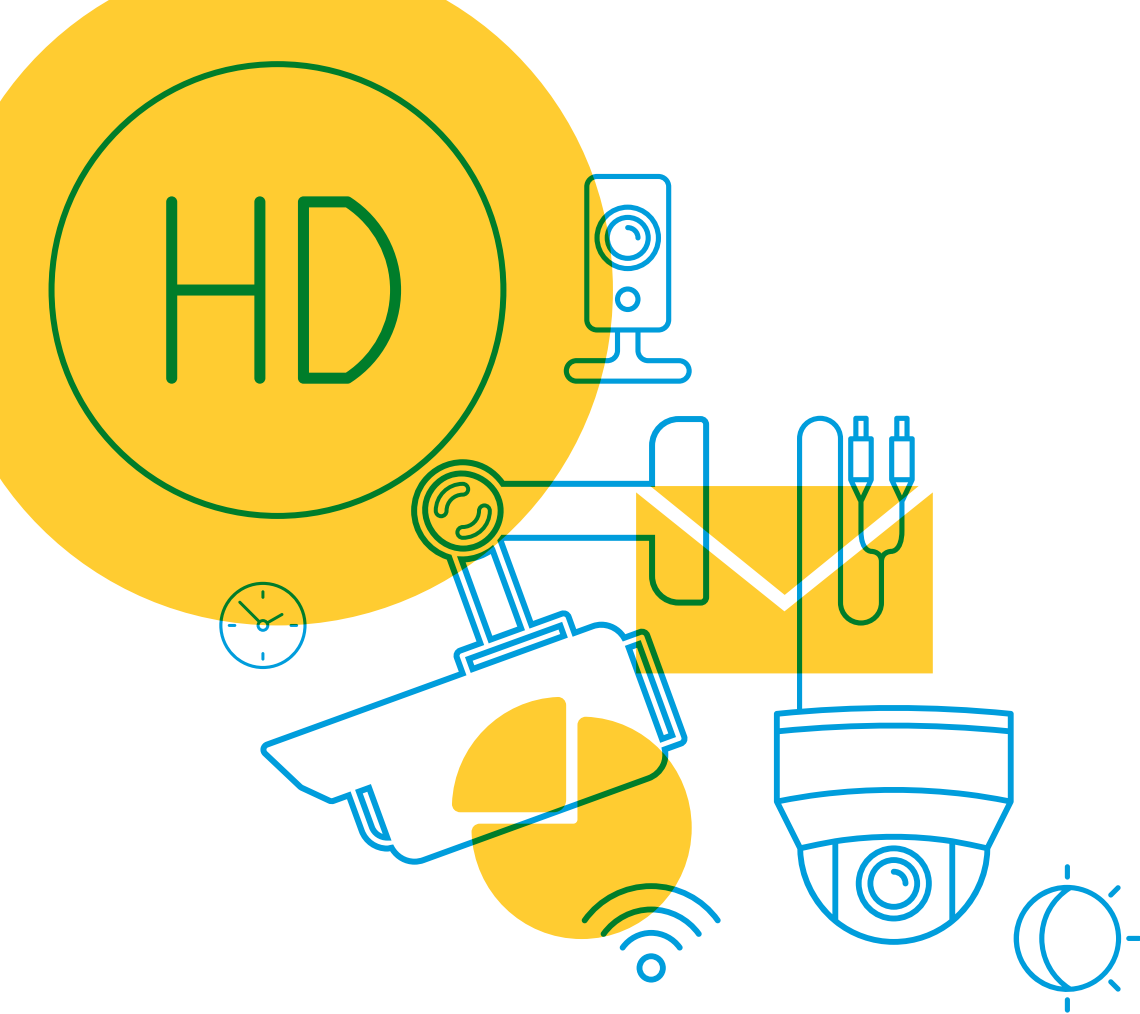




White Paper

Better insight for better business decisions

Analyzing the Total Cost of Ownership
(TCO) of video surveillance systems

Executive summary

Total Cost of Ownership (TCO) is an established concept in many industries as a model to estimate costs across a system's lifecycle. In the video surveillance industry, there are few studies published that present TCO models or examples.

