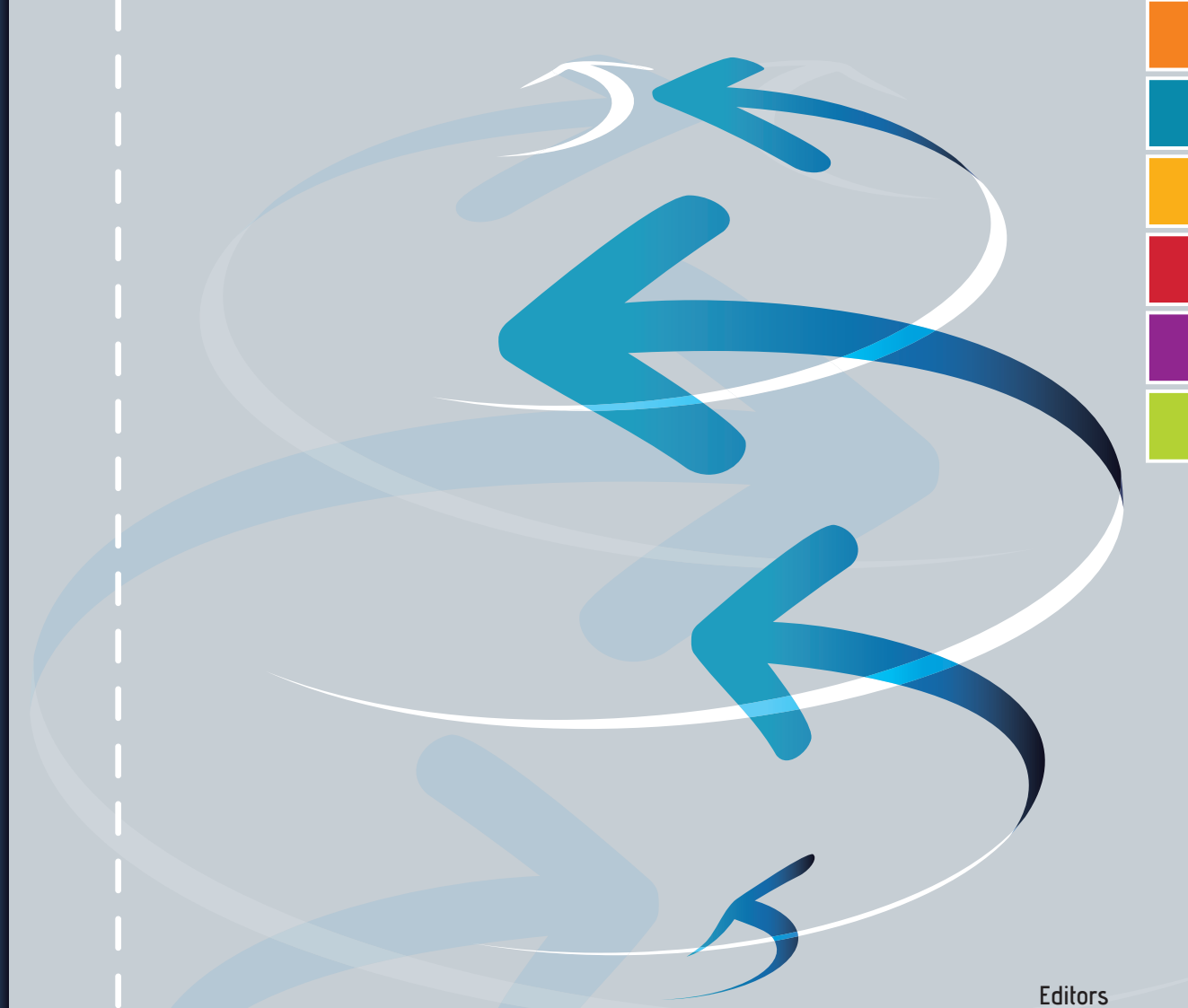

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COST CUTTING INNOVATIVE TECHNOLOGIES

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CROSS.INNO.CUT
cross border implementation
of innovative cost cutting technologies

