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Thirty Measurable Business Cases for IoT with Connected Services

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People matter, results count.

Content

The New Age of Customer Service

The only truly valuable post-purchase moment-of-truth for companies is customer feedback.

Since the industrial revolution companies have focused on and invested significantly to influence customer behavior during the decision-making process. This process refers to the 4 common steps leading up to a purchase: need awareness, information, evaluation, and transaction. The activities that companies use to influence behavior during these steps have been proactive in that a message triggers some response. In most product categories, however, the process of buying is significantly shorter than the final stage of the decision-making process, i.e. the use phase. In the automotive sector, for example, a consumer will spend 1 to 3 months deciding which new car to buy and then drive that car for 3-5 years. In the home appliance sector, the decision-making process is typically concluded in weeks, whereas the use phase can last a decade or more. Certainly, companies try to reinforce the post-purchase relationship with the customer with communications like standardized cross-sell offers and periodic service reminders, but these communications are seldom truly valuable to the customer, because they are mostly based on generalizations about segments and do not reflect a customer´s actual product condition or his/her product usage. The only truly valuable post-purchase moment-of-truth for companies is customer feedback. Most companies erroneously celebrate no-complaint as quiet satisfaction and some companies actively solicit feedback, which is seen as an opportunity to engage the customer. Social media exacerbates the post-purchase customer relationship for many companies by giving customers the ability to share product opinions with hundreds or even thousands of followers and friends, thus giving birth to a new industry in social monitoring, and a new class of customers like the ego-poster or the professional product reviewer. But the ability to monitor customer "tonality" in near-time does not change the problematic paradigm, namely, the post-purchase customer process for most companies today is reactive in that the company usually does nothing that is truly individually relevant until a customer requests information or complains. In other words, companies use a stimulus-response model during the buying process to steer the customer, and then the customer uses the stimulus-response model post-purchase to manage the company.

Definitions

M2M. Devices equipped with sensors are connected and can communicate with each other.

IoT. The data from a connected device is made available on the internet. IoT requires a device with a sensor and internet connectivity, but the communication between devices is not a requirement for IoT.

CSX. The device data made available on the internet is analyzed to trigger proactive actions.

The Internet-of-Things (IoT) is profoundly changing the way companies interact with their customers in that it is enabling a post-purchase relationship that did not previously exist. By connecting devices to the internet, companies can gain insights into product performance and, more importantly, individual customer behavior with products. This is called “Predictive Monitoring” and it puts control of the stimulus-response model back into the hands of the company. The data collected from connected devices is “internal data,” because no competitor has this information. Internal data has very valuable proactive applications, which can create a competitive advantage. To maximize the value of this internal data, it should be used in near-time to create an impact for the business and its customers. This is where we differentiate between the Internet-of-Things and Connected Service Experience (CSX). IoT involves making the data generated by connected products available on the internet for reporting and monitoring. CSX involves analyzing the data from connected products in near-time, querying an expert system to find the most appropriate “Next Best Action,” and triggering an individual interaction between the company and the customer. For example, a fitness bracelet shows the runner his pulse, heart rate, and pace. The runner has to interpret this information and make a subjective decision. The runner may login to a website or use a mobile app to view dashboards, get advice from other runners, or post comments or questions for the manufacturer. Using CSX, the data from the runner´s bracelet is analyzed using a variety of methods and a specific tips is generated to help improve his/her performance. Instead of monitoring the runner´s community or waiting for the customer to request information or complain, CSX uses the data from connected products to stimulate the customer, thus putting the company in-charge of the post-purchase experience.

There are several reasons that a near-time proactive intervention is critical today. First, in the day of hyper-connectivity, preventing customer dissatisfaction is less expensive than addressing it. Instead of waiting for a customer to complain, either directly or on some social platform, CSX can predict issues that cause customer dissatisfaction and trigger an appropriate resolution before the customer rants to thousands of friends and followers. Furthermore, CSX can decrease the compounding effect of dissatisfaction. When a customer complains, several new opportunities to further dissatisfy the customer are created. A well executed recovery can restore some confidence in the company, but a post-complaint mishap in the customer care center or with technical service can exacerbate customer dissatisfaction and increase the costs of appeasing a customer. Second, the costs that are generated post-issue grow exponentially. Identifying issues and addressing them proactively lowers these costs. Imagine a piece of production equipment that is vibrating excessively. Using CSX, the vibration is promptly detected and remedied by providing the operator instructions or dispatching a technician to perform preventive maintenance, but ignoring the issue may cause a decrease in productivity and loss in revenue, unplanned downtime, outage compensation expenses, equipment damage or even workplace injury. Third, the revenue that is lost by not acting in near-time can be enormous. Many manufacturers of machinery and medical equipment do not know how their machines are actually used on a daily basis or if they are even turned on. Only when the customer calls to request repair or the periodic

Measurable Business Cases for CSX

1. Decrease CO_2 expenses
2. Increase CO_2 credit costs
3. Decrease fuel costs
4. Decrease the cost of retiring parts prematurely
5. Decrease waste in production
6. Grow revenue through recycling
7. Decrease costs of accidents
8. Decrease warranty expenses
9. Decrease insurance costs
10. Decrease product liability expenses
11. Decrease the costs of recovery
12. Increase revenue by optimizing productivity
13. Increase parts and service revenue through proactive selling
14. Decrease the costs of theft
15. Extend product lifecycle
16. Reduce costs related to unnecessary repairs
17. Reduce asset replacement costs
18. Reduce shipping costs
19. Reduce inventory costs
20. Reduce supply costs
21. Decrease service costs
22. Reduce outage penalities
23. Reduce service times
24. Decrease the costs of redundant assets

sales reports shows that the customer order volume for supplies is lower than planned does the company know there was an issue. In both cases, it is too late. A problem existed for a period of time, it was undetected, and revenue was lost. CSX can help these companies to monitor machine usage and respond proactively. If the machine data indicates that a piece of equipment is not used for a certain period of time or that the machine is being abused or not running efficiently, the company can offer the customer training, order parts and supplies, and schedule maintenance. This combination of proactive activities can eliminate unpleasant surprises and help ensure that after-market revenue targets are achieved. Fourth, CSX can help companies to establish a stronger differentiation. Competition in the industrial age was based on some combination of price, quality or time. Products were cheaper, better, and/or readily available, but never all three. This is called Goods Dominant Logic (GDL) and it is still the differentiating rational for many companies today. Differentiation in the information age is achieved through service. Service Dominant Logic (SDL) involves layering products with value-adding benefits. Service in this context is different from the class of intangible products that we call “services” in that the service is not the product per se, although the cost of service is often included in the price of services. Because CSX relies on internal data, the service that it enables is unique to the collector of the data. For example, FedEx provides shipping services for a fee and an online tracking service. Only FedEx knows where your package is and FedEx can use this internal data to offer additional value-adding benefits.

