New Management Tools – From Video Management Systems to Business Decision Systems

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ABSTRACT

In the last decades management was characterized by the increased use of Business Decision Systems, also called Decision Support Systems. More than that, systems that were until now used in a traditional way, for some simple activities (like security,) migrated to the decision area of management. Some examples are the Video Management Systems from the physical security activity. This article will underline the way Video Management Systems passed to Business Decision Systems, which are the advantages of use thereof and which are the trends in this industry. The article will also analyze if at this moment Video Management Systems are real Business Decision Systems or if there are some functions missing to rank them at this level.

KEYWORDS: *video, management, system, security, business, decision.*

JEL CLASSIFICATION: *M10*

1. INTRODUCTION

In the last ten years, applied technology was more and more present in all our life aspects, economics, social and cultural, bringing new and new features that society use more often.

This way, a domain that until recently was limited to the simple delinquency detection and its prevention, now tends to become an important management and decision tool for operational and marketing activities.

We will analyze how the video monitoring technology evolved from the analogic technology to IP technology, and how Video Management Systems transformed into Business Decision Systems.

1.1 Video Management Systems (VMS)

Starting with the analog video camera, than with the digital camera and then with the IP camera that appeared after 1996, security industry made big and fast steps to the integrated Video Management Systems (and video networks) (Kille, 2014). In the first stages of video monitoring, the CCTV systems were isolated and independent, and in most cases worked locally. From the appearance of the Internet and of the big data networks, wired or wireless,

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video monitoring passed to a next level, integrating locations - that not so long ago worked independent - in big networks, which can be managed and operated unitary, on arborescent levels of competence.

This way, by merging the classical technologies with the data networks, we obtained what we call today Video Management Systems.

More specifically, a Video Management System is an IT application based on a software application and on a hardware platform that allow the management of a big number of subsystems or video cameras placed in remote locations. By managing we understand the simple use of the systems and subsystems and also the use of data and images analysis, data collection and generating statistics and forecasts.

The development of the Video Management Systems had two directions: one focused on some specific markets with customized solutions (in this case there are products for specific markets like banking, health, hotels, residential, etc.) and one focused on general markets, with open and scalable solutions, which can be adapted by their functions to a large area of industries.

Another feature of Video Management Systems that differentiate them from the hermetic classical video systems is the capability of integration of a lot of equipment. Here we can talk about video cameras (generally IP video cameras), NVR (Network Video Recorders), storage solutions or SDK modules (Software Development Kit) used to integrate with other business or operational platforms. This way, a Video Management System by excellence can configure, control and manage equipment provided by different suppliers and which works on different technologies.

Figure 1. A Video Management System structure
Source: http://www.axis.com/files/whitepaper/wp_choosing_right_vms_50485_en_1302_lo.pdf

Extrapolating, based on the functionality of Video Management Systems, we can draw a parallel between a Video Management System and an ecosystem, the network and the connection system being the environment where we can find the rest of the components, bodies found in bidirectional link (the hardware part of a Video Management System).

1.2 Business Decision Systems

The main disadvantage of the classical video cameras is their incapability of determining features and patterns of the monitored elements. Here we can talk about theft attempts, destroying actions or injuries, or we can talk about the behavior of the monitored elements (people or cars) in some specific spaces.

This extension of the features turned the classical Video Management System into a Business Decision System. This is an informational system on which some business decisions are made.

The concept of Business Decision System is quite old, being used for decades, and it was found in different shapes, as technology developed.

The main purpose of a Business Decision System is to be a tool through which the managers can make business and operational decisions.

1.3 Legal Framework

In Romania, at this moment, there is no legal framework regarding this activity. The only law that regulates the security activities is Law no. 333 from 2003 republished in 2014, and also the Government Decision no. 301 from 2012.

However, a law regarding this activity, respectively the Video Management Systems used for analytics and business purposes must take into consideration not only the security issues but also the privacy and intimacy issues.

Being a quite new area of interest, which is still evolving, even the standards do not approach this subject (even if we talk about security standards or SCADA standards).

There is a number of Standards that refers to video surveillance, like ISO 31000 or ISO 31010 for risk management, or technical standards like Facilities Physical Security Measures Guideline or Security Management Standard: Physical Asset Protection published by the international Security Association ASIS International. But these standards also are quite general and focused on the security aspects of CCTV.

