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UNDERSTANDING
INFORMATION REVOLUTION
AND ITS SOCIAL CHALLENGES

Gana Kiritharan

Understanding Information Revolution and Its Social Challenges

By:
Gana Kiritharan

At the end of the last century human civilization was dreaming about information revolution and consequently economic prosperity. There was enthusiasm about the information superhighway and internet. Intellectuals were dreaming about and calculating sustained economic growth for the next 25 years and alleviation of social problems by the information management system. When everybody was waiting for the economic slowdown which started around the beginning of this century to get reversed, September 11 terror attacks on America came as a blow to every dream. Today human civilization is faced with several questions. Whether the economic recession is over? Will the next economic growth be a long-lasting one? Are all our dreams about the information revolution true and all the multi-trillion dollar investments made on it necessary? What is the impact of computerization on human civilization? How is the management function going to be changed by the information revolution? How should we prepare ourselves to face the information revolution?

Definition of Information:

Before trying to answer these questions, let's try to have a better understanding of what exactly we mean by the word information. Defining information or giving detail explanation for it which is acceptable for all educational disciplines may not be an easy thing. Each educational discipline will try to have a comfortable definition for them. As today information revolution brought by computers it is better to have a definition on that basis. In computer science the most popular way of programming information management software is called object oriented programming. Let try to have a detailed understanding of object and object oriented programming.

The world is made of several objects and functions which directly or indirectly influence other objects and existence. For example, our environment is made of furniture, people, electronic equipment and many more articles. All these objects influence other objects directly or indirectly. The next task is defining and explaining these objects in detail. In an environment when you can identify and define something uniquely and differentiate it from other components of environment then it can be considered to be an object. These objects have certain properties which help to identify them and differentiate them from other objects in the environment. When some of these objects have certain properties which are common to them then they can be considered to be a group. People for example have properties common for everybody so that they can be grouped into one. These common properties help us to differentiate people from other objects like furniture or tools. The furniture, tools, computer components and procedures all these can be grouped into different groups. Within the group we use certain other properties to differentiate objects with one other. For example, we use height and facial appearance of people to differentiate between them. We gave identification number to differentiate one piece of furniture from another. These properties vary for each object hence the mathematical term variable can be used for them. This can be explained with a simple example. People's height is a property when measured and will vary between people and help us differentiate between individuals. So the height of a person is a variable. In computer science, the technical word used to define the variable is data.

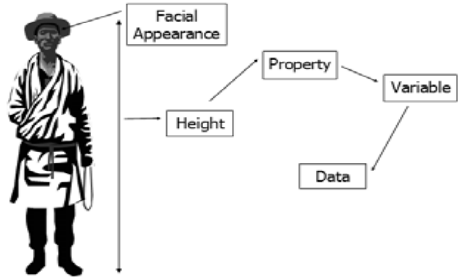

Fig 1: Property, Variable and Data.

Though all the objects around us have several properties, all of them may not be necessary for the management function. For example, each employee has several properties which are important to identify them. Some of these properties are important on one occasion while different set of properties are important on a different occasion. For example, heart rate and blood pressure may be important for a doctor but his educational qualification and work experience are important for his work site manger. Let try to classify these properties according to their importance for management practice. Properties like name, facial appearance are important for the identification purposes. Properties like address, telephone number and email address are important for contact purposes. Educational qualifications, previous work experiences are important for hiring purposes. While all these properties are important for different purposes, many other properties are not necessary, they may even be considered illegal to be recorded and used in management practice. For example, employee's personal interest or family detail may not necessary for management function. Recording their race or caste is even illegal for administrative purposes. So, whenever recording properties regarding employees, grate care should be taken to prevent collection unnecessary or biased information.

Data, Information and Knowledge:

Now let us go back to our discussion about properties, variable and data. Data is a piece of information with a definite value but little meaning. When the data gets analyzed, summarized and arranged in a logical order, to give a useful idea about the object, it is called information. For example, the following is a list of data, Plant A, Light Bulb, 23 Employees, Week 32, 108 Good Products and 12 Bad Products. All the data above give a definite value but little meaning. If the above data can be arranged as follows, it will give a more meaningful idea. "Twenty-three employees are working in a production line of light bulbs in Plant A, in week 32, they produced 108 good products and 12 bad products." This sentence gives a useful idea so it is information.