There are many use cases for CSX. Some of these benefits are emotional and not easily quantified. Protecting the environment is a respectable undertaking and customer satisfaction is a worthy objective, but the business impact of a greener image and happy customers is difficult to quantify. Investments should be based on the measurable impact that systems have on the company´s top and/or bottom lines. In the remainder of this article, I describe the applications of CSX as measurable business cases. I outline the issue, quantfy the economic impact, and then briefly show how CSX can address the issue. I describe problems and cite data for several seemingly unrelated sectors to show that many businesses are burdened with similar challenges. Hospitals, manufacturers, logistic and energy companies have a lot in common and can learn from each other.

The most common application of CSX is predictive or preventive maintenance. Because preventive maintenance can impact the top and bottom lines in several ways, it is probably the most salient business case for CSX for manufacturers. Nevertheless, I start with descriptions of the other business cases for CSX in order to draw attention to these lesser known benefits.

I also want to emphasize the practice of combining business cases in order to maximize the business impact of CSX. Often, the business impact of implementing CSX can generate compounding business benefits. For example, a shipping service reported that 20% of the company´s drop boxes were empty. The company wanted to identify these empty boxes in order to reduce unnecessary stops with the goal of improving ontime delivery. By installing a

CSX requires IoT, and IoT requires that devices have sensors and are connected to the internet.

simple sensor in the drop boxes and alerting drivers when they are empty, CSX enabled the company to decrease the number of unnecessary stops per day and also decrease the number of drivers and vehicles without affecting service level, increase routesize and driver productivity, and lower fuel costs by optimizing routes. All these benefits are quantifiable and the combined impact on the company´s bottom line is very attractive. To this end, I encourage all companies to at least consider all the business cases, before prioritzing and focusing on few.

The exercize of identifying a combination of relevant use cases for IoT and CSX and then quantifying the business impact serves to justify the investment in such systems. This exercize also serves a very important function in that it ensures that the system is architected to be future-safe. CSX requires IoT, and IoT requires that devices have sensors and are connected to the internet. The use cases dictate the data that is required, the operating environment and the transmission frequency. These are critical factors in selecting sensors and connectivity. For example, last year, a city in Germany implemented a large scale garbage container tracking system in order motivate homeowners to decrease their waste. Instead of charging customers a flat rate for twice monthly pick-ups, the city started a program to charge customers by weight and frequency. The city spent more than €1 million to retrofit 150.000 garbage cans with RFID chips and hundreds of trucks with RFID scanners. When the trash can is loaded into the dumping mechanism of the truck, it is scanned and its weight is recorded. The data is downloaded when the truck returns to the collection center. The sensors and connectivity selected make sense for this use case, but the program´s designers did not consider other important use cases. As it turns out, some scrupulous homeowners wait for their neighbors to set out their garbage cans before rolling theirs to the curb and then simply redistribute their waste. The city reports that it is not collecting less garbage by weight, but it is emptying fewer containers, because the waste is now consolidated. Although emptying fewer containers has a measurable business imact, it is not the intended benefit, and many homeowners are not pleased with their higher invoices. Retrofitting 150.000 garbage cans with the proper sensors is no longer in the budget, and the program was deemed ineffective and cancelled.

Lower Environmental Impact, CO_2, and Fuel Costs

By monitoring tire pressure and other vehicular states in real-time, a company can ensure that its fleet is properly maintained, that vehicle issues are addressed proactively or identified and resolved quickly, and decrease its environmental impact as well as its fuel expenses.

The World Health Organization reports that the exhaust from combustion engines is the leading cause of air pollution. An important driver of emissions is fuel efficiency, and vehicle condition is an important factor. The U.S. Department of Energy estimates that a 1 psi drop in tire pressure alone can decrease fuel economy by 0,4%. That may not sound insignificant, but when calculated for a large fleet of service vans or 40-ton trucks, the extra pollution and additional fuel costs caused by low tire pressure can be substantial. By monitoring tire pressure and other vehicular states in real-time, a company can ensure that its fleet is properly maintained, that vehicle issues are addressed proactively or identified and resolved quickly, and decrease its environmental impact as well as its fuel expenses. A 0,4% improvement in fuel efficiency for a fleet of 10.000 service vehicles can eliminate tons of CO2, which can be used in a green marketing campaign, and – more importantly - save a company €1.000.000 per year in fuel expenses and around €10 per ton in carbon credits. For comparison, a passenger vehicle produces on average 4 tons of CO2 per year.

In his article titled „Spritspartechnik für LKW," Jürgen Pander writes about the nine automotive technologies that are helping companies with large fleets of trucks and buses to reduce their environmental impact and cut operating costs. Jürgen admits that these technologies are worthless "if the driver does not cooperate" and estimates the potential savings that can be achieved by influencing driver behavior at 10-15%. Driver behavior is, therefore, an even more important factor of emissions and fuel costs than vehicle condition. Driver behavior can be influenced by monitoring it in real-time, providing drivers with periodic tips and incentivizing individuals or teams to drive efficiently visavis "gamification." Using CSX, driver behavior data can be analyzed in real-time and trigger alerts when, for example, a driver frequently shifts too late, drives at high speeds in lower gears, uses a lesser efficient route, or uses the wrong fuel. Left unaddressed such behavior can cost the company with a large fleet tens of thousands of Euros over weeks. The benefit of CSX in this case is the ability to identify and address undesired driver behavior in near-time and recommending some corrective action before costs spiral. The idea is not to respond to every case of infringement with a tersely worded reprimand, but to establish best practices and help drivers who are not achieving certain goals to drive more economically. A 10% improvement in the fuel efficiency of a fleet of 100 40-ton trucks would reduce CO2 emissions by 924.000 tons per year, thus lowering the cost of CO2 credits, and also decreasing a company´s annual fuel expense by €525.000. The idea of monitoring and modifying operator behavior can be applied to fleets of taxis, cars, forklifts and service vehicles. The combined business impact of ensuring simply that tire pressure is correct and that drivers drive efficiently can eliminate tons of pollution and save the company millions of Euros in fuel costs.