2. STATE OF KNOWLEDGE REGARDING VIDEO MANAGEMENT SYSTEMS AND BUSINESS DECISION SYSTEMS

The works published in the last period that refers to Video Management Systems are mainly focused on the technical aspects of these software applications. For example, the works approached the way that data networks that fundament the Video Management Systems work, the algorithms used for the software applications etc.

For example, Boghossian treats in the paper *Motion-based machine vision techniques for the management of large crowds* issues about the algorithms used for analyzing big crowds movement recorded by CCTV systems, with application on the dynamics of big groups of people.

Another important paper focused mostly on the structure of video networks and on the way that can be adjusted depending of their application is *Intelligent Distributed Video Surveillance Systems*, published by Velastin and Remagnino in 2008. Like the afore-mentioned paper, this one also approaches mainly technical aspects, with no reference to the economical correlations of this system's use.

But the literature does not approach many subjects about the practical aspects regarding Video Management Systems. And here we talk about the way that Video Management Systems can be used in business administration, the way they influence the financial aspects of business, like cost reduction and indirectly the return on Investment (ROI) rate.

Business Decision Systems (or Decision Support Systems) and the literature about them are developed since 1950s, in different ways. But in fact these systems are really used and practically developed since 1970s – 1980s. All the works for these systems are focused on their three main components: the database (or the knowledge base), the decision model (the algorithm) and the user interface.

An important book about a lot of issues regarding Business Decision Systems is *Decision Support Systems: Issues and Challenges* published by Fick in 1980. The book is focused on the main frame of these systems, the informational systems and flows and the decisions algorithms. As I said before, the main parts of the Business Decision Systems.

Another book, more actual and more practical than the previous one is *Decision Management Systems: A Practical Guide to Using Business Rules and Predictive Analytics* published in 2012 by James Taylor. The book is more about how to use these systems and which are the benefits than the general theory.

Another book from 2014, with an interesting approach, focused on Business Intelligence, but also with a global overview about Business Decision Systems is *Decision Support Systems for Business Intelligence* by Vicki Sauter.

3. PASSING FROM VIDEO MANAGEMENT SYSTEMS TO BUSINESS DECISION SYSTEMS – TRENDS IN INTEGRATING TECHNOLOGY IN BUSINESS, MANAGEMENT AND SECURITY ACTIVITIES

The direction of the technology integration in business activity is not necessarily a trend. It is mostly a consequence of the features offered by technology. For example, when we talk about video IP technology, the big retails chains switched to this technology in proportion of more than 50% in only a few years from its appearance (Rajput, 2011) because of its flexibility and scalability, and not the least because of its better Return on Investment (ROI) rate than in the classical technology case (this fact that is more and more important these days because of the economic and social context of the last decade).

If until now the Video Management Systems tried to answer to the "What is most important to a security professional?" question, now they mostly try to answer to "What is most important to a business administrator?" question.

This fact defines best the transition from Video Management Systems to Business Decision Systems, how these systems passed from a narrow security approach (the operative field of security) to a multiple use, which include the business administration and decision.

The basic functions which answer the question "What is most important to a security professional?" are the manual or automatic record, events signaling, quality settings for recording or live view, image format, etc. But when we talk about management decisions, we talk about video analytics, functions that identify, collect and bring in front of us quantitative data which can fundament business decisions.

3.1 The limits of the Business Decision Systems

A major problem of the Business Decision Systems in their actual form is that they do not integrate an artificial intelligence component. At this moment, the decision regarding the measures that can be taken based on analyzed data is still made by human being and is not a decision made by an electronic system (software or hardware) (Bonczek, 1981). This fact is also sustained by the Video Management System featured of working based on data bases and logical rules (rules for detecting events and of storage them). Therefore, we can say that the system is a passive one. These kinds of systems do not have a proactive component (we talk about a finding and centralizations system).