In this paper, Axis presents the results from a TCO study conducted in 2015, resulting in a model with 40 costs relating to system components and stages. The model is populated with an example 1,500 camera city surveillance project resulting in a TCO of around USD 17,000,000. The analysis shows among other things that about 50% of the total cost is made up of investments in hardware and software, and 50% occurs during installation, maintenance, operating and decommissioning.

The TCO is also used to simulate the result of Axis' Zipstream technology, resulting in total savings of USD 450,000 or around USD 300 per camera. The TCO is also used to simulate a scenario where product failure is increased, leading to a negative impact on the TCO with failure costs increasing from USD 800,000 to USD 2,300,000.

A TCO like the one presented here can be a useful tool when calculating projects or assessing tenders. It presents examples of costs which can be expected, and indicates areas to focus on to reduce costs and improve the quality of the surveillance solution.



Table of contents

1. Introduction	4
1.1 Total Cost of Ownership (TCO) insight for better business decisions	4
1.2 Definition of TCO	4
1.3 Purpose of a TCO – how can it be used?	5
2. Methodology and considerations	5
2.1 Every TCO is unique	5
2.2 Industry differences	5
2.3 Who carries the cost?	5
2.4 Developing the TCO	6
2.5 Data sources and research	6
3. Determining the cost factors	6
3.1 The lifecycle phases of a surveillance system	6
3.2 Factors covered in this TCO	7
3.3 Examples of factors not covered in this TCO	7
4. Defining an example project	7
4.1 Attaching values to each factor	8
5. Analysis of the result	8
5.1 Total cost of ownership for the city surveillance project	8
5.2 Costs for products vs. other costs	8
5.3 Observations on costs not included in the TCO	10
6. The impact of more efficient video storage	11
7. A closer look at product quality	12
8. Conclusions	13
9. Links	13
10. Appendix 1 – Cost factors	14
10.1 Cost factors during acquisition	14
10.2 Cost factors during operation	14
10.3 Cost factors during decommissioning	14
11. Appendix 2 – The example system	15

1. Introduction

1.1 Total Cost of Ownership (TCO) insight for better business decisions

Imagine you are responsible for a safe city project, and you are tasked with deploying a multi-million dollar video surveillance system. Where would you start? How would you evaluate tenders? How would you assess upfront costs in relation to the long-term operating costs? And which areas of the system should you focus on to optimize its total lifecycle cost? These are just some of the questions you need to ask to minimize risk and avoid unpleasant surprises once the system is deployed.

This TCO study presents a comprehensive picture of the total cost for a large hypothetical surveillance system in a major city. It shows how costs are divided between different parts of the system as well as the different phases over the ten-year lifecycle of the system. It also includes an analysis of certain factors that sit outside the TCO, such as business costs due to system downtime. Finally, this model shows how camera technology and product reliability could impact the total cost of ownership in a significant way.

1.2 Definition of TCO

TCO is a financial estimate model that intends to capture all the costs associated with an activity over its complete lifecycle. TCOs are used in many industries as a tool to correctly estimate the direct and indirect costs of deploying a system, and as a tool to compare different systems with different characteristics and cost distribution.

In a fact sheet from 2009, Accenture defines Total Cost of Ownership as "defining the range of costs associated with the asset lifecycle including research, development, procurement, operation, logistical support and disposal of an asset."

In this white paper, the Axis definition is: Quantify a selection of relevant costs associated with a video surveillance solution throughout its complete lifecycle.

TCO studies from other industries

There is a tendency to estimate the total system cost based only on the initial investment. This is not unique for the security industry, but this bias has been proven in many TCO studies in various industries.

In a TCO study from 2016 on the cost for mobile devices in enterprise companies, conducted by Wandera, they found that the actual **total cost was 116% higher** than CIOs believed. The main explanation for this gap was that purchasers focused primarily on the upfront cost for devices and the data plan cost, and drastically underestimated other operating costs, for example within IT, services and security.

In another TCO study on the cost for HR payroll systems, conducted by ADP in 2012, they found that **only 37% of the costs were "visible"**, i.e. costs that the survey participants were aware of. This included costs such as system installation and direct labor. On the contrary, 63% of the total cost, including indirect labor cost and system maintenance, were not top of mind for the participants.