In “Are You Killing Your Car,” Thomas Bey recommends some tips for extending the life of a vehicle. He suggests replacing the fuel filter every 24.000 miles, the air filter every 12.000 miles, the battery every 48 months, and tires every 40.000 miles. Surprisingly, service time and odometer reading have little to do with wear and tear, but these triggers are used by service stations and fleet managers around the globe to schedule maintenance. It results in a huge amount of waste and also higher vehicle operating costs, because roughly half of all car parts are replaced before their true end of of life. According to estimates by some solid waste recycling companies, almost 50% of the car parts are discarded prematurely. This practice can be very expensive for a company that operates a fleet of 1000 service vans that are driven 100.000 kilometers per year. Using the odometer as a trigger for parts replacement, such a company would replace 40.000 fuel filters, 8.000 air filters, and 8.000 tires per year thus creating a small mountain of toxic waste. To cut waste and lower costs by as much as 50%, a company can use CSX to monitor vehicle performance in real-time and replace parts when the first indicators of performance degradation are identified.

Many industries generate significant waste throughout the manufacturing process. In the printing industry, for example, one-third of the paper purchased ends up in the recycle bin. 25% of this waste is produced prior to printing, and the other 75% is printed waste. To compensate for the waste generated at each step in the finishing process, over-runs are printed at the press. Although printed waste is recyclable, a chemical process is used to deink paper and convert it to pulp. This process produces sludge and more than 200 million kg of toxic pollution per year globally. An article by the SCO titled “Waste in the Printing Process,” describes clearly the nature of the challenge, “It is difficult to find out the quantities and causes of white and printed waste. Most waste monitoring systems are manual.” Using CSX, each machine in the printing process can be equipped with sensors that automatically measure the quantity or weight of incoming paper and outgoing product. An analysis of the data will indicate where in the process waste is being produced. Additional sensors can be installed on machines to monitor performance and build best practices. When the data indicates unexpected waste, an intervention can be triggered. The intervention can be immediate in the form of an operator alert to make certain adjustments to reduce waste, in near-time in the form of maintenance, or periodic in the form of training. A 1% reduction in paper waste in the printing industry would save 40 million trees and eliminate 2 million kg of toxic sludge, statements that sound great in green marketing messages. But, more importantly, reducing waste can save money. The same logic of monitoring machine and operator performance to identify and remediate the sources of waste can be applied to steel, wood, packaging, and other fabrication sectors.

Just as we track the location of products in the supply chain, tracking the location of products in the “disposal chain” is possible with IoT. According to studies conducted by MIT, only 30% of recyclable trash is diverted to a recycling center. Using “trash tags,” MIT and participating cities in the U.S. are tracking

the location of water bottles, razors, and other everyday recycle objects in the disposal process. Tracking trash is done in real-time using IoT in order to be able to intercept recyclable items before they end up buried in a landfill. By increasing the amount of intercepted reusable and recyclable garbage by just 1%, US cities would decrease landfill fees by up to €2 billion per year. The same logic of tracking waste to achieve “Zero Impact” can be applied to hotels, offices, hospitals, homes, shopping centers, and factories.

The benefits of using IoT data to help customers decrease their environmental impact are measurable and an enterprising company can capitalize on this by offering customers subscriptions to environmental monitoring services. Aside from selling or leasing equipment and vehicles, the company can generate recurring revenue streams by helping customers to use those products in a more environmentally friendly way. A trucking company would pay €100.000 per year to monitor 1.000 trucks in order to lower fuel costs by 10% and decrease the cost of spare parts by 50%. A printing company would pay €50.000 per year to monitor a finishing line in order to save €200.000 in waste. Many consumers would gladly pay €3 per month for a subscription to receive tips to save €120 per year in fuel.

Improve Safety, Decrease Accidents

By monitoring machine performance and operator behavior with IoT and CSX, a company can identify the causes of workplace injury early and take immediate preventive action.

The U.S. Bureau of Labor Statistics reports more than 270 million occupational accidents per year. In Germany, the Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA) estimates the number of occupational accidents at 1.000.000 per year. The cost of these accidents is defined in terms of direct and indirect costs. The American National Safety Council estimates the average direct costs for occupational accidents is $4.800. In Germany, workplace injuries cost the employer on average €3.300 per incident.

Many occupational injuries can be prevented using CSX. The most common causes of occupational injury are poor ergonomics, manual handling of heavy loads, misuse or failure of equipment, exposure to general hazards, inadequate safety training and clothing. By monitoring machine performance and operator behavior with IoT and CSX, a company can identify the causes of workplace injury early and take immediate preventive action. For example, when the data indicates that an operator is using a machine in an unsafe manner, the operator can receive an alert containing specific instructions or an invitation to participate in training. Or if early indicators of performance degradation are identified, the operator can receive an alert to stop using the equipment or lessen the load on the equipment, and technicians can receive a task to perform preventive maintenance. On average, a company with 10.000 workers will report 1.700 workplace injuries per year at a cost of ca. €6,8 million. A 10% reduction in accidents can decrease a company´s injury related expenses by ca. €680.000 per year.

The German Kraftfahrt-Bundesamt (KBA) reports 43,9 million registered vehicles and 2,3 million accidents per year. The economic impact of traffic accidents in Germany is reported at €31 billion per year, or €14.000 per accident. A company with a managed fleet of 1.000 cars will claim 190 accidents per year at a cost of ca. €2,7 million. Using CSX, the condition of a service vehicle can be monitored constantly to ensure that it performs properly and driver behavior can be monitored to ensure that drivers drive carefully. By proactively correcting vehicle performance issues and addressing poor driver behavior, a company can decrease accidents by as much as 90% per year and save over €2 million per year in accident related costs.

The World Health Organization lists the top causes of car accidents: distracted driving, drunken driving, wreckless driving, night time driving, inexperienced driver, vehicle defect, speeding, and weather. CSX can address all vehicle accident factors. By monitoring vehicle condition, the manufacturer or insurance company can identify potentially dangerous issues like bad tire condition or warn brakes and trigger alerts to address the deficiency before it causes an accident. Likewise, the vehicle data can be used to evaluate driver behavior and trigger appropriate interventions to reduce the likelihood of an accident. When the data indicates the erratic driving behavior or that the driver is not adjusting to the road or weather conditions, the system can immediately send alerts to the driver.

When the data indicates dangerous behavior, police and emergency vehicles can be proactively dispatched to a vehicle´s location. Because the benefits of preventing or reducing accidents are so huge, many insurance companies are launching pay-as-you-drive programs. Accordingly, drivers pay insurance rates that reflect their driver behavior and the insurance company adjusts rates proactively to reflect an individual´s true risk, instead of a driver´s history. Last year, a survey by LexisNexis Risk Solutions found that drivers participating in pay-as-you-drive programs cut their premiums by 20-50% and that these drivers were 5-10% more profitable for insurance companies. A company that implements a pay-as-you-drive program would cut its insurance expenses significantly.