A very probable future step for this new business decision systems, after consuming the next step when the systems will be able to make their own decisions will be the heuristic decision making system. This model will assume a self-improvement of the working algorithm, based on the accumulated history, an adjustment to an uncertain world (Gigerenzer, 2010).
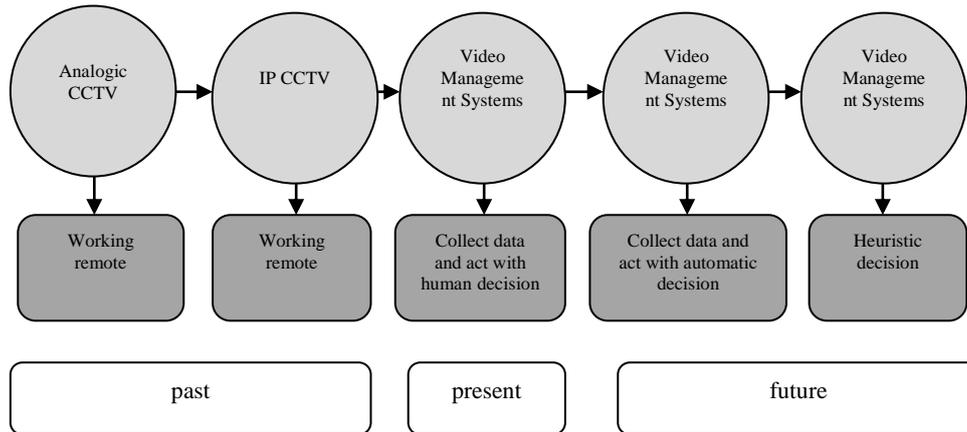
Figure 2. An overview of Video Management System functionality
Source: authors

3.2 Advantages - security, operational and marketing

One of the advantages of technology integration in business activity (with the consequence of extending the result of an activity considered until now narrowed) is the extension of its use with financial results. For example, in the Video Management Systems case, the way we evaluate the rate of the Return On Investment (ROI) or the Return On Security Investment will take into consideration not only the investment result provided by the loss reduction, but also the efficiency of the data obtained for the business and management decisions.

For this, if we consider the classical ROI/ROSI (Return on Investment / Return on Security Investment) formula:

$$ROI(\%) = \frac{Net\ \Pr ofit}{Costs} x100 \qquad (1)$$

we can underline that Net Profit can be obtained by totaling the value of loss reduction with the income obtained on the statistical information provided by the evaluated systems (in this case a Video Management System).

One of the main functions provided by a Video Management System to a business administrator, function that provides basic data for a Business Decision System are: visitors counting, traffic analysis for persons or cars on hours, crowd and tails analysis, and identification of area with intense traffic (of persons or cars). Although this application is most used in retail, it can also be used in domains like health institutions, public transport, administrative or government buildings, educational institutions, etc.

This way, the Net Profit mentioned in the previous formula can be quantified from the security, marketing and operational standpoint.

For example, in the commercial retail activity, the Video Management Systems functions can help for (Rajput, 2011): measuring the store performance, merchandise display strategy evaluation and its optimization, faster customer support and generally optimizing operational activities by analyzing them in detail and in real time (empty shelves signaling, etc.). One of this functions highlighted by Rajput can be briefly described like functions that analyze the consumer behavior, a very important fact for any of the industries that use a Video Management System.

Regarding the Costs from the above formula we can also observe an improvement. Some costs with a Video Management System based on IP technology can be shared with the general IT department costs. This way, many costs regarding the infrastructure, storage servers management, etc. can be already found in the IT department budget (department that is present in almost all mediums and large companies).
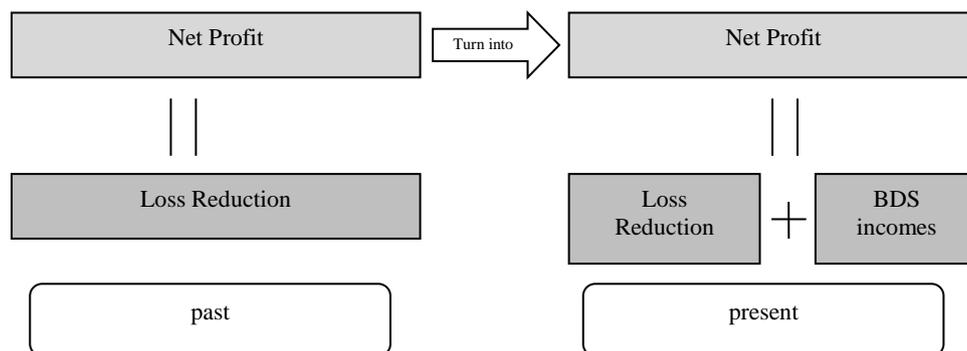
Figure 3. Changes in Net Profit structure
Source: authors

3.3 Return on Security Investment calculation model for Video Management Systems

According to the previous paragraph, the Return on Security Investment calculation model for a Video Management System must take into consideration the loss reduction and also the increasing incomes from the commercial activity optimization.