In a TCO paper by Nash Networks from 2009, they consolidated data from a number of TCO studies and concluded that **as much as 75% of the total cost for a server was maintenance and other costs during operation** – or conversely, only 25% of the total cost of ownership was in the initial investment of hardware, software, installation and training.

1.3 Purpose of a TCO – how can it be used?

A TCO when included in any financial analysis, provides a cost basis for determining the total economic value of an investment and as a product/process comparison tool. A TCO can:

- > help project teams understand how the cost is distributed over time from installation to operation and decommissioning
- > help to understand the distribution of costs between different system components
- > minimize the risk of unforeseen costs that can erode budgets
- > help to focus efforts and reduce costs over time
- > help during discussions with stakeholders about long-term perspective and lifetime expectancy of a system
- > be a contributing factor, out of many, when evaluating project tenders

2. Methodology and considerations



2.1 Every TCO is unique

It is important to point out that there is no single uniform TCO model that fits every project. On the contrary, every project has a unique cost distribution, and it is up to each project team to determine which cost factors to take into account and how to judge the monetary aspect of each factor.

2.2 Industry differences

Even though many of the cost factors presented here are common in surveillance projects across different industries, there are many that will be different. For example, in an airport or critical infrastructure installation, the consequences of system downtime are vastly different from a school district. Another example is the lifespan: in some industries such as city surveillance, a system could be expected to remain in place unchanged for years, while in others such as a retail environment, cameras may be moved around and the system upgraded on a regular basis.

2.3 Who carries the cost?

This TCO model captures and assesses a number of system costs that occur during acquisition, as well as over time, in a hypothetical city surveillance project. However, this analysis does not define who actually has to carry the cost in the end. In some projects it might be the end customer that pays for everything, while in other projects the system integrator will carry the cost for some areas. Naturally it will also depend on the warranty agreements, service level agreements, financing etc.

2.4 Developing the TCO

To develop this model TCO, the following steps have been taken:

1. Determining the cost factors
2. Defining an example system
3. Analysis of the results

2.5 Data sources and research

Axis has based this TCO on information gathered from a number of sources to determine cost factors and reasonable values to enter into the system.

Sources for this project include:

- > Interviews with system integrators
- > Interviews with end customers
- > Data at Axis from existing similar projects
- > Knowledge, experience and statistics from Axis support, sales and field engineering organizations
- > Data available from security industry organizations and other security sources

The data gathering and development of the model took place during 2015, which means factors such as equipment prices, labor and maintenance costs represent a snapshot of the market situation during that period of time.

3. Determining the cost factors

3.1 The lifecycle phases of a surveillance system



Figure 1. Costs during the lifecycle

To create a simple overview of all the costs that affect the TCO of a video surveillance solution, the cost factors have been categorized according to the activities and chronological order in which they appear throughout the system lifecycle. The ownership of a product can be divided into the phases: acquisition, operation and decommissioning. Following these phases, the costs are then divided into three main categories: total cost of acquisition, total operating cost and total decommissioning cost. See Figure 1. The costs in each of the main categories vary in nature. While the acquisition costs and the decommissioning costs only occur once, the operating costs occur continuously throughout the system lifecycle. The size of the operating cost is then heavily dependent on the expected length of the system service time.

3.2 Factors covered in this TCO

As stated above, some direct costs as well as some indirect costs are obvious when purchasing a surveillance system. For example:

- > Hardware investment
- > Software investment
- > Costs for warranties
- > Installation and integration cost
- > User education

However, these are only a few of the costs that can be incurred during a systems lifecycle. In this TCO, a total of 40 cost factors have been taken into account, including project management, operation, maintenance, decommissioning and much more. See Appendix 1 – Cost factors for details.

3.3 Examples of factors not covered in this TCO

There are a number of factors that could have been included in the TCO model, but were omitted. One reason for not including these costs is that estimates vary considerably between industries. This could skew the TCO in the wrong way. For example, the costs for alarm failures and costs incurred in the business operation due to system downtime, will have very different consequences for a headmaster in a school compared to the security manager at a nuclear power plant.

