Making the shift from capital expense to operational expense for Ultrasonic Flaw Detector Equipment

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A well-established trend from the IT industry is switching from upfront, outright purchases to new business models, named “as-a-service” offerings (e.g., pay-per-use or subscription models). This trend is gradually becoming more widely adopted by other industries, including NDT. Such models imply a huge reduction in high fixed costs in the form of CapEx (capital expense). Instead, the cost of purchasing can be translated into recurring variable costs, i.e. OpEx (operating expense). The OpEx costs can potentially scale with the business' needs. For inspection service providers, who are typically sensitive to cash-flow, the evolution from CapEx equipment purchases to OpEx subscriptions can be a powerful tool in optimizing their cash flows.

This paper will model and quantify the benefits and balance between the reduction in CapEx and the increase in OpEx for inspection service organizations of various sizes. It will demonstrate the impact of this shift on the economics of inspection service organizations.
1. Introduction: Equipment subscriptions and Hardware-as-a-Service (HaaS)

Traditionally, NDT procurement processes have been a one-time, upfront capital expenditure (CapEx) fee. The process of buying this equipment can be expensive, time-consuming and fraught with authorization bottlenecks that focus on a one-time expense rather than on the long-term value that the equipment uses can create for the consumer. New business models have been launched in the NDT equipment industry in recent years. It allows the user to buy equipment (hardware) at a price significantly cheaper than the conventional one-off method, while at the same time committing to the time-based use of the equipment (e.g. annually).

In this paper, we will model and quantify the benefits and balance between the reduction in CapEx and the shift towards OpEx for three types of inspection service providers. Additionally, we will investigate the extent to which these organizations’ purchasing pain points could be resolved by switching to a subscription-based model.

Subscriptions are nothing new; they have existed in the consumer market for many decades, e.g. with newspapers, premium TV, mobile phones and gyms. Most of us are no strangers to product subscription. Actually, the average cost consumers are spending for these subscriptions is significantly increasing, [REF (1)].

Hardware-as-a-Service (HaaS) is a subscription-based business model that has been transforming the IT industry in recent years. Under HaaS, customers pay for services, not things, as with a typical one-time purchase model. It has been shown that the way individuals and businesses consume hardware products is changing. A study by McKinsey & Company [REF (2)] revealed that business owners increasingly prefer subscriptions over traditional methods, thanks to a subscription’s flexibility and reduced costs (see Figure 1).

![Figure 1: Main reasons customers prefer a subscription offering over a one-time purchase. [REF (2)]](image)

For NDT equipment purchases, the opportunity to change to a subscription model is much more complicated than for the consumer market. Legacy equipment can be specified in maintenance
manuals, and users can become accustomed to the specific way such equipment works, raising barriers against change.

The following section will first look at the advantages and disadvantages of purchasing equipment using CapEx or with OpEx. We then discuss a traditional Total-Cost-of-Ownership (TCO) calculation to show the window in which subscription is beneficial. Finally, we run through three case studies for inspection service providers of various sizes, concentrating on the issues they have with procuring equipment as one-off CapEx.

2. Capital Expenditure purchases

Capital expenditures are major investments in goods that show up on the balance sheet and are depreciated over the life of the asset (typically assumed to be six years for NDT equipment). Decisions related to the purchasing or replacement of equipment are often embedded in formalized processes. Bottlenecks can appear in such approval process, sometimes due to the sheer number of stakeholders that are involved in the decision. The number of hand-offs required for management approval understandably increases as the one-off cost of the device or the number of devices increases. This only adds further delays to decision-making, as well as uncertainty in the planning of equipment availability to address the pending volume of inspection jobs in a timely manner. To add to this complexity: as with all forecasting, so is estimating future capacity needs for inspection equipment also never without uncertainty; for example, no model can account for unpredictable world issues such as the Oil & Gas industry downturn in 2014—especially not, when the capacity is mostly calculated using data from historical usage.

The main advantage with CapEx is that you only have to make the purchase once. However, the decision-making process itself, as well as the process of gathering the necessary resources for the purchase both take time. Rarely, if ever, does that time not come with an opportunity cost, for example in the form of lost job opportunities for an inspector, or increased equipment failure risk for an asset owner. As part of the sunken-cost fallacy strengthened by a high expenditure, there is also the very real risk of living with the consequences of the decision for longer time than necessary, e.g. even after the purchased equipment has become obsolete or otherwise been superseded by superior solutions.

3. Operating Expenditure purchases

Operating expenditures show up on the profit-and-loss statement and relate to expenses incurred on an ongoing basis. They are thus better suited for organizations anticipating or pursuing rapid growth or changes in technology requirements, or in volatile markets or industrial settings. The reduced upfront costs often allow customers to scale their business quickly with more equipment in the instrument portfolio. This scaling scenario becomes more likely if the subscribed-to equipment also offers a user experience that enables inspectors to become competent and productive much faster than with legacy equipment. OpEx offers the advantage of full control of costs and better budget visibility by smoothing the cash outflows over a longer period of time compared to the “spiky” one-off CapEx for equipment purchases. Another advantage is that OpEx are fully tax-deductible in most countries.