It may be useful to have a basic understanding of some more words related to information. When a considerable amount of information about an object presented in organized and logical manner, another term given is knowledge. By definition knowledge means information gathered from a formal research or education and presented in formal

manner. The word “common sense” is used more for information gathered from experience not by formal education. Knowledge and common sense are essential for performing any kind of job. Though knowledge can be defined, written in procedure and can be instituted through formal education, common sense comes from gathering and sharing experience. There are several different ways of classifying of knowledge field. The basic way of classification comes from Auguste Comet (1798 – 1857), the person who is considered to be the father of sociology. He organized the basic knowledge fields according to increasing complexity in a pyramid shape. According to him mathematics which is less complex gets placed on the bottom of the pyramid and sociology the more complex one placed on the top of the pyramid.

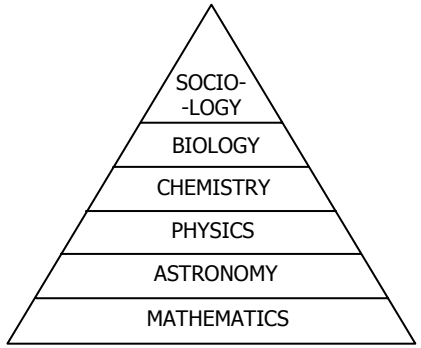

Fig 2: Comet’s Hierarchy of Sciences

Definition of Management:

With this basic understanding about information, let’s try to understand how it influences management function. To make this task easier, first try to define the management functions in a more logical way so that it may be easy to understand how information influences its process. The traditional way of defining management is making products and services possible from human, material and money resources.

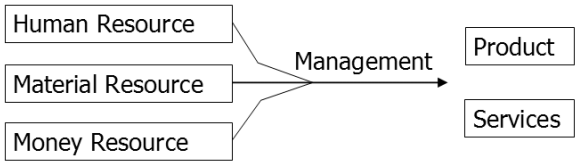

Fig 3: Traditional Definition of Management.

Let’s try to rearrange the components here so that information can be included within the definition with logical understanding. The basic resources of production can be defined as Human Resources, Material Resources, Time Resource and Space Resource. Management by utilizing the resources above in an appropriate way, in the appropriate amount makes the products and services possible. What is the role of money and information here? They are actually management tools which help to measure and access those resources in the appropriate amount, in the appropriate way to make the product and services possible. Before human civilization invented and started to use money in the management process, it

had invented and utilized two other tools for making products and services possible. They are law and culture. Here the contribution of law to human civilization can be attributed to kings and culture to religions. What can law and culture achieve without money? There are two examples – the first one is the Egyptian Pyramids and the second one is the Great Wall of China. Yes, these two wonderful monuments were built without banks, credit cards, securities and share markets. Whether they were necessary for those civilizations, whether they were the actual cause of destruction of those civilizations is another matter. But they are clear examples that great achievements, which cannot be even imagined today, can be accomplished without the help of money and market systems.

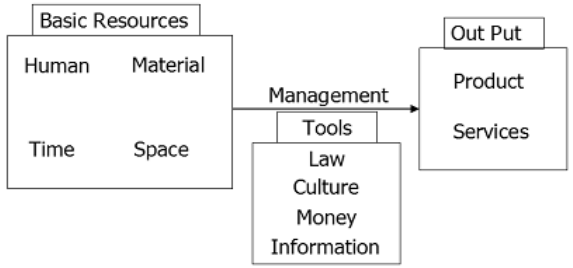

Fig 4: New Definition of Management.

Money may not be a recent invention of human civilization. Various forms of money were used by kings for their administration from very early days. But the failure of organized administration to control money distribution prevented its use as an efficient management or social tool. The establishment of organized banking system around the 19th century in America and Europe helped human civilization to make the best use of money and helped it to climb several steps towards success. While human civilization created and utilized law, culture and money as tools to measure and utilize resources in the production process, from time to time it was understood and accepted that information will be the best tool which may help us to understand the resources of production and will help to make the best relationship between them.