There are other costs that have been excluded from the TCO because they are potentially so huge that they dwarf the overall system cost – for example, salary costs for staff that operate a monitoring center, or the cost of a climate-controlled server room for storage.

Examples of costs not included in this TCO are:

- > Extended warranty costs
- > Freight costs
- > System inspection costs
- > Insurance costs
- > Server room costs
- > Software failure costs
- > Alarm failure costs
- > Business costs as a consequence of system downtime
- > Staff costs in operations center

The latter two will however be explored in separate sections later in this paper.

4. Defining an example project



The example project in this TCO model is a large-scale city surveillance project in a mature market. The project includes 1,500 outdoor cameras and an enterprise-class video management, network and storage solution. For details, see Appendix 2 – The example system.

4.1 Attaching values to each factor

Values/costs have been defined for all factors based on the extensive input as described in an earlier section. Examples include:

- > Prices for all products are Manufactured Suggested Retail Prices (MSRP) without any discounts
- > 13 labor roles are defined ranging from an administrator to a senior consultant
- > Labor costs range from USD 35 to USD 200 per hour depending on role
- > Electricity cost is USD 0.13 per kWh
- > Cable installation time is estimated at 4 hours per camera
- > Camera installation time is estimated at 2 hours per camera
- > Camera maintenance is estimated to happen twice a year

5. Analysis of the result

5.1 Total cost of ownership for the city surveillance project

The analysis of the TCO in this chapter focuses on the relative distribution of cost in percentages, and less on the actual dollars and cents. But to create an understanding of the magnitude of this system, the first conclusion is that the total cost of ownership for this 1,500 camera system over a ten-year period amounts to approximately USD 17,000,000.

Cost per system phase

See Figure 2 for the percentage of cost split during the lifecycle of the system.

The cost per system phase amounts to:

1. Total cost of acquisition: USD 11,400,000, or around 67%
2. Total operating cost: USD 5,200,000, or around 31%
3. Total decommissioning cost: USD 300,000, or around 2%

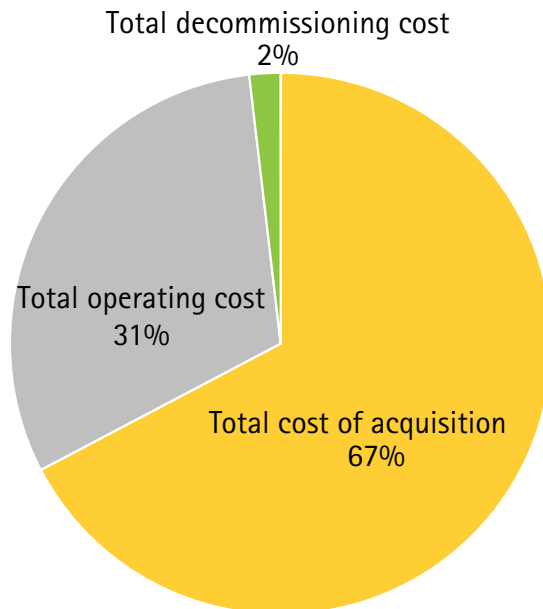


Figure 2. Share of costs during the lifecycle

5.2 Costs for products vs. other costs

Another top view of the TCO is the division between product costs and other costs. In this TCO, as shown in Figure 3, about half (49%) of the total costs relate to direct upfront costs for the purchase of cameras, software and other equipment – also referred to as contract costs. The other 51% are costs relating to design, installation, maintenance, etc.

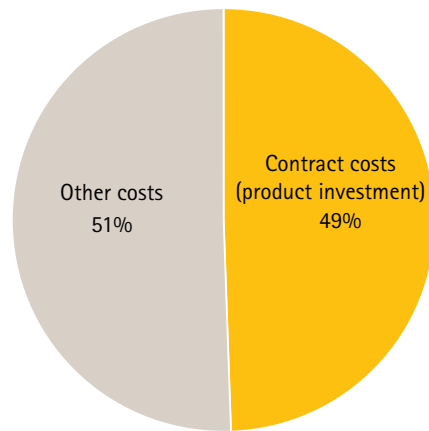


Figure 3. Contract costs compared to other costs

Detailed costs per area

Looking closer at the TCO, Figure 4 and Figure 5 presents two different views of the detailed distribution of costs during the lifecycle.