European Territorial Cooperation Programme
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INTRODUCTION

This book is published in the framework of Cross-Inno-Cut of European Territorial Cooperation Programme Greece-Bulgaria 2007-2013. The book aims to exemplify cost-cutting innovative technological solution to SMEs in the area.
The project aims to introduce and apply cost reduction innovation technologies to SMEs in Greece and Bulgaria.
The main activities of Cross-Inno-Cut are:

- To introduce the areas and diagnostics tools for cost reduction.
- To provide cost reduction auditing activities in 100 SMEs in the targeted areas in Greece and Bulgaria.
- To provide action planning activities in 30 SMEs.
- To pilot apply cost reduction pilot actions in 10 SMEs.

The book is published under the collaborative effort of the Cross-Inno-Cut working team, which is composed of Sotiris Zygiaris, Elena Sefertzi, Maria Sxoina, Anastasia Martzopoulou, Paraskevi Tarani, Kostas Tramantzas and Ioannis Komninos, as members of the Cross-Inno-Cut working team of Aristotle University of Thessaloniki, Urban and Regional Innovation Research Unit.

The partners of the Cross-Inno-Cut project:

Federation of Industries of Northern Greece (leading partner)

South-West University "Neofit Rilski"

Industries Association o Eastern Macedonia

Federation of Industries of Rhodopi

Industrial Association o Petritch

Union of Industry and Manufacture of Xanthi

Industrial Association Karjali

Federation of Industries of Evros

have enriched this edition with important contributions.

The book presents in practical terms selected cost reduction innovative technologies, which could be applied as pilot actions in the Work Package 6 of the project.

Editors
Dr. Sotiris Zygiaris
Dr. Eleni Sefertzi

PROJECT: CROSS-INNO-CUT

Cross Border Implementation of innovative cost cutting technologies

Renewable Energy

Project
Cross Border Implementation of
innovative cost cutting technologies
CROSS-INNO-CUT

Author: Konstantinos Tramantzas

CHAPTER 1

CHAPTER 1

Project

"Cross Border Implementation of innovative cost cutting technologies – CROSS-INNO-CUT"

Renewable Energy

0. INTRODUCTION

During recent years researchers of various disciplines are working in the direction of exploiting renewable energy sources for efficient production of power. Various systems using Renewable Energy Sources (RES) have been developed and implemented in order to reduce dependence on conventional fuels (oil, natural gas etc.) RES can be defined as: energy sources that are plentiful in our natural environment, they are constantly regenerated by natural fermentations and can be converted into electricity or thermal energy. The worldwide interest towards their exploitation is due to two reasons:

i) they solve the energy problem in a cost effective manner
ii) they are environmentally friendly solutions.

The overall objective of the European Union is to increase use of renewable energy from 3.7% in 1991 to 18% of total energy consumption in 2020. This involves efforts for both a) increasing the participation of RES in energy production and b) increasing the efficiency of energy consuming systems in use today.

By contrast to conventional sources of energy, the RES replenished through natural cycles and are practically inexhaustible. The sun, wind, geothermal, rivers, organic material, like wood and even household and agricultural waste are energy sources that will never be exhausted. Moreover, the utilization for energy production does not burden the environment. The available forms of Renewable energy sources are:

Solar Energy

A) Passive Solar Systems

Passive solar systems are components of the building, which, using the laws of heat transfer, collect solar energy, store it in the form of heat and distribute it in space. The collection of solar energy based on the greenhouse effect and especially the entrance of solar radiation through glass or other transparent material and trapping the heat within the room. Passive solar techniques are combined with natural lighting and passive systems and techniques for natural cooling of buildings in summer. They can be applied both in new as well as in existing buildings.

B) Active Solar Systems

Active (or thermal) solar systems are mechanical systems which collect solar energy, convert it into heat, store and distribute it using either a liquid or air as heat transfer fluid. They are mostly used for heating domestic hot water, for space heating and cooling, various industrial processes, for sea water desalination, for various agricultural applications, for heating water in swimming pools etc. The simplest and most common form of solar thermal systems is the solar water heaters.

