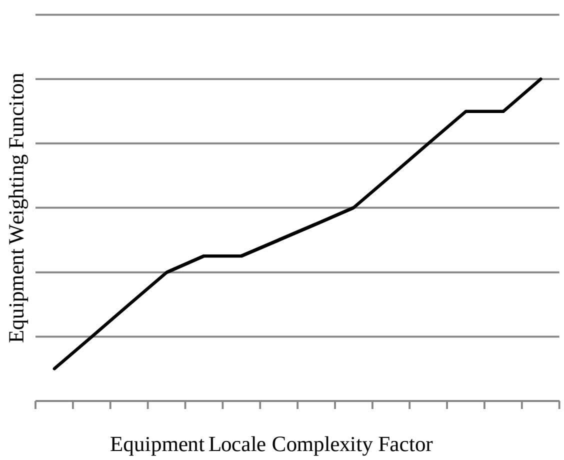

Figure 3

Optimal Ease of Use

Whenever a new piece of equipment or software is introduced into service, there are some differentiators between products that can have an impact on real operational costs. Training is the first element in the calculation of Optimal Ease of Use, or OEU. Training material must first be developed. These could be as small as talking points posted to a call center knowledge base or as involved as a multi-day, hands on session with a live instructor. Once training is developed, the degree of complexity, which can be correlated to time off the job, varies as described. But it is not only the length of training that is of concern, it is the complexity associated with it and the probability that repeat training would be needed. Representing the training aspects of this analysis, Training Development & Deployment, or TDD is used.

OEU is also influenced by the degree of difficulty or ease with which a user can debug and solve a problem on a given device. This is reflected in the Total Time Usage Factor, or TTU.

Standards are so well embedded into our daily life that the average worker rarely, if ever, considers the impact of standards. The Standards Product Factor, or SPF, is a factor that lends itself to the ease of integration, training, etc. when compared with non-standards based products. Standards based products allow for efficiencies to be realized and this can lead to a division of labor which can re-purpose resources to more important and complex challenges.

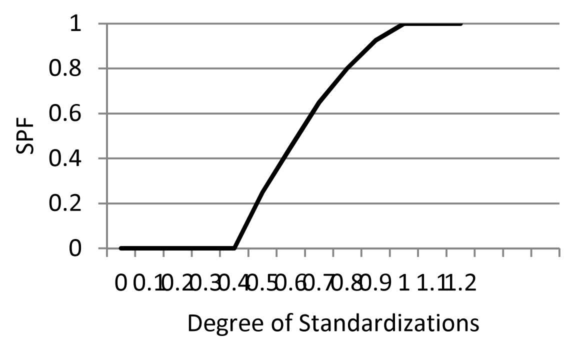

Figure 4

SPF can be looked at as an inverse function so that if a product is standards based, it will help lower the total cost of ownership. This leads to the formulation of OEU.

$$\mathrm{OEU} = f(\mathrm{TTF}) * f(\mathrm{TTU}) * f(\mathrm{SPF}) \quad (7)$$

There are multiple other considerations that could be included in the OEU calculation such as: how much a technician likes a particular product and thus an internally created efficiency of how it helps improve his or her daily work duties; the support provided by a particular vendor; or the creativity and innovation instilled in an employee inspired by the technology and associated ease of use.

Customer Type Factor

The customer must not be forgotten in this analysis, so the introduction of an OPP parameter for the customer is necessary. CTF, or the Customer Type Factor is a complex, non-uniform variable that is heterogeneous in nature. If only one service was provided to a customer and each customer had the same propensity for calling when things didn't work correctly, assessing the CTF would be a much simpler effort, as opposed to the ever growing number and complexity of products a customer may have, as well as the level of, or lack thereof integration that exists. CTF is a function of the products or services a customer has, their likelihood to call into customer care based on a characteristic distribution, the number of different revisions of software, firmware and/or hardware and the types of equipment and level of integration of such devices.

$$\mathrm{CTF} = f(\mathrm{products}) * \mathcal{L}(\alpha|\mathrm{x}) * f(\mathrm{revisions}) * f(\mathrm{integration}) \quad (8)$$

An additional component that could be considered in CTF, but is not reflected here, is if an operator were to prioritize service for their most valued subscribers.