Acquisition

As stated above, almost half the TCO is made up by the initial product investment, also referred to as contract cost. Around two thirds of that contract cost, or 34% of the whole TCO, is for video management software, network, storage and hardware other than cameras. A third of the contract costs is camera cost, making up around 16% of the TCO for the system.

The other costs that occur during 'year zero' of the system in this model are pre-contract and deployment costs. Pre-contract costs include among other things system design and vendor evaluation. Deployment costs cover everything connected to installation, configuration and integration. Together, pre-contract and deployment costs account for around 18% of the TCO.

Operation

During operation of the surveillance system, a number of costs are incurred, the main one being system maintenance. This covers all planned and regular maintenance (cleaning etc.) of cameras, servers, software etc. Operation also includes costs due to system failure as well as software license fees and power consumption. Maintenance costs represent the single largest share of the TCO for this system, amounting to around 20% of the TCO. Other operating costs add up to approximately 12%.

Decommissioning

The decommissioning of a surveillance system is very important and is often overlooked in the initial costing stage of a project. From a sustainability perspective it is essential to properly dismount and recycle equipment at the end of its lifetime, and these costs must be factored into the system's lifecycle. In this TCO model, the decommissioning costs represent 2% of the total cost.

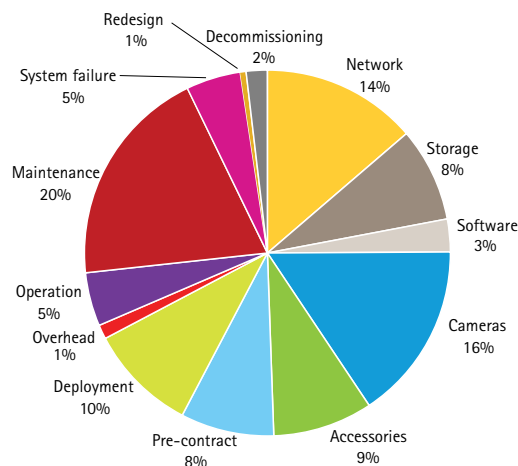


Figure 4. Cost distribution of the TCO in percentages.

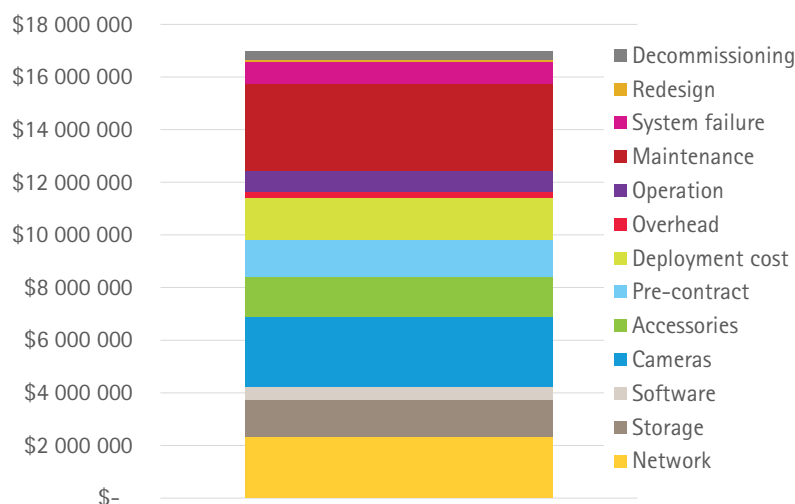


Figure 5. The cost distribution of the TCO in money.

5.3 Observations on costs not included in the TCO

Security costs due to system downtime

When compiling this TCO model, security costs that appear from the downtime of a failed surveillance system were excluded. However, when it comes to protection of valuable corporate assets, the costs of a security breach can of course be catastrophic. Especially if confidential business information or other intellectual property is destroyed, stolen or made available to competitors.