In England, the A&E reported last year that more than 3 million people visited an emergency room following a home accident and that the leading cause of accidents were falls followed by fire, burns, and poisoning. Last year alone 3.662 seniors in England died as a result of a fall, because they could not contact emergency services and eventually succumbed to their injuries. The NHS estimates that more than 2.746 would have survived had emergency services been alerted. Using CSX, some of these accidents can be prevented and CSX can enable emergency services to respond quicker to falls and save lives - by issuing seniors a simple wearable device that alers someone (a physician, emergency services, a neighbor or a family member) when a fall is detected.

Failure is a process, and product usage including maintenance are important factors in product performance. The most common reason consumers are awarded compensation when products fail is the manufacturers “failure to warn.” Manufacturers have 2 opportunities to educate (or warn) customers about safe product operation: before a product is shipped using instruction manuals and warning labels and during the operation of the product using CSX. The first opportunity is only effective when the manufacturer can anticipate specific improper behavior, like using a hair dryer in a bathtub. But not all behavior can be anticipated, like holding a 5 kg chain saw upside down with one hand. The U.S. Consumer Products Safety Commission reports that there are more than 28,000 chain saw injuries per year, corresponding medical costs exceed 350 million US dollars per year, and workman's compensation exceeds 125 million US dollars annually. A study by the University of Minnesota lists the leading causes of chainsaw accidents: human, mechanical, environmental. The human factor refers to the operator´s physical and mental condition, mechanical refers to the condition of the equipment, and environmental refers to material, weather, and terrain. Most factors can be monitored in near-time using CSX giving the manufacturer the ability to identify the causes of injury and promptly send the operator safety tips, an alert to stop using the product immediately, or instructions to care for the product or bring it to a certified repair center – before injury occurs.

Hydraulic, electrical or engine failure do not happen suddenly. Failure is a process. Passenger planes are equipped with thousands of sensors and processors, but this is a closed M2M system. The data is stored on-board, but rarely transmitted. That´s why, after every aircraft accident, investigators search the crash site for a black box to retrieve the flight data and determine the cause of the accident. Using CSX, some aircraft accidents can be prevented and when they cannot the reason for the accident can be determined quicker – without searching for a black box. Available technology enables the critical aircraft data to be transmitted in real-time to the ground crew. The data can be analyzed thoroughly and used to plan preventive maintenance when the aircraft is at the terminal. Parts and technicians can be mobilized so that the repairs can be performed quickly on the ground, and when the aircraft is in the air again, the system can continue to monitor the aircraft´s performance to reduce in-flight mishaps. Obviously, repairs cannot be performed in the air, but when such anomolies are detected, the appropriate preventive action can be triggered immediately. Such a proactive system would save lives and also lower costs. Malaysia Airlines Flight 370 disappeared on March 8, 2014, killing 239. The aircraft´s location is still a mystery. The Montreal Convention established a €143.000 cap per victim, which means Malaysia Airlines will pay close to €30 million in compensation to the family of passengers and crew. The CSX system would cost a fraction of this.

Improve Efficiency, Improve Productivity

CSX can trigger a customer service interaction when the behavioral data indicates the customer is frustrated with a product or using it inefficiently.

When a customer purchases a product, it has a benefit expectation. A printer spends €500.000 on a new digital printing press and expects to print 10.000 pages per hour. A consumer spends €139 on a fitness bracelet with the expectation that she will lose weight and improve her athletic performance. A company or consumer purchases a vehicle with the expectation that it will use 8 liters per 100 km. When these various expectations are not met, the customer can become dissatisfied. Dissatisfaction is contagious. Prior to the information age, managers knew that "an angry customer will tell 10 friends", but today, a disgruntled customer can tell 100 friends and family about his problem and influence their perception and subsequent purchasing decision.

Companies are very keen on ensuring that customers experience the promised benefit, and the most common tool today is the customer satisfaction survey. This is a reactive tool. The company knows that the customer is not happy only after the customer has expressed his dissatisfaction. This means the company has to recover, and recovery is always more expensive than prevention. Furthermore, the reactive recovery process creates additional opportunities to exacerbate the customer´s dissatisfaction when, for example, the customer has difficulty reaching customer service, the service process is overly complex, or the agent appears incompetent or unhelpful.

CSX can change this. Instead of waiting for customers to request assistance or complain, CSX can trigger a customer service interaction when the behavioral data indicates the customer is frustrated with a product or using it inefficiently.

Car companies perform a standardized driving cycle test to determine the expected fuel economy of their vehicles. In his article titled "Why car makers lie about fuel consumption," Michael Hanlon reports that the the average consumption reported by consumers, which is called "true MPG," of the world´s leading economy cars is actually 17-26% higher than the fuel consumption reported by the manufacturer. In 2014, after receiving complaints from 900.000 consumers, Hyundai and Kia were fined more than $300 million and ordered to reimburse customers $300 to $600 each for additional fuel costs, because the true fuel efficiency did not match the manufacturers stated economy. There are more than 50 such cases pending today against other manufacturers and, in most of these cases, the true economy deviates from the stated economy by no more than 17%. Most of this gap is attributed to driver behavior. Research by the National Renewable Energy Laboratory shows that improving driving behaviors can reduce vehicle fuel consumption by 10% on average, and savings of up to 20% can be achieved for aggressive drivers. Using CSX, carmakers can monitor the actual fuel economy of its vehicles in real-world conditions, benchmark drivers that achieve the best efficiency, and send aggressive drivers fuel-saving tips. A proactive fuel efficiency monitoring service powered by CSX would cost the carmaker a fraction of the settlement amount paid by Hyundai and Kia, protect the brand, and help retain customers.

One of the incentives for investing in a solar system is the feed-in-tariff (FIT). Depending on the regional FIT scheme, the investor can earn as much as €0,20 per kilowatt hour of energy generated plus an additional €0,10 per kilowatt of surplus energy that is returned to the grid. Figures from Solar PV show that a 12-panel 3-kilowatt system costs around €6.000 and that an average household can eliminate energy bills and also generate up to €1.000 per year in income. Once a solar system is installed, it requires almost no maintenance other than periodic cleaning and tree trimming, but neglecting to keep the panels clean and out of the shade can result in huge decreases in output. “Shade is the enemy of solar panel efficiency. Even a little shade on one panel can shut down energy production on all of other panels (like a bad bulb in a string of Christmas lights),” states Pure Energies, an NRG company. Presently, the energy generated by solar systems is calculated monthly and this can result in unexpected losses to the homeowner or business when dirty panels or shade are undetected for weeks. When the solar system fails to produce the expected energy, the homeowner or business loses feed-in income and draws more expensive energy from the grid. Solar vendors, energy companies and public entities that subsidize solar systems have a vested interest in ensuring that the systems are efficient. This can be ensured using CSX. Inexpensive sensors on each panel can measure energy production and, when the data indicates a de-gradation, an alert can be sent to the homeowner or business instructing him to clean a panel, remove debris, or trim trees.