Technical Advancement Advantage

Every piece of equipment has its merits and its opportunities for improvement. As rapidly as technology evolves, as well as the associated operations and customer expectations, a relationship between a given piece of equipment and the technological advantages that it provides is proposed as the Technical Advancement Advantage, or TAA. TAA is the calculated as:

$$\mathrm{TAA} = (\mathrm{FPF} + \mathrm{HPF}) * f(\mathrm{CPD}) \quad (9)$$

Both FPF, the Future Proofing Factor and HPF, the Historical Performance Factor functions are characterized similarly as described by following which is then normalized.

$$\begin{array}{ll} \sigma_i \geq 1 & \mathrm{i^{th}\ device\ 100\%} \\ 0.3 < \sigma_i < 1 & \mathrm{i^{th}\ device}\ \sqrt{\sigma_i - 0.3} \\ \sigma_i \leq 0.3 & \mathrm{i^{th}\ device} = 0 \end{array}$$

FPF is essentially the ability of a given piece of equipment to extend its operational usefulness. An alternative, inverse way to think about this would be the less changes required over the life of products from a technological operations perspective. HPF is a confidence value in a vendor who is trusted and has demonstrated past performance of delivering what has been requested. The higher value in both of these factors correlates to a positive impact on TAA and overall OPP.

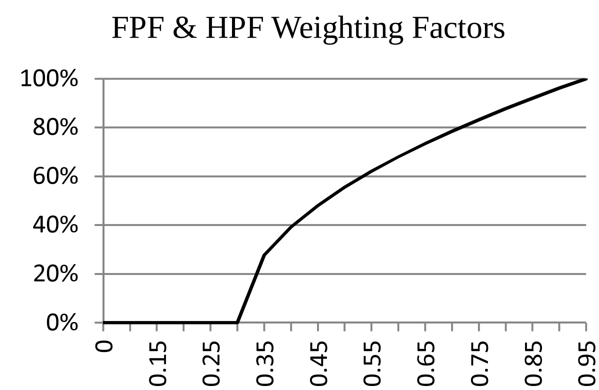

Figure 5

CPD, or Customer Platform Diagnostics, is another proposed functional scaling variable that highlights a piece of equipment's overall diagnostic ability to cross platforms and reduce overall time to repair. One representation of this function is that it gives an increasing, exponential positive benefit to the overall calculation because significant improvements in this area are challenging to come by to say the least.

Each of the attributes of this advanced technology element can be very individualistic and multiple other relationships could be used.

Smart Energy Adjustment

Economic times have made it more difficult for operators find costs savings in their business, but one of the more recent areas of focus is on energy use. Power bills are still a major component of cable expenses and both space and existing power are becoming rare resources. In order to factor energy into the equation of capital purchases, a Smart Energy Adjustment, or SEA, is needed. Presented here are four areas for consideration.

The first component of SEA is the Energy Efficiency Factor, or ε_F, which is a calculation of how efficient a given piece of equipment is. Proposed here is a ratio measure of average throughput and total power used, e.g. bits/watt.

$$\varepsilon_F = \frac{\bar{X}_n}{P_T} \quad (11)$$

Other elements that need to be included in the smart energy calculation are: density (a function of throughput and physical area), size (a function of how much space a given device occupies, particularly critical in centralized equipment locales) and diagnostic ability. For the purpose of this formalism they are reflected as:

$$\varepsilon_D = f(\tau, A) \quad (12)$$
$$\varepsilon_S = f(S) \quad (13)$$
$$\varepsilon_{PD} = f(t, I) \quad (14)$$

The power diagnostic factor, ε_{PD}, is an intriguing area that could have significant impacts on energy consumption and power availability. The ability here is for a device to understand the historical current (or voltage or power) use and correlate it to potential failure modes, essentially looking at energy as a proactive indicator of overall service availability and reliability. This is major focus related to the fiscal health of the industry and an opportune area for further research.