Challenges of Information Management System:

The major challenge faced for collecting, storing and utilizing information about resources of production is practical and technical difficulties in collecting, storing and analyzing large amounts of information which make it a cost ineffective process. To explain this difficulty, take a small society or institution with 500 people in it. It may be a small village, a small religious organization or a production facility. How many people may be needed to create, implement and maintain law and order? The number may vary from 5 to 10. Another 5 people may be necessary to organize and maintain cultural practice and religious beliefs. Another 5 to 10 people may be enough to maintain money circulation and implement market relations. Imagine it was decided to implement an information based organization between people and their products and services. If computers or a computerized information management system were not available, then the only alternative would be a paper based information management system. How many people may be needed to collect, store and analyze a paper based information management system. If the same system is followed for 5 years, then how many bundles of information sheets will be there with vital information? If all the information is stored according to the date of entry, how long it might take to retrieve

information about the activity of an individual over the past 5 years? It may require 25 to 50 people, or more, a huge room to maintain such a system and it may take anywhere from a few days to a few weeks to retrieve information about an individual.

The above mentioned difficulty prevented utilizing information as an efficient tool in management practice. Management consultants like William Edward Deming utilized sampling techniques and other statistical tools to overcome this problem. Deming proved how the production process can be improved with the help of information collected through sampling techniques and the system and tools developed by him helped Japanese industry to become the icon of quality products and services. Nowadays, there is another solution to the difficulty of handling information. The invention of computers, networking facilities of computers including the internet and the availability of efficient and reliable information management systems all made the task of collecting, storing and analyzing information an easy, reliable and much faster function.

Computerized Information Management System:

In computer science, the software used to store, analyze and retrieve information is called Database Management System and the most popular one in this kind is Relational Database Management System. Database Management Systems provide different objects and services which help to enter, store, retrieve and present data into it. The object that helps to enter data into a database is called Form. These forms may have appearance and functions more or less similar to a form used in school applications and credit card applications. The data entered into the database stored in another object is called Tables. Tables are created in the format of row and columns and may have similar appearance and functions to the old register which was used to store information in paper based database management systems. Whenever it is necessary to retrieve the information from a Table, another object called Query is used. A query helps to retrieve summarized information with specific criteria from a database containing several complicated Tables. When the retrieved information need to be represented in a logically organized format, another database object called Report is used. These database objects and associated software which provide integrity and security for the data are logically organized in Relational database management systems.

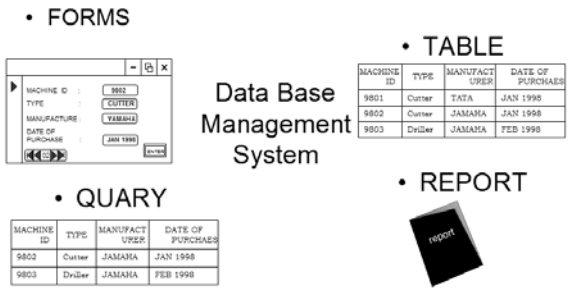

Fig 5: RDBMS and Objects.

Computerization:

When you understand the definition of information and the way it is stored in computers, the next question is how computerization of information management system influences the management function and the society. The field computerization studies how the usage of computers influences and changes individuals, groups, organizations, relationships between

these social components and society as a whole. The usual way to explain the influence of computers on the society is to compare it with what automobiles did for human civilization in the 1950s. Car road analogy may be a better way to explain the expected changes by computers and the internet, but when discussing expected changes brought by computerized information management systems, it may be easier to understand the expected changes through a comparison with money and the banking system. Enough evidence can be found that various forms of money and information collection systems have existed from very early days of human civilization. But until the 17th century, rulers of European countries were able to maintain their control over the society with law and religion as their main tools. Though various forms of money, banks and information collection systems existed at that time, they did not play any significant role in social relations or social control. But during colonization, when markets started to expand all aver the world, the need for a better social control was created. In 1602 the formation of Dutch East Indian Company signaled the beginning of the great expansion of market and Holland and its capital Amsterdam became the centre of international trade. As a need in 1609 the Wissel Bank was founded to accommodate the needs of merchants by maintaining a true standard of values in commercial transactions. But it did not give us a straight forward development of the international banking systems of today. During that time several banks including Wissel bank were formed and dissolved with their contribution for both good and bad, to the credit mechanism of today.

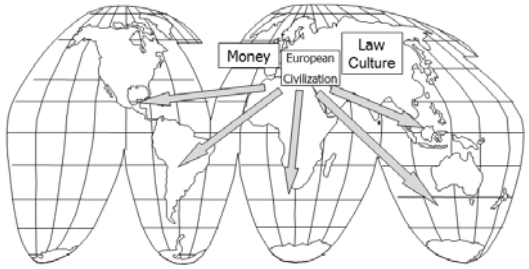

Fig 6: Money and European Civilization.