For many machine manufacturers, helping customers to optimize productivity serves two purposes. First, the customer is satisfied when his output matches performance expectations. Second, the manufacturer can generate recurring revenue from parts and supplies. For a manufacture of test equipment used in medical laboratories, the annual revenue from selling supplies can exceed the initial price of a machine by 300%. This recurring revenue is realized when the technician operates the equipment efficiently. This equipment can analyze up to 4 trays of 12 test samples simultaneously. The test cycle for 12 tests is the same as for 48 tests. A laboratory that runs batches of 12 will perform fewer tests in a month and order fewer test kits. Without CSX, the company relied on quarterly account reports to gauge a laboratories performance. When orders for supplies were lower than expected, the manufacturer responded. This, of course, was reactive. The manufacturer generated lower than expected revenue for 3 months before recognizing the problem and taking action. In one case, the manufacturer found that a customer did not order any supplies for 3 months. As it turns out, the trained technician was on maternity leave, her replacement was not familiar with the equipment, and so she performed tests using a competitors machine. Using CSX, the manufacturer can monitor equipment usage on a daily basis and, when the data indicates that a machines’ utilization is lower than planned, the manufacturer can respond proactively before losing significant revenue. This may involve training technicians, redesigning laboratory processes, or reconfiguring test procedures to allow different types of tests to be performed at the same time.

Grow After-Market Sales and Service Revenue

Using CSX, the manufacturer monitors vehicle condition in real-time, identifies performance issues that pre-empt an error code or warning light, and pro-actively contacts the driver.

In the example above involving the manufacturer of laboratory test equipment, CSX was used to improve customer productivity, which, in turn, fueled the sale of supplies. The same use case has valuable application for manufacturers of all types of machinery.

A manufacturer of pulp processing equipment discovered a similar problem. Like many manufacturers, this company tested and recorded the life cycle of specific parts used in its machines and forecast after-market sales based on fixed intervals. As consumers, we are comfortable with the idea that certain parts require replacement based on intervals. Car tires need replacement after 40.000 miles, an incandescent light bulb after 1.000 hours, a liter of milk after 10 days. This company studied the parts orders for customers that were serviced by a partner in a foreign region and found that the parts revenue in that country were suspiciously low. The problem was hidden by a complex organizational structure and a confusing network of subsidiaries and distributors. In fact, more than €7 million in parts revenue had not been realized in the past 5 years. A technician was dispatched to one of the customers to perform a “safety inspection.” The technician reported that the customer had set-up its own work-shop to repair and fabricate spare parts on site. The technician also observed a busy shipping station and concluded that the customer was probably supplying other customers in the region. This company has started now to retrofit some customer´s machines with simple sensors and new machines with embedded sensors to monitor run times and proactively trigger offers and even automatic orders for parts.

The National Auto Dealers Association´s survey of 16.300 U.S. car dealers showed an annual average profit of €1,9 million per dealer. The same survey showed that service and parts related to service account for 55% of car dealer’s average annual profit. One major automaker learned that 40% of its customers were taking their vehicles to independent garages to be serviced, instead of to the dealership where they had purchased their vehicle. The automakers dealers were each losing €1,3 million in service revenue to local, independent competitors. This represents an enormous opportunity. A driver´s decision to go to an independent service station is based on a combination of criteria, but almost always triggered by some issue, error code, or warning light. Using CSX, the manufacturer monitors vehicle condition in real-time, identifies performance issues that pre-empt an error code or warning light, and pro-actively contacts the driver to order parts and schedule service – before the driver is aware that service is required. Initially, some drivers considered the proactive alerts from the dealership a clever sales trick, but when the warning light eventually did come on and their mobility was compromised, they learned quickly to trust the system and accept the proactive offers.

Prevent Loss and Theft

In today's global economy, manufacturing occurs in one part of the world, while the finished product is consumed in another.

Using CSX, the location and condition of shipments can be tracked worldwide – per minute.

In the United States, the National Insurance Crime Bureau estimates that more than $1 billion in construction equipment is stolen each year. The most commonly stolen equipment are backhoes ($45.000 to $55.000 each), skid steer loaders ($25.000 to $35.000 each), generators, ($25.000 to $150.000 each) and forklifts ($12.000 to $50.000 each).

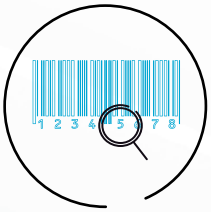
In England, an audit performed by the Information Commissioner's Office (ICO) showed that £13 million worth of hospital equipment in NHS facilities went missing every year. One hospital group in London had written off more than £220.000 in stolen equipment in one year. Theft of equipment has a two-pronged impact: The next patient who arrives may not have immediate access to lifesaving equipment that has been stolen, and the hospital must divert scarce resources to replace the stolen objects. For example, the Central Middlesex Hospital reported that at least one operation had to be postponed, because vital surgical equipment worth more than £250.000 was missing. The equipment was eventually recovered – in a Palestinian hospital. Stolen hospital equipment usually ends up in developing countries, but a paramedic in the U.S. state of Virginia had sold more than $500.000 of stolen emergency equipment on eBay before being apprehended by police, and, ironically, a significant portion of the problem comes from the patients themselves. Patient theft costs hospitals at least $52 million per year in the U.S., according to a survey conducted by VHA, Inc., a national network of hospitals.

A company (or hospital) can incur other costs in addition to those for replacing lost or stolen equipment. Hospitalization costs involving a lost instrument average more than $60,000, according to data compiled by Medicare, and related malpractice suits cost hospitals, on average, between $100.000 and $200.000 per case. In the UK and the US, 6.000 cases of "retained surgical instruments" or "unretrieved device fragments" are reported every year.

In today's global economy, manufacturing occurs in one part of the world, while the finished product is consumed in another. Cargo can be stolen or damaged at any point in the supply chain, compromising product integrity and availability. The National Cargo Security Council (NCSC) estimates that the global financial impact of cargo loss due to theft or mishandling exceeds $50 billion annually and FreightWatch International reports more than 1.700 incidents of cargo and container loss are reported annually with an average value of $550.000 per incident. Cargo loss has a rippling effect on the economy. The loss of product between manufacturer and distributor can affect a local business or hospital. If the business or hospital can't get a replacement shipment in time to meet the demand, customers will seek out another retailer or patients may not receive necessary treatment. The trucking company involved may be held liable for the loss, have to pay the supplier or the customer for the stolen product, and

incur higher costs to expedite the shipment of replacement cargo. If the trucking company has insurance, it may not cover the entire loss, because of the policy deductible and reporting the theft may also result in higher insurance premiums. Those additional costs will be passed on to the retailer, which will pass them on to customer. Furthermore, the condition of recovered goods is uncertain. Stolen or recovered perishables or pharmaceuticals, for example, may not be maintained in temperature-controlled environments creating potential for a serious health risks when the stolen product is eventually sold.