Diagnostic Capability Determinant

One of the most crucial areas of focus in this formalism is the value of investing in technology, particularly in CPE, that can include diagnostic elements that lead to the optimization of operational costs by identifying customer impacting issues throughout the lifecycle of the customer. This identification, as detailed below, can ultimately lead to process efficiencies and thus even greater savings and enable the possibility of even more technical innovation. Characterization of this capability is done through the definition of the Diagnostic Capability Determinant, or DCD. There are four drivers of DCD, the first of which is Pre-Customer Realization, or PCR. PCR outlines the ability of diagnostics to identify a service related issue before a customer would notice it. Ideally, the best scenario would be if an event could be identified before it happens, however, there are events that will always be impossible to prevent. The time variable in the PCR equation accounts for this situation and is reflected in the overall calculation as the duration of an event multiplied by a function of the percent of time that identified instance occurs times the frequency of occurrence. The calculation is shown with a summation because there may be multiple devices with identical alarms that are worked independently by the work force.

Additionally, unique issues can occur simultaneously. The summation is across the total of all of these events.

$$\mathrm{PCR_i} = \sum_{i}^{n} \Delta t_i * f\left(\frac{I_i}{I_T} * \frac{F_i}{F_T}\right) \quad (15)$$

As mentioned, customer-impacting events are impossible to prevent, but PCR identifies how well the diagnostic capability works in a pro-active fashion. When an event actually impacts a customer it is critical that we identify a DCD component that measures how well the embedded software can identify and distinguish an issue and provide information to the service provider to remedy the situation, which is suggested here as the Diagnostic Activity Factor, or DAF. DAF is a nonlinear function that heavily weights quicker resolution of troubles, as is seen in Figure 6.

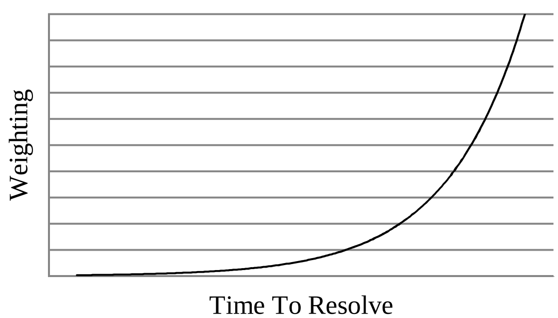

Figure 6

Even with a high DAF, the cause of the problem may not be known. For example, the problem or occurrence may be identified and the problem resolved quickly, which is the initial priority in operations, but the underlying cause was not determined. The Post Issue ID, or PID, addresses the intrinsic value in knowing what caused the problem. PID is a measure of how specific diagnostics are in their ability to identify the actual cause of the problem. Many times using posteriori data can help put new alarm parameters or thresholds in place or identify new process steps or errors in an existing processes.

Figure 7 articulates a scalar multiple that can be used in the DCD calculation. Notice that if no or minimal post problem identification exists, the value for PID is zero. Above that, a three tier value is proposed. These values should be evaluated based on the particular type of equipment in use and the services it supports. Another consideration is how many actual devices are or would be deployed.

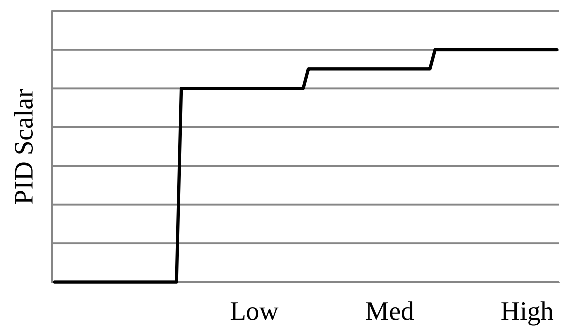

Figure 7

The last consideration in DCD is a proposed parameter that reflects the accuracy of diagnostic recommendations. In operating a network there are many times when data being presented point to a particular issue but when further due diligence is performed, the identified issue is inaccurate. The value of such a parameter is individualized on how important that is to a given user. Here we simply call it Error ID Avoidance, or EID and is a function of user ranked importance, ϕ.