As money and banking system have made several contributions to human civilization they also faced several challenges for their development. In the same way today information management system is also making several contributions and facing several challenges in its development.

Spectrums of Social System:

In order to understand how society influences computerization and computerization influences society, we must understand how each social system such as legal systems, religious systems, market systems and information management systems get organized into different spectrums. All social systems can be divided into four distinguishable spectrums. The bottom spectrum of all social systems is the practical spectrum, on top of it, lies the technical spectrum, on top of the technical spectrum, the professional spectrum, and on top of all these lies the philosophical spectrum. Let's try to understand each spectrum in detail. In each social system the spectrum which is obvious and accessible for each and everyone in the society is the practical spectrum. Before the development of money and banking systems, important people in the society who provided services and influenced people day to day life were governors as representatives of kings and priests as representatives of religions. They developed and performed several practices to maintain their legal and

religious authority over people. Swords and religious books were carried by people to maintain their status and identity. Though money and information existed at that time, they did not play any key role in social relations. When money became the important form of social relations, every thing started to change. Banks and several other forms of market organizations became the important terminals of service providing. As money started to influence social relations, law and religion lost their significance. People started to carry a wallet or purse as their daily carryon. With the introduction of electronic form of money, a 3.4 by 2.1 inch plastic card became an important part of everyone's life. Once again the Information revolution is changing everything. Information providing organizations became an important part of everyone's life. The Internet and computers are influencing everybody. When managers want to make decisions, they are more concerned about information than other factors. Today pagers, cell phones, palm tops and many more electronic devices which can carry information have become important parts of daily carryon.

The next important spectrum of every social system is the technical spectrum. Before money and market era, kings and religious institutions maintained several technical individuals and technical institutions to support their systems in the society. While governors maintained soldiers and other technicians to maintain law and order, religious institutions maintained several kinds of technicians to support their religious organizations and various welfare institutions. When money and the market system came to existence, a different set of technical personnel were trained. These technicians printed and distributed bank notes, maintained accounts at business institutions, got involved in marketing goods and services etc. An information revolution is once again training a new set of technical personnel. Computer technicians to install, maintain and repair computers, data entry operators and a wide variety of computer technicians are being trained. This technical spectrum is important to maintain the functioning of the practical spectrum which lies below.

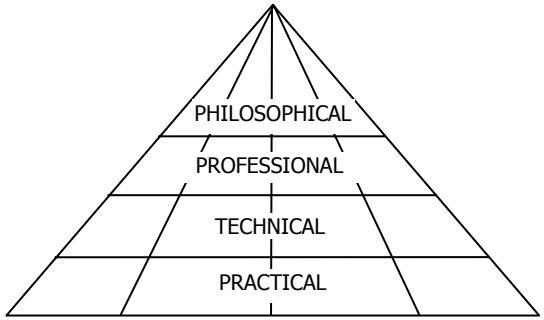

Fig: 7 Spectrums of Social System

Professional spectrum is the next important spectrum of any social system. Important functions of professional spectrum are to create and maintain the institutional backbone and train personnel for each system. During the reign of kings and religious eras, we had ministers and their ministries to create and maintain law. Various types of educational institutions were maintained to train the required soldiers and rulers. Religious institutions also maintained several supportive structures to develop and maintain religious infrastructure and train priests. When money came into existence, a new set of professional spectrum was created. With banks and necessary physical structures, business studies, accounting studies and several other educational courses were created. Computers and information management systems are once again creating a new professional spectrum around us. High speed, big bandwidth information superhighways, internet, information servers, several educational courses in computer science and related institutions, as such a complete new set of professional spectrum is being created. By creating the necessary physical infrastructure and training personnel, the professional spectrum creates and maintains a backbone for each system.