Using CSX, the location and condition of construction machinery, tools, medical devices, valuable equipment and shipments can be tracked worldwide – per minute. When the data indicates the shipments location deviates from the planned route, the container is being mishandled or the interior temperature is growing too warm, the shipping company can receive an automatic alert containing the required action to stop theft or decrease spoilage.



Extend Product Lifecycle, Optimize Disposition

There are products for which the practice of proactive lifecycle monitoring makes business sense today, namely vehicles and equipment.

Many perishable products have expiration dates. A carton of milk, a jar of strawberry preserves, a loaf of bread will all become inedible within weeks. Half of all food is wasted worldwide, and about 40% of this occurs at the retail and consumer levels. The two major causes of food waste at these levels are poor planning and improper storage. The total food wasted by consumers in industrialized countries (222 million tons) is almost equal to the entire food production in sub-Saharan Africa (230 million tons), according to the British Institution of Mechanical Engineers (IME). Embedding sensors in commodity groceries to monitor their condition and alerting the retailer or consumer when they are not properly stored does not make economic sense today. But I am certain this will be common practice in the future.

There are other products for which the practice of proactive lifecycle monitoring makes business sense today, namely vehicles and equipment.

The U.S. Department of Transportation Federal Transit Administration publishes a periodic report showing the “useful life” of transit buses and vans. In this report it shows that the minimum retirement age for a heavy bus costing $600.000 is 12 years or 500.000 miles (800.000 km). The most recent report showed that only 27% of the 91.000 buses used in the public transit system in the U.S. reached their expected useful life, but 73% did not. The cost of retiring buses earlier than planned cost the U.S. transit system more than $2 billion per year. When inquired about their early bus retirements, transit authorities explained that service hours, operating environment and passenger loads played important roles in forecasting a useful life than miles or age, but these factors were not considered in the mandated service schedules, which were based on miles and age. Simply put, buses used in rural areas were maintained more frequently than they actually required, and those driven in stop-and-go urban traffic had not been serviced frequently enough. The cost of unnecessary service also has its price. In fact, more than $3.000.000 is spent every year to replace parts that do need replacement. The brakes on a rural bus, for example, do not need to be replaced every 12.000 miles. By equipping vehicles with sensors that monitor operating environment and usage, a company with a large fleet can better diagnose vehicle condition and schedule the proper service when it is actually needed thus extending vehicle life and decreasing the costs of unnecessary repairs and premature replacement.

The constant development of medical science and the related diagnostic, therapeutic and rehabilitative methods requires many financial resources for the procurement and maintenance of medical technologies. An effective maintenance management can result in a significant reduction of operational costs. On one hand, an increase in the failure rate of medical devices increases both break-down maintenance costs and the risk of unfavorable events. On the other, if devices are replaced too early, an increase of purchase costs will occur. The American College of Clinical Equipment (ACCE) sets forth guidelines for planning equipment disposition and replacement based on a combination of criteria. Accordingly, medical equipment should be replaced when the maintenance

costs for the past 3 years exceed 25% of the purchase price or when the failure rate is outside one standard deviation for like equipment. I could not find industry information quantifying this problem, but I did find a case study of a hospital in Italy that specialized in cancer treatment and had 6.000 pieces of equipment in its records. The hospital estimated that it spent more than $1 million every year to prematurely replace equipment that had high service costs and low reliability. Coincidentally, the ACCE factors are functions of usage. When medical devices are not operated properly, they produce unexpected results, fail more frequently, require more service, and are likely to be replaced sooner - with a competitors device. Using CSX, the manufacturer of medical equipment can analyze machine performance and usage and automatically trigger appropriate preventive actions. When the data indicates that the technician is having difficulty operating the device or that the results are unexpected, alerts to offer support and onsite training can be instantly triggered. If the issues persist, CSX can trigger preventive maintenance. The expenses for periodic training and preventive maintenance can be significantly lower than the cost of repairs plus the future revenue from the sale of supplies that is lost when equipment is decommissioned earlier than forecast.

Preventive Maintenance

As soon as the operator of machine or driver of a vehicle sees an error lamp, he senses frustration, an early form of dissatisfaction, and several new opportunities to disappoint the customer are created.

Preventive maintenance entails forecasting when products will require parts and service in order to reduce unplanned downtime. This is the most salient of the use cases for CSX, because predicting parts and service generates a huge measurable business impact, especially for manufacturers. Traditionally, preventive maintenance is based on intervals, but, as I showed above, factors like miles driven or age are not accurate determinants of true machine condition. Some companies rely on error codes and warning messages to schedule maintenance, but this is a reactive approach. As soon as the operator of machine or driver of a vehicle sees an error lamp, he senses frustration, an early form of dissatisfaction, and several new opportunities to disappoint the customer are created. The reactive recovery process is, therefore, a huge vulnerability for many companies:

1. When the user has difficulty reporting the issue, because he cannot find the contact information for the customer support department, the support department is not open, or an agent is not available and the customer is on hold for a long time.
2. When the customer service agent is unsympathetic to the users situation.
3. When the case creation process requires information that the user does not have like serial number or contract number.
4. When the next available service appointment is not soon enough.
5. When the service technician arrives later than scheduled.
6. When the service technician appears incompetent, is unfriendly or is poorly groomed.
7. When the service technician cannot resolve the problem during the first visit, due to missing parts, skill, or tool.