C) Photovoltaic Systems

The photovoltaic systems (P/V) convert solar energy into electricity. Initially they were developed in order to solve the problem of electricity supply to areas that are difficult to reach through power lines (isolated houses, lighthouses, etc.) while at the same time the technology was suitable for powering small computers and watches which was actually their first mass use. The last two decades the technology matured and now there are stand alone photovoltaic systems which provide energy in a cost efficient way for a wide range of applications.

Wind Energy

Since ancient years, the exploitation of wind energy has been a solution to meet the energy needs of man (sailboats, windmills etc). Today in order to capture the wind energy we use wind turbines, which convert the kinetic energy of wind into electricity. Islands and coast lines in general, are among the most favorable locations for the exploitation of wind energy.

Biomass

With the term biomass we mean firewood, agricultural and forest residues (straw, wood chips, seeds etc.), animal waste (manure, scrap fish catch etc.), plants grown in energy plantations specifically for use as energy source as well as municipal waste and residues of food industry and agricultural manufacturing. The main uses of biomass are:

- Greenhouse heating
- Heating buildings by burning biomass in individual / central boilers

- Power generation in agricultural industries
- Production of energy in wood industries
- District heating: the supply of central heating and hot water for an entire building, a village or a town from a central station. Heat is transported through a network of insulated pipes.
- Power generation at sewage treatment plants and sanitary landfills

Geothermal

Geothermy is a mild and renewable energy source that, with today's technological capabilities, can meet energy needs for space heating and also for production of electricity. The temperature of the geothermal fluid or steam varies from one region to another and can have values from 25 °C to 350 °C. In cases where geothermal fluids have a high temperature (above 150 °C) geothermal energy is used mainly for electricity generation, when the temperature is lower, geothermal energy is used to heat homes, greenhouses, livestock farms, fish farming etc.

Greece has considerable potential for renewable energy, which can offer a real alternative and cover part of the country's energy needs, contributing to reducing dependence on fossil fuels, reduce the greenhouse effect, creating new jobs and developing decentralized areas.

Every kilowatt-hour generated by renewable energy sources replacing a KWh produced by conventional (polluting) fuels, implies avoiding the release of at average approximately 12 kg of carbon dioxide in the atmosphere. A typical photovoltaic system for each KW capacity prevents the release of 1.3 tonnes of carbon dioxide each year; this is equivalent of the carbon dioxide that would absorb by two hectares of forest. Furthermore, apart from carbon dioxide conventional fuels cause emissions of other hazardous pollutants (such as particulates, nitrogen oxides, sulfur compounds, etc.).

1. SOLAR ENERGY

1.1. Description solar systems

An important technology for harvesting solar energy is photovoltaic (PV) cells which convert sunlight into electricity. Nowadays the use of PV cells is considered as the most environmentally friendly technology for production of electricity. Despite the today's relatively high installation costs, prices are falling continuously and will soon be competitive compared with the price of kWh generated from conventional fuels.

The general Balkan area has a considerable potential for the development and implementation of PV systems thanks to plenty of sunshine all year round, thus the use of PV systems for producing electricity without environmental impact, is particularly attractive in this area of the globe. Especially in isolated areas which are not connected to the grid, PV systems is the best solution to meet the electrical needs and at the same time the use of PV systems in residential areas (connected to the grid) has a lot of advantages.

PV cells convert solar energy into electricity, using the photoelectric effect. Each solar cell consists of two layers of semiconductor material, usually silicon. When solar radiation strikes these two layers, continuous electrical current is produced. The performance of a PV cell depends on the materials used and the method of construction. The two basic categories / types of PV panels are the monocrystalline silicon and the amorphous polycrystalline panels. The production method and the characteristics (color, appearance, reflectivity, etc) of these two categories differ significantly.