OpEx instead of CapEx for NDT solutions makes sense less due to changes in technology requirements of the hardware and much more thanks to ongoing advances in digital technologies
impacting the value that software delivers. The hardware side of most NDT devices has long reached the top plateau of the technology S-curve. Improvements in hardware specifications and performance are few and far between, and of marginal impact, as the hardware relies on proven electronics concepts and technologies that have been maturing for numerous decades through applications in other industries. It would not be an exaggeration to state that almost all NDT hardware is practically commoditized and not a playground of innovation potential; to the contrary, for both the customer and the solution vendor there is plenty of untapped value in the software side of the solution.

This untapped value is mutually beneficial. For a vendor offering a subscription-based solution, it is important to minimize customer attrition and thus maintain the predictability of the recurring revenues. This motivation is beneficial for the customer, as the vendor typically offers an ever-evolving platform of enhanced software features to prove to the customer the enduring value of the software, to which the customer is subscribing. Such an evolution is possible because, contrary to the hardware side of things, the software side of an NDT solution relies on a large number of digital technologies (mobile computing, wireless devices, ubiquitous connectivity, cloud platforms, Machine Learning frameworks, and others) that are increasingly accessible at lower cost, increasingly usable in industrial solutions, yet also very far from the plateau of their respective technological S-curves.

An example of the software release schedule of a subscription-based NDT inspection device is shown in figure (2). In this specific example, the maturation of the aforementioned digital technologies thanks to advances in consumer-grade devices enabled the development and deployment of a roadmap of class-leading features, such as Augmented Reality visualization. Customers of the rental/subscription-based model enjoyed a stream of software updates that delivered new features and unlocked new functionality, long after the solution initially became available for sale.

Figure 2: A timeline of software features added after the launch of the Proceq GP8000 inspection solution for concrete structures.

4. A simplified Total Cost of Ownership (TCO) calculation
Cost is one of the main points on which decisions are based. It is tempting to just look at the upfront investment; however, the operational aspects are equally—if not more—important. The TCO is therefore introduced as a financial estimate intended to help buyers determine the direct and indirect costs of a product. To determine if transferring the purchase costs from CapEx to OpEx makes sense for your NDT instrument you need to know the price of the equipment, its expected usage patterns, and the estimated life / payback period.

In the example below, a subscription business model yields a financial benefit of US $1,156 versus purchasing equipment. The calculation is shown below, adapted from [REF (3)]

**Cost of outright purchase**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Purchasing Price</td>
<td>$8,000</td>
</tr>
<tr>
<td>Estimated Life (in years)</td>
<td>6</td>
</tr>
<tr>
<td>Annual Usage Hours per year</td>
<td>1500</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>5.3%*</td>
</tr>
<tr>
<td>Monthly Payment</td>
<td>$129.96</td>
</tr>
<tr>
<td>Total Payments (over life)</td>
<td>$9,356</td>
</tr>
<tr>
<td>Residual Value</td>
<td>($2,000)</td>
</tr>
<tr>
<td>Total Ownership Cost</td>
<td>$7,356</td>
</tr>
<tr>
<td>Total Operating Cost:**</td>
<td>$4,000</td>
</tr>
<tr>
<td>Cost of Ownership</td>
<td><strong>$11,356</strong></td>
</tr>
</tbody>
</table>

**Cost of subscribing:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Fees (over life)</td>
<td>$600</td>
</tr>
<tr>
<td>Software Fees (per year)</td>
<td>$1200</td>
</tr>
<tr>
<td>Yearly subscriptions</td>
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<tr>
<td>Residual Value</td>
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</tr>
<tr>
<td>Total Ownership Cost</td>
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</tr>
<tr>
<td>Total Operating Cost:**</td>
<td>$3,000</td>
</tr>
<tr>
<td>Total Cost of an OpEx-based purchase</td>
<td><strong>$10,200</strong></td>
</tr>
</tbody>
</table>

* Taken from World Bank interest rates for Singapore  [REF (4)]

** Operating Cost: Cost of calibration, maintenance, repairs and consumables, estimated to be more for a traditional legacy system than an inspection solution based on new digital technologies matured in consumer-grade applications.

Based on this simple calculation, the subscription business model is more attractive financially than an outright, one-off purchase. When the estimated life is increased above 7 years, the outright purchase model becomes more advantageous. Figure 3 below shows the change in TCO when the estimated life / payback period is varied. Of course, looking at only cost does not reveal the full story, as we assume the ability of the customer to pay the one-off CapEx to begin with. In reality, waiting for this capital to become available can be the root cause of losing business, which results in an even higher total cost when the opportunity costs are included.
5. Case studies for equipment purchase

Here we look at 3 cases of subscribing to NDT solutions vs. one-off purchasing NDT equipment, for various types of users. We look at the pain points of these users and identify which method (OpEx or CapEx) would generate the most value for them.