Using CSX, preventive maintenance is scheduled based on true machine condition, which is a function of environment and actual usage. Scheduling preventive maintenance involves ensuring that the proper parts, skill set, and assets are available at the right time. Aside from the additional revenue captured by proactively offering parts before the customer knows he needs parts (and purchases them elsewhere), there are several measurable benefits related to forecasting the demand for parts. First, when the manufacturer knows which parts a customer will need in the future, the manufacturer can send parts sooner using a lesser expensive shipping service. One manufacturer told us that, “when the customer calls, it´s always an emergency and he needs parts now to get his machine back online, so we ship most parts orders per express service.” The volume of orders and the difference between standard ground and express is significant so that the company could save almost €2 million per year by shipping parts ground. Shipping parts a week in advance so they arrive just-in-time requires accurate forecasting. Second, many manufacturers and customers maintain inventories of spare parts. A municipality told us it had more than €2 million worth of inventory tied up in spare parts for street and signal lights just in case. By forecasting when parts are actually required, the municipality can order parts just-in-time thereby decreasing its inventory costs. Third, when parts are ordered on-demand, there is little time to shop for the best price. Using CSX, the demand for parts can be accurately forecast giving the company more time to compare prices and lower its costs. Fourth, first-call resolution (FCR) is a performance indicator used in service to

measure the number of cases that are closed after the initial visit. When cases are not closeable in a single visit, additional costs for travel, labor, and possibly downtime compensation are incurred. One energy company reported that its FCR rate was 70% and that half of the cases that could not be resolved in the initial visit were attributed to the technician not having the proper part. Fifth, many companies offer service level agreements (SLAs), which set forth a response time when an issue is reported and, in some industries, includes downtime compensation or outage penalty when the response time is not met. The manufacturer of industry machines reported that it did not meet the terms of its SLA several times last year due to missing parts and incurred downtime penalties of €270.000. An SLA that stipulates outage penalties when SLAs are not met creates a double burden for the manufacturer who also loses out on the supply revenue when a machine is not online. The manufacturer of digital printing equipment that also provides the special paper and toner informed us that, independent of outage penalties, the company loses €400 per hour in supplies when a machine was off-line. The typical down-time for a digital printing press was 6 hours. Using CSX to forecast parts enables the company to produce or procure parts just-in-time, lower the cost of procuring parts, decrease inventory costs, decrease shipping costs, improve FCR rates, eliminate follow-up service calls, and ensure that SLAs are and penalties are spared.

Preventive maintenance also entails forecasting specific activities and these activities are usually performed by field service technicians. Field service technicians are trained in different areas, for example, mechanical, electrical, and programming. When an error message is reported from a machine, the root cause of the message is not always apparent. Does the “Service Required” lamp indicate an electrical, mechanical or possibly a programming issue? In the traditional reactive approach, a technician is dispatched to diagnose the issue and, after the true nature of the issue is determined, the technician with the proper skillset can be assigned to the case. When the diagnosing technician does not have the proper skillset to resolve the issue during the initial visit, a follow-up visit for the correct technician is scheduled. An operator of a wind farm reported that around 10% of its service cases required 2 or more visits to resolve due to dispatching a wrong technician and the company incurred travel, labor and downtime compensation costs of more than €1.000.000 per year for these incidents. Using CSX, the nature of the problem is diagnosed remotely and the most appropriate resolution is automatically generated ensuring that a qualified technician is dispatched the first time, thus eliminating the costs for follow-up visits. The second measurable use case for CSX pertaining to preventive maintenance and forecasting skillset is decreasing response times and ensuring service levels by optimizing workforce planning and hiring. Aside from product availability, technician availability is an important driver of response time. Technicians may not be available due to vacation, staffing levels, and training. Using CSX to predict issues and the skillset required to resolve them, the company can better plan when technicians schedule time off from work. Furthermore, forecasting skillsets can be used to create better training plans. When the data indicates that the number of issues requiring a specific skill will increase in 6 weeks, the company can start efforts today to cross-train or hire technicians with the specific skillset and ensure that SLAs are met and penalties are avoided. A third measurable case of CSX in preventive maintenance is reducing service times by optimizing assignments based on SLAs. Even though

technicians may have the same training or certification, they will have differing levels of experience. One technician may be able to resolve an issue faster than another with the same skillset. When the more experienced technician is assigned to a customer with a stricter SLA, he can get the machine on line faster thus lowering the cost of service and also capturing material revenue.

The third area of preventive maintenance deals with predicting which assets are needed when. Assets in this context refers to specialized equipment such as scissor lifts, cranes, forklifts, helicopters, ATVs, and electronic equipment, which do not belong to a service technicians standard set of tools, because they are often expensive, sometimes require special training to operate, and are used infrequently. In the traditional reactive service setting, specialized equipment is checked out on-demand, on a first-come first-serve basis. This sometimes means that a high priority customer does not receive a satisfactory level of service, because the specialized equipment was already assigned to a case for another lower-priority customer. When necessary assets are not available, SLAs cannot be met and the company may incur penalties or the company can rent the specialized equipment, in which case additional unplanned costs are incurred in order to satisfy the SLA.

To ensure that specialized equipment is always available and that service levels can be met, many companies acquire redundant assets in order to satisfy SLAs and avoid applicable penalties.

Due to the compounding measurable benefits of CSX in preventive maintenance, it is no wonder that this is the most attractive use case for predicting issues and proactively ordering parts, scheduling technicians, and planning assets.

Capgemin´s 5A Model for IoT

Function	Technology
(A5) Action	CRM, Call Center, Field Service
(A4) Assignment	Knowledge Base, Expert System
(A3) Analytics	Reporting, Predictive Analytics
(A2) Aggregation	Database
(A1) Acquisition	Sensors, Gateways, Connectivity

New Revenue Models

The ability to predict and proactively address issues before they occur creates several opportunities to develop new business models.

Capgemini uses a 5A Model to assess the maturity of an IoT system, to serve as the framework for IoT architecture and as the IoT project plan. CSX requires multiple technologies. Think of these 5 layers as building blocks: machines need sensors that generate and transmit data (acquisition), the sensor data from multiple machines is stored (aggregation), the data is visualized and analyzed (analytics) to identify anomolies, the presence of an anomoly triggers a resolution (assignment) that generates a task (action). These functions are implemented typically in sequence and the incremental build creates 3 value levels for the company.

The first value level is achieved when the customer has reached the analytics level, because at that level the company has the information required to optimize its processes. The second level is achieved when the company reaches the action level, because at that time the company can automate processes and become a proactive company. Reaching the action level also presents a third value level – transformation. The ability to predict and proactively address issues before they occur creates several opportunities to develop new business models. I mention this, but do not focus on this, because few companies have reached IoT maturity and creating new revenue models for machine data is lesser important than improving internal processes in order to realize the measurable benefits described above.

- Data Brokering. The most common new business model that is being explored by companies that have reached IoT maturity is data brokering. This entails providing access to the insights gained from the data to third parties. A company that manufactures street lights that are equipped with motion sensors is considering reselling the data to advertising agencies so they can calculate the cost-per-impression for their bill boards.

- FaaS or PaaS. Some manufacturers are exploring new concepts like Factory-as-a-Service or Product-as-a-Service. Accordingly, the company does not sell the machine or the refrigerator, but provides the customer a related service. The company that sells bottling equipment, for example, is contemplating not selling the equipment, but offering a bottling service and charging customers on a per bottle basis. One company that makes home appliances is exploring the idea of not selling refrigerators, but providing a grocery service.