$$\mathrm{EID} = f(\phi) \quad (16)$$

Combining the fore mentioned components of DCD leads to the following calculation. PID and EID are important factors but their influence is adjusted appropriately when compared to DAF or PCR.

$$\mathrm{DCD} = \mathrm{DAF} * \left(\mathrm{PCR} + \frac{\mathrm{PID+EID}}{\mathrm{PCR}}\right) \quad (18)$$

Workforce Effectiveness Principle

The last element of OPP is a parameter called the Workforce Effectiveness Principle, or WEP, which is composed of four parts. The first three parts are directly correlated to the technician using a given device and the fourth is a new concept addressing the possibility of quantifying the ability to distribute labor in the most efficient way.

Two of the WEP components measure a technician's ability to work with a given piece of equipment. Both are straightforward in the sense that their intent is to assess the technician's interactions during installation and troubleshooting. They are called Installation Ease, or IE, and Troubleshooting Ease, or TE. An ideal approach for these factors would be to perform a time and motion study, using the techniques to identify business efficiency through Frederick Winslow Taylor's Time Study work combined with work of Frank and Lillian Gilbreth on Motion Study. This will provide a historical baseline and then a static, multi-tier variable based on a suggested difficulty factor here called, δ, can be determined.

$$\mathrm{IE} = f(\delta_{IE}) \quad (19)$$
$$\mathrm{TE} = f(\delta_{TE}) \quad (20)$$

A less scientific measure, but perhaps even more valuable consideration in WEP is the technician's confidence in working with a given piece of equipment, which here is called the Technician Confidence of Use, or TCU. Anyone who has managed a workforce of technicians can readily articulate the benefits of a confident and enthused team. TCU is a proposed measure to capture just that.

Distribution of Labor, or DOL, is the main driver in WEP and on a macro scale can have the most significant impact on operational expenses. The reason that DOL is so significant is that it looks at the current workforce operations and processes through a 'Scientific Management' lens that Frederick Winslow Taylor proposed and used in the Efficiency Movement. DOL attempts to evaluate the most efficient ways to accomplish the tasks at hand by using advanced diagnostics that will enable the problems to be worked in a more efficient manner. As such WEP is defined as:

$$\mathrm{WEP} = f(\mathrm{DOL}) + \frac{\mathrm{IE+TE}}{||DOL||} + f(\mathrm{TCU}) \quad (21)$$

Due to the inherent complexity for this key component of OPP and because of its many interrelated degrees of freedom, computational algorithmic analysis is required.

Summarizing Optimal Purchase Price

There are a dozen main contributors that have been used to describe OPP. Each of these components has its own level of complexity and interrelatedness to the others. A structured model is required using computational algorithms with bounded, varying randomized inputs for the many individualized computations proposed in this formalism. A Monte Carlo type analysis is suggested that is specifically targeted at reducing the overall total cost of ownership, including resource reallocation efficiencies. The largest challenge of such a model will be integrating those components that are more "soft", less deterministic and highly dependent on the individual or company prioritization of such elements. One such example is how worker satisfaction is valued via parameters such as TCU, which was described earlier as part of WEP.

Once this is done, a new ROI can be evaluated taking OPP into account and the overall value of a product can be effectively evaluated, both from the operator and vendor perspectives. Next the varying lifecycles of a product should be considered. This may be done by creating different ROI analyses, e.g. via the Monte Carlo analysis mentioned above. If, within a given set of parameters, the ROI exceeds the expected lifecycle, one would need to iterate the formalism to identify areas of cost that could be removed from the business and thus creating a lower OPP with a potential a higher TCO. These realized savings can be thought of as 'insurance' against unforeseen costs. This approach is particularly applicable in the current business climate given how short life cycles can be.