On top of all spectrums lies the philosophical spectrum. The function of this spectrum is to create a culture for each system which will be made up of morals, values, knowledge and practice. Kings had several advisors and teachers who created and helped the society to maintain several mythological values and related practices on the basis of ancestors and natural forces like the sun, fire etc. Religions through their holy books and religious faiths created and maintained theological values and practices. When money and market economy came into existence, several political philosophies were created. These philosophies helped to improve several theological values, also created several social values based on market principles. Today computers and computerized information management systems are opening doors for scientific understanding of all other values and practices. The availability of a huge collection of information helps to break several unanswered questions about human relations and allows us to scientifically analyze these values and create a broad base for a positive knowledge about human relations. So it is the philosophical spectrum which creates a culture and values for every system which will guide and guard their course.

Challenges of Computerization:

The discussion above on different spectrums of social system would help us to understand the challenges on computerization and development of computerized information management systems. The important information we can gather from this discussion is the expected time duration for implementation of new systems. As explained earlier the spectrum which is obvious and accessible for each and everyone in the society is the practical spectrum. Today people have started to see the advantages of this spectrum of computers and computerized information management system. It may be as simple as assistance in typing a professional letter or as complicated as weather forecasts; we started to see the advantages of computers. As earlier societies dreamed and achieved everything in the name of the king, everything in the name of god, everything through market mechanism, today we have started to dream towards everything through computers and the internet. Though we are able to see several successes towards this direction, we are faced with several failures as well. How long is it going to take to see a fully computerized world? What are the reasons for the failure and delay in this direction? To answer these questions, we should understand the difficulties in establishing the three spectrums which lie on top of the practical spectrum. To establish a computerized world, one of the important techniques everyone has to learn is keyboarding. To install, maintain and repair computers we need to train technicians. To plan develop and maintain infrastructure for computers and computerized management systems we need to train professionals and develop a complete infrastructure. To guide and control the development of all other spectrums we need a philosophical spectrum, that is, scientifically selected values, law and culture. Today we are facing several challenges on the development of each of these spectrums.

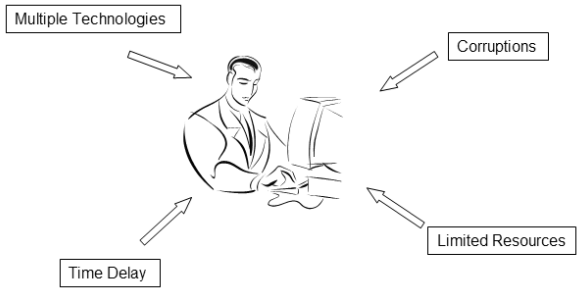

Fig 8: Challenges of Computerization

The most important challenge is finding the necessary resources. Though prices of computers have decreased over the past ten years, still they cost lots of money. As most of the governments and other institutions are running on tight budgets, finding and allocating resources to implement computer systems is a great challenge. For example: whether all the schools in the world are capable of implementing computer labs for their students, so that keyboarding can be taught to the future generation. Another important challenge on the establishment of each system is corruptions and mismanagement. The formation of Bank of Amsterdam did not give us a straightforward development of today's banking system. For failure of this bank corruption was considered the main reason. When an investigation committee checked deposit of Bank of Amsterdam in 1760, they could find only 10,000,000 coins out of 30,000,000 supposed to be there; that is 2/3 of the deposit was stolen by Dutch politicians (city fathers). Unfortunately, it was not the first time nor the last time government stole bank reserves belonging to its citizens. John Low created the Royal Bank of France, which failed because of loss of confidence by its citizens on its performance. Today information management system is also facing similar challenges. Computerized information management system has made it possible to collect huge amounts of information, store it and analyze it with minimum expenditures. This helps the creation of several information management systems which contain valuable and personal information of people. Though such systems are being created with good intentions, to improve productivity and enhance humanity, misuses of these systems were not uncommon. Several governments and institutions are being blamed for misuse of information management systems to interfere with civil liberties of their citizens. Stealing information form websites or from communication done through the internet is also not uncommon. Today, we can see that financial management has created a complicated legal system. To protect its function, we need to create a new set of laws to protect information management system as well. Today, we need globally accepted laws to protect information management systems, websites, and information shared through the internet.