Groups of PV cells connected in series or in parallel form a PV panel. The most important technical characteristic of a PV panel is the peak power (W) expressing the generated electrical power when the PV is exposed to 1 kW/m2 of sunlight radiation (energy). Given that the PV panels currently available in the market have an efficiency of approximately 11% (they convert 11% of solar radiation into electrical energy) a 1 m2 panel can produce approximately 110 W of electrical power. Assuming that in Greece the average annual solar radiation is approximately 1.800 kWh/m2, a PV system of about 30 m2 can produce 4.500 kWh of electricity per year (average consumption of a 4 member family).

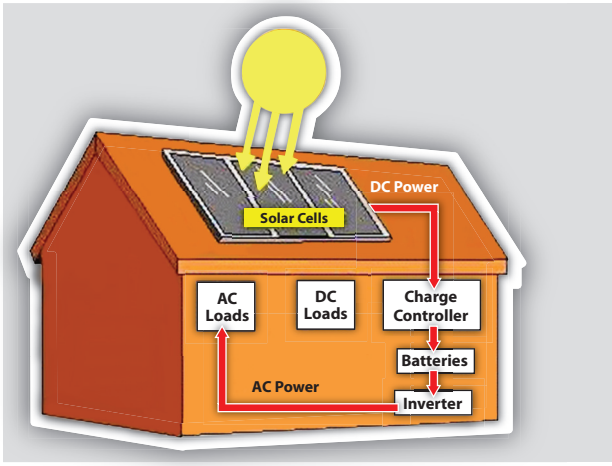
A typical photovoltaic system consists of the PV panels, the batteries to store electricity and the power conversion system. The most common type of batteries used today is lead-acid type, open or closed, specially designed for solar power systems. Inverters and charge controllers are used for the conversion of power and

the control of the whole system. The experience from PV operation show that the minimization of electrical losses in partial load operation, the optimization of the inverter output and proper charging and discharging of the batteries, can significantly increase the overall efficiency and lifetime a system.

Incorporation of PV panels in the outer shell of a building (roof, windows, walls) is a rapidly developing technique and continues technological developments increase the overall efficiency of the systems while at the same time installation and operating costs are reduced. This allows the prediction that in the near future, an important part of the electrical needs of buildings covered by PV systems.

The main types of PV systems are:

- Standalone system. This system has the capability of producing DC or AC electricity by using power converter (inverter).
- System connected to the grid. This system consists of a series of PV panels which through an inverter are connected to the grid. In the case of small capacity (domestic) systems, where the PV must meet specific load, the electric grid is used as storage system to temporarily store the energy produced. In large systems, the output of the PVs is provided to consumers through the connection to the grid.
- Hybrid system. This system is autonomous and consists of a photovoltaic system that operates in conjunction with other energy sources (for example, in conjunction with a diesel generator or other renewable energy source such as a wind turbine).
- Embedded solar systems. Typically small capacity systems, which provide power for other active or passive solar systems (often used to operate pumps or fan motors used for the movement of air or water in solar collectors).



Installation of photovoltaic panels

Using PV panels (frames) as functional components of a building is a new economically attractive solution especially with the new translucent PV panels, which can be used instead of glass, providing both solar energy and protection from the sun light during the summer months. Incorporation of PV panels on the roof or the facade of a building can be done through several installation solutions, the basic installation types are:

- Mounting on inclined supports. There is a wide variety of wood or metal surbase types and most manufacturers PV systems offer them along with the PV frames. In some cases, the inclination of the PV panel is adjustable. This type of fixture offers easy access to both the front and the back of the PV panel for maintenance activities and also helps to ensure proper ventilation and cooling, thereby increasing performance of the panel. However, the cost is relatively high because of the use of additional equipment and extra work.
- Placement on static basis adjusted to the outer shell of the building. As the panels are based on the outer shell of the building special attention is required for insulation. This type of installation also allows good ventilation and cooling the PV panel and is a good solution, especially in renovated buildings where changes in the outer shell are not possible.
- Direct placement. In this case, the outer layer of the building is replaced by PV panels. For example, the PV cells can be mounted on the roof with an overlap, like tiles. The PVs cover and protect the building, but as they are not fully waterproof additional sealing measures are required.
- Integration of PV panels in the building's structure. This method replaces entire sections of the building by PV panels. Proper application of this technique requires good insulation, for example PV components without metal frame mounted on a support similar to those used to support conventional transparent facades. New type PV with translucent elements may be placed instead of glass, giving the designer the possibility to apply lighting and shading techniques while producing electricity.