- Proactive SLA. CSX gives every manufacturer the ability to offer customers a new type of service level agreement. Different than the traditional reactive SLA, which sets forth a response time when an issue is reported, the new Proactive SLA would eliminate unplanned downtime – naturally at a higher cost.

- Value-Added Services. The insights gained from analyzing data can be repacked and made available to customers as subscription services. One automaker offers drivers a mobile app to monitor their vehicle performance, location, and fuel consumption. A manufacturer of forklifts offers its customers a subscription service to track the location and utilization of equipment.

Conclusion

By identifying a combination of cases, the company that invests in CSX can maximize its ROI.

I am confident that I achieved the intent of demonstrating that there are many measurable business cases for IoT and the Capgemini extension called CSX. By identifying a combination of cases, the company that invests in CSX can maximize its ROI. In conslusion, I provide 3 different ways of summarizing the business cases:

Business Impact Questions. How much money would your company save (or generate) with IoT and CSX if it could

1. lower its emissions by 20%?
2. reduce waste in production by 20%?
3. improve fuel efficiency by 10%?
4. reduce the cost of occupational injuries by 50%?
5. reduce product liability claims by 50%?
6. grow after-market sales by 40%?
7. improve productivity by 20%?
8. grow after-market service by 40%?
9. reduce theft by 50%?
10. reduce product damage or loss in supply chain by 50%?
11. improve asset utilization by 20%?
12. decrease assets by 20%?
13. decrease the cost of equipment abuse/misuse by 50%?
14. extend product lifecycle by 10%?
15. eliminate unnecessary parts and service?
16. optimize asset disposition by 50%?
17. eliminate downtime penalties?
18. decrease inventory costs by 50%?
19. decrease parts cost by 10%?
20. decrease shipping costs by 40%?
21. eliminate the cost of follow-up visits by 70%?
22. decrease service times by 20%?
23. decrease service costs by 30%?
24. decrease equipment rental expenses?

IoT in the Supply Chain. The use cases are realized by embedding or retrofitting sensors on “things” and monitoring the condition and usage of those things in near-time. There are opportunities to track things throughout the value chain. The list of “things” is sorted to show what things are easiest to track and also what level impact tracking has on the business. A SmartOffice solution can be realized quickly and can help to optimize operations (lower costs), whereas tracking customers is more difficult, but can transform the enterprise.

Category	Things	Notes	Use Cases
Business Assets	furniture, equipment, tools, vehicles, buildings, lights, doors	Smart Building, Connected Car , smart Office, or Smart Home Retrofit DIY kits exist, sensors are commodities, connectivity is simple.	1. Decrease Energy Costs 2. Decrease Loss & Theft 3. Decrease Misuse & Accidents 4. Improve Efficiency & Productivity 5. Decrease Assets
Production Machines	manufacturing equipment	Smart Factory, Industry 4.0 Connectivity is simple, but access to some machines may be restricted by the manufacture and proprietary protocols can be challenge.	1. Decrease Unplanned Downtime 2. Decrease Inventory Costs 3. Decrease Labor Costs 4. Decrease Cost of Waste 5. Decrease Costs for Parts & Supplies 6. Decrease Shipping Costs 7. Extend Machine Life 8. Improve Productivity
Shipments	boxes, pallets, containers, trucks, ships, planes, trains	Connectivity in a region is simple, but international connectivity and inter-model tracking are challenging.	1. Decrease Energy Costs 2. Decrease Mishandling & Loss 3. Improve On-time Delivery 4. Decrease Insurance Costs 5. Decrease Replacement Costs
Products	vehicles, white goods, machines, tools, shoes, trees, fixtures	Smart Devices, Connected Devices Requires close involvement of product development, thorough testing because the sensor has to outperform the device, and identification of all potential use cases to ensure future-safe design.	1. Grow After-Market Sales 2. Decrease Misuse & Warranty Costs 3. Decrease Accidents 4. Offer Value-Added Services 5. Improve First-Call Resolution Rate 6. Improve Product Development 7. Improve Customer Satisfaction
People	customers, patients, operators	iHealth, Wearables Privacy issues can be complex and requires a measurable benefit in order for the customer to opt-in.	1. Improve Efficiency 2. Reduce Costs of Undesired Side-Effects 3. Prevent Cost of Misuse

Use Case	Assets	Machines	Trans	Products	People
Decrease emissions	★	★	★	★	★
Decrease fuel	★	★	★	★	★
Decrease early retirement	★	★	★	★	
Decrease waste in production		★		★	
Grow revenue through recycling	★	★		★	
Decrease costs of accidents	★	★	★	★	★
Decrease warranty expenses	★	★		★	★
Decrease insurance costs	★	★	★	★	★
Decrease product liability expenses				★	★
Decrease the costs of recovery			★	★	
Increase revenue by optimizing productivity		★	★	★	
Increase parts and service revenue				★	
Decrease the costs of theft	★	★	★		
Extend product lifecycle	★	★	★	★	★
Reduce unnecessary repairs	★	★	★	★	
Reduce asset replacement costs	★	★	★	★	
Reduce shipping costs	★	★		★	
Reduce inventory costs	★	★		★	
Reduce supply costs	★	★	★	★	
Decrease service costs	★	★	★	★	
Reduce outage penalities			★	★	
Decrease costs of unintended side-effects					★
Reduce service times	★				
Decrease the costs of redundant assets	★	★	★	★	
Decrease on-demand rental	★	★	★	★	

About

Prof. Dr. Michael J. Capone has 20 years experience in CRM as author, professor, consultant, and program manager for global brands in automotive, entertainment, manufacturing and consumer electronics. Capone is Research Fellow at University Hamburg, Institute for Marketing and Innovation, where he researches „Early Indicators of Customer Dissatisfaction," developed the BING catalog of behavioral indicators, and patented SmartPOS technology. Capone´s research in "Predictive Monitoring" was recognized by the DWG/WWG in May 2015 as one of the top 20 contributions to CRM in the past 30 years. As Principal Analyst at Capgemini in Germany, Capone designed the 5A Model and champions the IoT initiative.

About Capgemini

With more than 145,000 people in over 40 countries, Capgemini is one of the world's foremost providers of consulting, technology and outsourcing services. The Group reported 2014 global revenues of EUR 10.573 billion. Together with its clients, Capgemini creates and delivers business and technology solutions that fit their needs and drive the results they want. A deeply multicultural organization, Capgemini has developed its own way of working, the Collaborative Business Experience™, and draws on Rightshore®, its worldwide delivery model.

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