Business costs due to system downtime

Unplanned events that cause a system to fail can lead to excess costs for a business. For example, in an airport, if the surveillance system fails, it could lead to very high costs as extra security guards may need to be dispatched, or flights might be delayed. In a retail store, a failed surveillance system may impact the ability to prosecute perpetrators for fraud and shrinkage, leading to substantial losses. In some city surveillance situations, camera maintenance crews need to be accompanied by police or guards when going out on site, which would increase the downtime costs substantially.

In the TCO, when operating costs are calculated, business downtime costs have been excluded. However the TCO model makes it possible to make an estimate and see how business downtime costs could impact the TCO. For example, assume that it is necessary to dispatch one security guard to protect the installer as he goes to a camera location to fix a problem or replace the camera. Adding the security guard cost – only labor in this case – increases the share of the operating cost from 31% in **Figure 2** to 33%, as you can see in **Figure 6**.

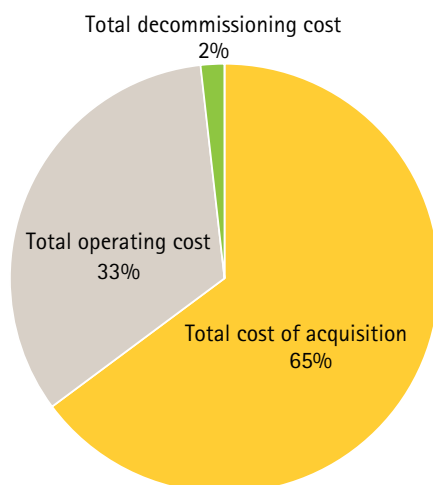


Figure 6. Share of costs during the lifecycle when an example of business downtime cost is added.



Labor costs in the operations center

When calculating the operating costs of the TCO, the labor cost of the staff needed to man the operations center during the ten year system lifespan has been excluded. However, the TCO model makes it possible to estimate this cost and factor it in to see how it impacts the TCO.

In an enterprise city surveillance installation, it is likely to have operators active 24 hours a day, 7 days a week. Assuming that 5 people are constantly present in the room, it is possible to make a rough calculation on the cost distribution. As you can see in Figure 7, the total operating cost now jumps from 31% to 73% of the TCO, almost triple the acquisition cost. This is in line with the findings in the TCO studies from other industries that are referred to in the introduction of this paper.

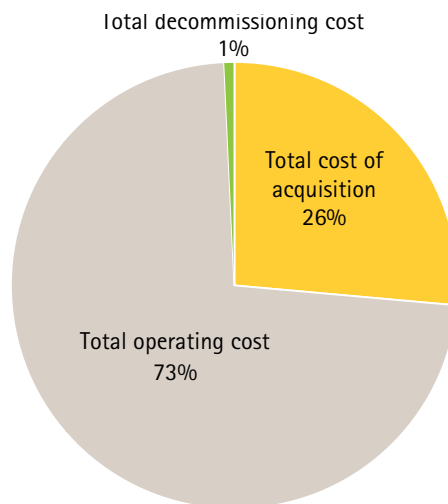


Figure 7. Share of costs during the lifecycle when staff for the operations center is taken into account.

6. The impact of more efficient video storage

The surveillance industry is constantly innovating to improve product and image quality, optimize video compression, speed up installation, and simplify maintenance.



In 2015, Axis released cameras with Zipstream, an award-winning compression technique that lowers bandwidth and storage requirements by an average 50% or more for many common 24/7 surveillance use cases.