5.1. Case 1: A large, multinational inspection service provider

Large inspection service providers are organizations that offer nondestructive testing, inspection and engineering across industries, including for the key markets of Oil & Gas, aerospace and power generation. They have around 2000 to 5000 employees and generate revenues greater than $100M. They have several hundreds of inspection devices and yearly take decisions regarding which devices they should replace and how to go about it. They noted that while equipment costs have continued to rise, the hourly charge-out rates remained stagnant or in some cases dropped.

The lack of visibility of instrument stock, accessibility and usage has been a problem for this yearly decision. Replacements were purchased to handle peak demand, and this led to over-buying and wasteful use, leading in turn to excessively high costs. Replacement did not consider any potential changes in demand, so a one-time upfront payment was very inflexible. The organization is stuck with the depreciating equipment, which is shown on the balance sheet and increases overhead.

Connected devices that are capable of enabling a subscription-based model have great advantages. Inventory management is possible, and subscriptions can be enabled or disabled based on the annual demand forecast for the coming years. Maintenance schedules and annual testing of connected devices are seen as a significant added-value task, leading to reduced product downtime.

The businesses studied had limited cash flow, so a high upfront cost to upgrading equipment requires a number of approval signatures from senior management, with long delays and high handling costs.
If the procurement departments of major inspection companies have a more detailed understanding of the actual use and usage of the fleet, good purchasing decisions can be made with less time and cost for approvals. Subscription-based NDT solutions incorporate measures to help them maximize the use of equipment and achieve maximum cost savings.

### 5.2. Case 2: Midsize inspection team

Consider this scenario: a two-person NDT company is looking to hire a third person to expand its capacity of e.g. providing inspection services. Traditionally, this means buying an additional set of instruments and training a person who is new to the work of ultrasonic inspection. Using the traditional mindset, the two business partners are going to need to build up cash reserves of approx. $8,000 just to buy an instrument, plus spend the wages and their own valuable time to train a new person so that he can work autonomously without risk to customers or the business. It is going to be months before the new employee and his equipment together can start producing revenue to offset the upfront one-off investment into both new equipment and the effort to make use of it with peace of mind for the business partners.

This is a risky way to grow your business; lots of upfront cost with a low chance of a short payback period. At the same time, this approach is not scalable, e.g. when a huge opportunity comes in that requires two or three additional equipped inspectors to tackle a larger inspection job.

### 5.3. Case 3: Sole proprietor

Sole proprietors and contractors make up approximately 13% of the total number of inspection professionals. There is a significant increase of contract NDT workers in the Oil & Gas industry, amongst others because it allows to keep staffing levels flexible [REF (5)]

Sole proprietors typically know what device they want, as it is either dictated to them from their main client or it is their own preference from past experience or word of mouth. They have no approval loops for purchasing equipment, except if they need to organize a loan from a bank.

Their main wish is to run the business from the moment they purchase the equipment and begin to make money. They can ramp up and capture market share much more effectively by using a subscription model thanks to its low upfront cost. Earlier and affordable access to the instruments’ sophisticated imaging capabilities means that competing service providers using legacy equipment acquired later in the game cannot do everything that you can do.

This, in turn, a) offers a unique value proposition against incumbents using legacy equipment, b) generates returns on their investment earlier and c) frees up capital to be allocated elsewhere in the business, such as growing their team and/or fleet of equipment with further technologies. It also allows them to scale their business according to their evolving understanding of the market demand for their inspection services.

### 6. Conclusions

In markets for equipment that has been characterized for decades by relatively undifferentiated hardware and stagnating software functionalities, offering a subscription model may seem counterintuitive—even more so, as such concepts originate in the “B2C” space, and the NDT
industry is decidedly “B2B” in its marketing and sales. It may seem counterintuitive that you can increase customer lifetime value through subscription pricing. After all, your customers can and will do the calculation on a subscription’s total cost of ownership and won’t always be willing to pay a significant premium over the expense of a perpetual license. However, we have observed that there is almost always a window where the economics and issues resolved are favourable for both the vendor and the customer.

To offset the potential rising costs for the procurement of non-destructive testing equipment, purchasers must adopt the best procurement practices and strategies to efficiently optimize their spend. For instance, buyers are advised to move equipment to an OpEx budget by subscribing instead of procuring in large quantity. This allows buyers to access a wide variety of products and reduce inventory management and storage costs.

7. References

1. https://www.growthbusiness.co.uk/subscription-nation-9-10-uk-consumers-now-subscribers-2552406/