INDUSTRIAL QUALITY & EFFICIENCY

There are many possible ways to divide where the work should be done vs. where it is being done. There are three primary tasks investigated here: issue identification, fix implementation and resolution confirmation. The most fundamental view of efficiency in this discussion is purely how much more efficient a worker can be doing the same tasks as were done previously. This worthwhile endeavor is the same approach outlined by W. Edwards Deming in his approach to Total Quality Management. Workers and management alike should continually assess their duties to look for opportunities for improvement. Detailed chronicling of this work is imperative to drive consistency into the services that are provided to end customers, i.e. standardization. Once the work is documented, methods and procedures can be built into training materials and subsequently the training being given, bringing efficiencies to the training resources as well. Once standardized, many tasks can then be modeled and implemented in software tools to remove menial labor tasks. When this happens, the proverbial flood gates open and one can investigate how to divide the workforce and reallocate the work in the most efficient manner. One example of this would be how the three primary tasks mentioned above could be divided. Taken in order, issue identification could be implemented in software and the verification of issues could be done in a centralized work group. This work group would have fewer total resources than a distributed model as they would be able to fill in the otherwise distributed, individual lows of work with the volume that comes from the total distributed load. Additionally, the speed of identification would also increase. The fix implementation process would also improve. Not all work could be centralized, but any fix that could be done remotely could move into a centralized group and similar efficiencies could be realized.

Finally, much like the issue identification scenario, issue resolution confirmation could be moved to a centralized work group, once again creating a way for the most efficient manner possible.

TECHNOLOGICAL INNOVATION

Some believe that the source of the Western idea of 'creative destruction' is the Hindu god Shiva, who was thought to be the destroyer and creator simultaneously. However, as mentioned earlier, Joseph Schumpeter is credited with introducing the term 'creative destruction' in his famous book, *Capitalism, Socialism and Democracy*. It was in this book where he described how innovation can cause the disruptive process of transformation.

So how does 'creative destruction' apply to this formalism? First, an example is necessary to baseline the concept. In the retail market, previously, many small, older, local companies historically offered retail consumer products. The distributed nature of this model left little opportunity for expense reductions. Then came the technological innovations that Wal-Mart introduced, including new ideas such as personnel, marketing and especially inventory management. While these innovations destroyed businesses like Montgomery Ward and Woolworths, it created a whole new set of technology that spawned other businesses and innovations. Another example is the destruction/creation cycle of 8-track to cassette to compact disc to MP3.

If the proper division of labor outlined in this paper is considered, work is moved from a distributed workforce to a centralized one requiring fewer resources overall. This destroys the structure of the legacy labor pool, but creates an increased level of customer service, reduces operational expenses and opens the door to a whole new set of technological innovations that could never have been imagined before this change, i.e. a disruptive innovation that helps create new business opportunities for existing and new vendors. Along with these new business opportunities comes the scientific possibility for further innovation, aka, 'creative destruction' which leads to rapid and sometimes radical change that yields economic growth over the long-term.

There are other tangible benefits that are realized from the suggestions in this paper, such as increased customer service and loyalty, i.e. reduced churn, marketing advantages as in brand strength, reduced advertising costs and thus lower costs of acquisition. Additionally, an interesting benefit is how capital may be used more effectively and spent in places where the greatest benefits are. Reduced cycles for new product introduction may also be realized as would softer advantages like internal and external public relations.

CONCLUSION

Solely choosing purchase price for equipment based on traditional volume discounts or on a 'lowest cost wins' basis is not sufficient. Today's high fixed cost of doing business, simultaneous priorities, ever increasing level of competition and return on investment expectations, demand a new approach.

Determining the optimum purchase price for equipment can be identified through the combination of the many factors described earlier. These factors require operators to take a look at the capital costs with a new total, comprehensive perspective. This approach requires that personnel in operations, engineering, marketing, finance and purchasing work together in evaluating the total cost vs. assessing it in silos with competing priorities.

Evaluating products in a manner described in this formalism provides: the possibility for operational performance optimization; product and operational standardization; lower short term costs; distinct competitive advantages; increased customer service levels; reduced product deployment times; the proper division of labor; and the radical and rapid innovation required to sustain long-term economic growth.

It is imperative that operators take into consideration the kind of upfront investment and implement a capital strategy that takes into account the vast and complex array of variables that contribute to the overall fiscal health of their business and set themselves up for the next generations of success.

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