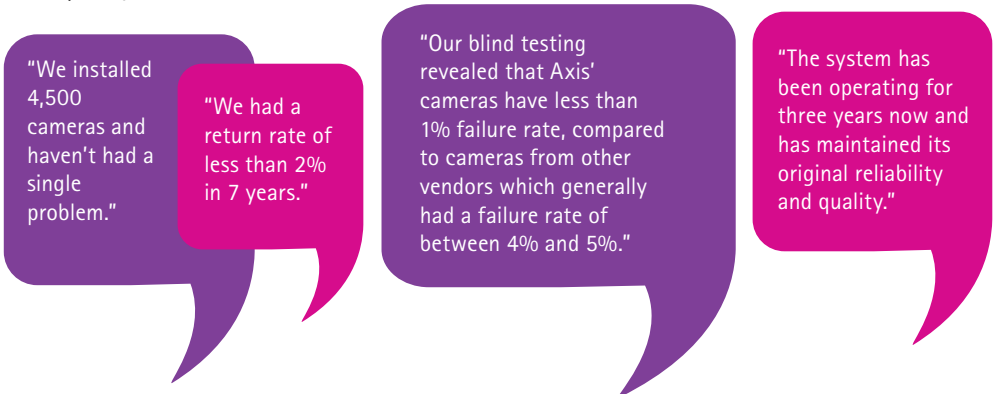
So far in the TCO, the cameras in the system do not have Zipstream included, but it is easy to simulate the effect if the cameras were to compress video with Zipstream. With an assumption of 25% savings on storage, in this kind of scenario, the impact of Zipstream on the TCO amounts to 3%. This may sound insignificant, but translated to money it represents approximately USD 450,000 in savings in total, or around USD 300 per camera.

7. A closer look at product quality



Maintenance and repair costs play a significant part of any TCO. The importance of product reliability is often underestimated when considering the cost of maintaining and operating a system. High product quality is of course one critical aspect to keeping maintenance and repair costs to a minimum.

Axis products are designed for performance and reliability and are tested to withstand extreme conditions. The TCO presented so far is built on typical failure and maintenance frequency, as captured by Axis support statistics. The following examples taken from Axis customer feedback demonstrates Axis quality:



The last customer claims that Axis products are four to five times more reliable than other comparable products. How would the TCO be impacted if the failure rates were increased by a factor of four? As you can see in Figure 8, the system failure cost jumps from the 5% in Figure 4 to 13%, representing a significant cost increase from USD 800,000 in the original case to more than USD 2,300,000.

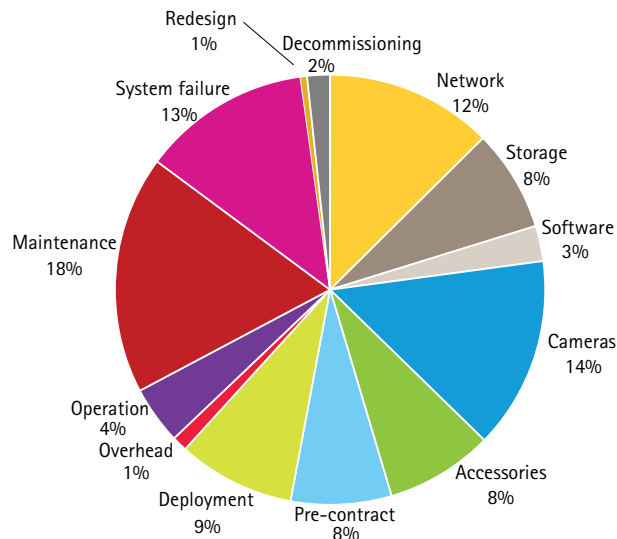


Figure 8. The TCO with an increased product failure rate.

8. Conclusions

Axis has presented the results from a comprehensive TCO study conducted in 2015, resulting in a model with 40 costs relating to different system components and stages.

The model was populated with a large-scale 1,500 camera city surveillance project, with data taken from internal Axis sources as well as interviews and comparative surveillance industry information. The TCO is based on current equipment, labor and maintenance prices sourced during 2015, so market situation and costs may differ at time of reading. The result showed among other things that about 50% of the total cost is made up of investments in hardware and software, and 50% are in installation, maintenance, operating and decommissioning.

The TCO was used to simulate the result of deployed cameras with Axis Zipstream technology and showed that this technology saved around 3% costs in the overall TCO. To highlight the importance of product reliability, the TCO was used to simulate a scenario where product failure would increase by a factor of four. This resulted in the additional costs making a huge negative impact on the TCO, increasing the failure cost from 5% to 13% of the total cost.