Another challenge is identified and established legal and cultural values obstructed and prevented any scientific attempts to identify, measure and analyze information about these resources. Scientists from various disciplines faced greater challenges from kings and religions to discover information about objects around us. As a good example, in the history of medicine, the first person who tried to count pulse and respiratory rates of people was criticized for damaging the values of medicine. Another challenge of collecting and analyzing information is cultural values established about these objects will try to prevent us from searching for measurable properties and measuring them. Though educational disciplines like Physics, Chemistry and Biology have overcome this challenge to a greater extent, other disciplines like Psychology and Sociology which study human behavior and human relations are still fighting for a solution. In addition to the obstructions to identify and measure properties of the objects, in many instances the religious and cultural values were recorded and analyzed which may not have any direct relationship to the underlying problem. But the improvements being made on human civilization by information revolution and increasing market competition will ultimately break these barriers and will help to find measurable properties and will improve the human thinking and human relations.

Another problem being faced is confusion over standards and multiple technologies. American banking system which was developed parallel to European banking system faced the problem of multiple currencies. Travelers across America not only faced problems on exchange of local currency but were also totally confused over the currency system of those days. In the 1850s there were 7000 different kinds of bank currency notes, in addition to these, notes also issued by schools, bridges and turnpike companies, railroads and other banking institutions. There were no standards; every bank found it necessary to use several

bank note "reporters" and counterfeit detectors to determine the value of the notes offered at its windows. Several of these bank notes lead to failure. In the 1860s' several Acts in American congress brought an end to this confusion and brought standardization in American currency. Today we are facing the problem of establishing international standards for information technology as well. Though ISO and ANSI are trying to form a standard frame, much more work needs to be done. The present way of achieving international stranded through monopoly may not be the best solution. In addition to increase in price for the technology, it may prevent invention of better technology as well. Though creating an international standard for rapidly growing information technology will not be an easy target, development of an international standard platform will only help to achieve a stable growth for the whole system.

Changes Due to Computerization:

A factor which was influenced by financial management system and going to be influenced by information management system is the basis and style of economic and social transactions in organizations and society. Before the influence of money was fully understood, the basis for transaction of goods and services in the society was done on the basis of kings and religions. Though various forms of money existed, they were used by kings and religious organizations to maintain authority, not as a property of public. When the money and banking system started to become public, the basis of social transaction was changed. Though legal and religious based values existed, profit and financial advantages became the basis of social transactions. Profit and capital helped human civilization to create much complicated social organizations of old days. Though money has several advantages, it has its own disadvantage as well. It is not always possible to give a price for several goods and services according to their social importance or actual need for the products. Also as previously discussed, the price of products and services not always relate to their quality. The information and information management system may lead us to an entirely new world of economic and social relations. The new basis of transaction of goods and services is customer expectations not profit. Products and services are measured for quality according to measurable properties of them. Quality management consultant Philip B. Crosby has an organized system to measure quality of products and services with comparable financial figures. The figures developed by him, Cost of Quality (COQ) and Price of Non-Conformance (PONC), give us a way to translate quality related information into money values. For an example usually the loss due to poor quality of products is stated as 3-5% of production companies. It is just a direct financial figure obtained by multiplying poor quality products by their market value. But if we calculate PONC which includes all financial losses including customer dissatisfaction due to poor quality, the actual loss will go up to 25– 30%. In this way, the information management system is bringing a new way of understanding about economic and social transacting in the society.

Another expected change: increasing complexity of social organizations. As explained earlier, money and capital with their purchasing power enabled entrepreneurs to organize large factories. Entrepreneurs were able to build complex physical structures, buy machineries and large number of resources, hire people for money and organize the assembly line. Thus, money helped to organize complicated social organizations and helped to increase the productivity. The information and information management system is also helping us to build much more complicated factories and social institutions. Defined standards for resources of production, well developed procedure for production processes and quality stranded for outputs all these are enabling human civilization to form much more complicated organizations. This increases the productivity and the status of the human civilization. Expanding multinational companies nowadays may be a good example for this.

Disadvantages and Dangers of Computerization:

Another important matter of discussion is disadvantages and dangers of computerized information management systems. When money and market systems were introduced around the 17th century in addition to the advantages, they brought several disadvantages as well. In 1888, for the first time the word "Unemployment" appeared in Webster's dictionary. Unemployment led to several other social problems like organized crime, prostitution etc. Today, we still fail to find definite ways to overcome these problems. What are the expected problems due to computerized information management systems? We have to accept there is always a risk of unemployment with computerization, in addition, increased sedentary life, prolonged use of the keyboard, looking into the computer screen may bring several health related problems. What is the answer to this problem? The obvious truth is as unemployment did not stop the industrial revolution or the money and market revolution, information revolution is not going to be halted by these problems. So we have to search for the solution within the industry.