For example we will consider a company from the commercial retail field. We will consider for this company a 360.000 EURO turnover.

For understanding the case we will have two scenarios. One in which the company will implement a CCTV system based on analogical technology, and one in which the company will implement a CCTV system based on IP technology.

The initial cost structure (investment costs) is different between the two situations:
- For the analogical system there is a first cost of about 5.500 EURO for 12 camera CCTV system;
- For the IP system we can estimate a 4.950 EURO first cost for a 12 camera CCTV system.

We have a 10% difference between the two systems, estimated on the last studies (even the IP cameras are more expensive than the analogical cameras the complete systems are between 10% and 25% chipper because of the IP technology advantages – the wiring, use of standard IT equipment, etc.).

To this first costs we can add a monthly cost of 100 EURO for the maintenance of the analogical cameras, cost that assume collaboration with a specialized security company, or a 50 EURO monthly cost for the IP cameras maintenance - the second cost is smaller because we can use technicians already hired and budgeted from IT department.

In conclusion, the cost for the two situations, for a five years amortization becomes:

Initial cost for analogic CCTV system	5.500 EURO
Maintenance cost for 5 years	100 x 12 x 5 = 6.000 EURO
Total for analogic	**11.500 EURO**

Initial cost for IP CCTV system	4.950 EURO
Maintenance cost for 5 years	50 x 12 x 5 = 3000 EURO
Total for IP	**7.950 EURO**

Regarding the Net Profit brought by the two systems, we will consider for the both systems for the loss reductions, that an initial situation of 1% monthly loss will go to half, respective to 0,5% monthly loss. According to this, the first part of the Net Profit for a year will be around 1.800 EURO.

In the case of the IP cameras we will consider also an increase of sales of about 1% of the turnover, because of the use of video analytics. This increase represents around 3.600 EURO for a year.

For simplifying the analysis we will reflect strict to the turnover and not to the profit. According to all this, ROI (ROSI) becomes:

$$ROSI(\%)analogical = \frac{Net\ Profit}{Costs}\ x100 =$$
$$\frac{0,5\%*360000EURO*5years}{11.500EURO} = \tag{2}$$
$$\frac{9.000EURO}{11.500EURO} = 0,78\%$$

For the IP system we have the following situation:

$$ROSI(\%)IP = \frac{Net\ Profit}{Costs}\ x100 =$$
$$\frac{0,5\%*360000EURO*5years + 1\%*360000EURO*5years}{11.500EURO} = \tag{3}$$
$$\frac{9.000EURO + 18.000EURO}{11.500EURO} = 2,34\%$$

In conclusion, for the same commercial activity, but with two different systems (from a technological standpoint) we can analyze and compare which of them brings a better investment return rate.

The results of these two examples are not relevant. Their goal is to be an example for a calculation method, which will highlight the advantages brought by a standard analogical CCTV system versus an IP technology CCTV system with Business Decision System functions. For example, there can be other cost that may be taken into consideration, for example the costs with the video analytics functions for the IP system, etc.

CONCLUSIONS

The first conclusion is that we have a clear trend of migration for the classical CCTV systems to Video Management Systems based on IP technology. This trend is the result of the technological research applied on security industry, result powered by some clear benefits of this new applied technology.

Regarding the influence over ROI or ROSI for the security investments, by increasing the benefits (extending the use from the loss reduction to marketing and operational benefits) and by reducing the costs based on sharing them with other IT activities, we can tell that we have a clear positive trend of using this kind of systems for collecting data and using them for a Business Decision System.

Also we provided within this paper an analysis model for correlations between the investment level, the result obtained by reducing loss and the result obtained by other marketing and operational advantages.

Functionary is very possible that, if technology will refine its methods of events signaling by video analysis, and if various industries will define more clear their operational flow, we will assist to an improvement of the features of actual Video Management Systems regarding Business Decision Systems and we will observe the passing to a level where some active

systems that will be able to make their own decisions based on collected information. Is just a matter of time for the operators from various industries to define their business flows. And while this things will became real, it is possible to assist to some radical changes of some industries, even we talk about retail or other economic or social activities. (Gustitus, 2015).

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