A TCO like the one presented here can be a useful tool when calculating projects or assessing tenders. It presents examples of costs which can be expected during the systems lifecycle, and indicates areas to focus on to reduce costs and improve the quality of the surveillance solution.

However, be aware that this TCO is not applicable in all its details for all projects. Every project is unique, and the TCO will of course vary considerably depending on project size, industry application, system requirements and other unforeseen attributes.

If you are interested in learning more about this TCO, or to discuss your project requirements, please contact your nearest Axis representative, which can easily be found on www.axis.com/contact/.

9. Links

Axis resources

- > Axis product quality web page and white paper
www.axis.com/quality
- > Axis Zipstream web page and white paper
www.axis.com/zipstream
- > Axis sustainability web page
www.axis.com/sustainability

Other resources

- > TCO study on Mobile Devices by Wandera, conducted by Redshift Research in 2016
www.wandera.com/tco-whitepaper/ (registration needed)
- > TCO study on HR Administration by ADP Canada, conducted by PwC in 2012
www.slideshare.net/mattdubeau/pw-c-tco-whitepaperexposing-the-hidden-cost-of-payroll-and-hr-administration201203final
- > TCO paper on IT systems, developed by Nash Networks in 2009
www.nashnetworks.ca/pdf/TCOofIT.pdf
- > TCO description for Defense Industry, Accenture 2009
http://nstore.accenture.com/acn_com/PDF/Accenture_Defense_Total_Ownership_Cost_Optimization_Solution.pdf

10. Appendix 1 – Cost factors

The TCO includes the following 40 cost factors.

10.1 Cost factors during acquisition

Pre-contract costs	1. Define specifications
	2. System design
	3. Integrator selection
	4. Contracting
Contract costs	5. Hardware
	6. Software
	7. End user education
Deployment costs	8. Preparatory work
	9. Hardware installation
	10. Hardware configuration
	11. Software installation and configuration
	12. Testing and validation
	13. Work tools and equipment
	14. Late deliveries
	15. Broken on arrival
	16. Rework
	17. Support
	18. Work delays
	19. Weather-related delays
	20. Material handling
	21. Manpower logistics
	22. Project management
	23. Documentation
	24. Security

10.2 Cost factors during operation

Overhead costs	25. Administration
	26. Software licensing
	27. Training of new personnel
	28. Spare part inventory
System operating costs	29. Electricity
Maintenance costs	30. Camera maintenance
	31. Network/IT maintenance
System failure costs	32. Hardware failure
	33. Support cost on user side
System redesign costs	34. Change of surveillance objectives
	35. Change of system size
	36. System upgrade

10.3 Cost factors during decommissioning

	37. Hardware removal
	38. Site restoration
	39. Recycling
	40. Disposal

11. Appendix 2 – The example system

The following attributes define the example system for the purpose of this TCO model:

- > A city surveillance project in a mature market
- > A high-end surveillance solution with professional products
- > 1,500 top-of-the-line Axis outdoor cameras, some with 720p and some with 1080p image resolution:
 - 450 pan/tilt/zoom cameras from AXIS Q60 Series
 - 1,050 fixed cameras from AXIS P13 Series
 - Camera mounting accessories including cabinets, wall mounts and pole brackets
- > 30 days video retention time
- > A market-leading Storage Area Network (SAN) professional solution with around 1,400 Tbyte capacity
- > A market-leading network switching solution
- > The city already has a network in place, which means that only the last section of network cable to each camera needs to be installed
- > A market-leading corporate video management system
- > A control room with a 16-screen video wall, workstations and accessories from a leading supplier
- > Expected system lifespan of ten years



About Axis Communications

Axis offers intelligent security solutions that enable a smarter, safer world. As the market leader in network video, Axis is driving the industry by continually launching innovative network products based on an open platform – delivering high value to customers through a global partner network. Axis has long-term relationships with partners and provides them with knowledge and ground-breaking network products in existing and new markets.

Axis has more than 2,100 dedicated employees in more than 50 countries around the world, supported by a global network of over 80,000 partners. Founded in 1984, Axis is a Sweden-based company listed on NASDAQ Stockholm under the ticker AXIS.

For more information about Axis, please visit our website www.axis.com.