Moreover, though money was created as a tool by humans for the benefit of the society, now it works as a social force which influences and interferes with everyone's personal life and decision making. Instead, human civilization uses this tool to achieve its objective; it influences human civilization towards a different set of objectives which may not be desirable ones. Likewise, information and information management systems also being created by humans for the improvement of the society; they may turn to become social forces which will influence human civilization. Another problem with each social system is over investment and subsequent shrinkage. During the peak of money and banking revolution, there were 30,812 banks in America, but after the economic crash in the early 1930s, this number dropped to 14,624. At the peak, there was one bank for every 4000 people, but this number dropped to one for every 8000. One of the important questions about the present economic recession is whether it is caused by over-investment in information industry. But if you closely watch the events you will notice the industry which is more challenged is travel and automobile industry not the information technology. In addition to direct challenges by the internet which tries to reduce the unnecessary travel, automobile industry is also challenged by the increasing price of petroleum products and increased safety concerns.

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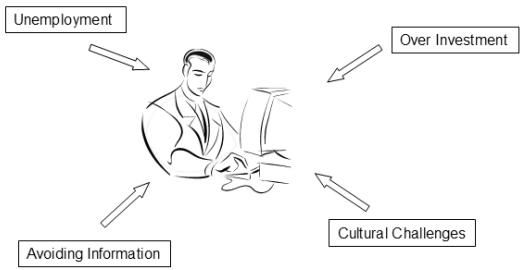

Fig 9: Disadvantages and Dangers

Before the invention of the information management system, human civilization had invented and used several other systems like several legal systems, different religions, capitalism and socialism to explain human needs and ways to satisfy them. Almost all of these systems, without any exception, were subject to corruption and mismanagement. In many instances this corruption and mismanagement led to failure and the collapse of several of these systems. While each system is searching for the reasons for these corruptions and

ways to overcome them, the question before us is whether there is a possibility of corruption and mismanagement in information management systems. In other systems, one of the main reasons for corruption or mismanagement is the usage of intermediate or imaginary values. Though the information management system tries to approach and measure properties of objects directly without use of intermediate or imaginary values which may lead to misunderstanding, still there are plenty of reason for corruption and mismanagement.

As the first risk, we may try to measure the property of an object, which may not have a direct relation to the underlying problem. This can happen as a result of poor knowledge, by mistake. The second problem is recording wrong values for measurements. Again poor calibration of measuring tools, mistakes and intentional action can be blamed for this problem. Identified actual property of objects, established accurate measuring scales, measured and entered data into database management systems without a mistake, will not ensure such information will be used to solve the problem. The stored information can be deleted, hidden or prevented from appearing in the final report. Distortion of important information on final report is also possible. Again these can happen due to technical reasons, by mistake or as a result of intentional action.

The above mentioned list may not the only challenge we are facing on implementing information based management systems in management practice. All above had been done according to procedure and receiving the final report without bias may not be enough. If we fail to make our management decisions according to the information available, all of our work becomes meaningless. When we make a decision to release a defective product knowingly to make profit or to meet the schedule, all the multi-trillion dollar investment will be nothing more than garbage. This is where Philip Crosby considers improvement in values and culture is more important than anything else.

Conclusion:

In conclusion, the discussion above may explain to us the challenges faced in the development and implementation of computerization and computerized information management systems. When talking about the delays and time frames, it is better to measure them by generations than years. When human civilization did not know anything other than kings and their rule, Abraham told us on the faith of the God that better civilizations can be formed. But it took more than 2000 years to form religions according to his expectations. When civilization organized itself on the faith of God, Adam Smith told us money and market can form better civilizations. Again it took more than 200 years to form an organized market system according to his expectations. How long is it going to take to form a civilization based on computers and computerized information management systems? Only future can give us the answer. Even if a few sides refuse to change increasing market competition, the increasing price of raw materials will lead us to change our values and practice. We can safely assume that improvement which is being made on management practice by information management system will eventually lead us towards better human relations and a better society to live in. It may be better to close this discussion with some words borrowed from Deming "You do not have to do this, survival is not compulsory".

"It is not the strongest of the species that will survive, nor the most intelligent. It is the most adoptive to change".

– Charles Darwin –