The cost of photovoltaic systems

The cost of the PV systems is usually expressed in euro per W peak and the basic cost elements are:

- PV panels: 40-60%.
- Batteries: 15-25%.

- Inverters: 10-15%.
- Installation equipment: 10-15%.
- System design and installation: 8-12%.

The main component of the total cost is the cost of PV panels which have a life cycle of up to 20 years without much maintenance, during this time batteries are expected to be replaced 4-5 times. Important factors affecting the cost of a system is the type of PV panels selected and whether the system is connected to the grid or not. The cost is usually lower for systems connected to the grid as these systems do not require batteries. Also, the cost per W produced decreases with increasing the size of the PV system. Today, subsidy schemes for installation and operation of PV systems exist in many Regions. There are two basic scheme categories a) investment subsidy (through development laws) b) operation subsidy (through special fixed price per W of electricity produced and tax exemptions of the income).

1.2. Application of solar systems

What type of PV should I choose?

PV panels when exposed to solar radiation, convert a 5% -15% of solar energy into electricity. The exact rate depends on the technology used (monocrystalline, polycrystalline, amorphous). The latter have lower performance but are significantly cheaper. The selection of photovoltaic type to be used in a system is a combination of the energy needs to be covered, the available space and the available budget.

What kind of energy needs can be covered by a PV system?

Lighting, telecommunications, air-conditioning and generally any energy need can be met by an appropriately designed solar system. The photovoltaic systems produce direct current (DC), this means that this power can either be used by DC appliances or special devices (inverters) should be used in order to convert this DC to AC 220 V. The use of PV produced electric power for heating appliances (electric radiators, stoves, cookers, water heaters etc) is not recommended for economic and efficiency reasons. For these uses there is a variety of deferent solutions, which are not based on the direct use of electric power, such as solar water heaters, solar air conditioning, cookers and heating systems with the use of natural gas or LPG etc. On the other hand, needs such as lighting (with the use of energy-saving lamps), electronic devices (computers, audio systems, refrigerators, televisions, telecommunications, etc.) can be met by a PV system easily and economically.

What happens the winter cloudy days?

In order to produce electricity from the sun, photovoltaic systems need solar radiation, not sun's heat. Even during a cloudy winter day there will be plenty of diffused light and a PV system will continue to generate electricity with reduced efficiency (for example, even during a fully cloudy day a PV system will produce 5% -20% of its maximum capacity). The reduced production of electric power during such a day can be met by the electric power company if the system is connected to the grid or, in the case of a fully autonomous system, by batteries. In many cases autonomous systems combine PV panels with a small wind turbine (hybrid systems), as sun and wind are complementary sources of energy (cloudy days are often windy days) and with the use of a small energy storage system and proper energy management system the overall efficiency is increased and the initial investment needed is reduced.

Where should a PV system be installed?

First of all, the space where the PV panels are to be installed should be without any shadows all year round (that's why most of the times PV panels are installed on the roof of the building), if possible PV panels should face south and have an inclination near 30 degrees. If not (if the roof is shaded or orientation is not south), the PV system will have reduced performance, without this necessarily meaning that it is not an economically viable investment. The size of the area needed depends on the site (roof or sloping roof) and the type of photovoltaic panels to be used (Per KW capacity, PV panels require about 12-15 square meters on an attic, or about 7 -10 square meters on a tile roof). In any case a detailed technical study should be contacted prior to installation of a PV system.

Can the roof hold the weight of PV panels?

The average weight of PV panel (including all the installation equipment) is about 20-25 kg per square meter so unless extreme conditions of the structure prevent it the installation of a PV system on its top in not a problem. In any case, a static control of the structure is included in the technical study of the PV system.

Installing a PV system means that the roof's insulation should be modified?
Usually not. Even if the insulation or waterproofing of the roof is injured by mounting the PV panels restoration is included in the installation works.

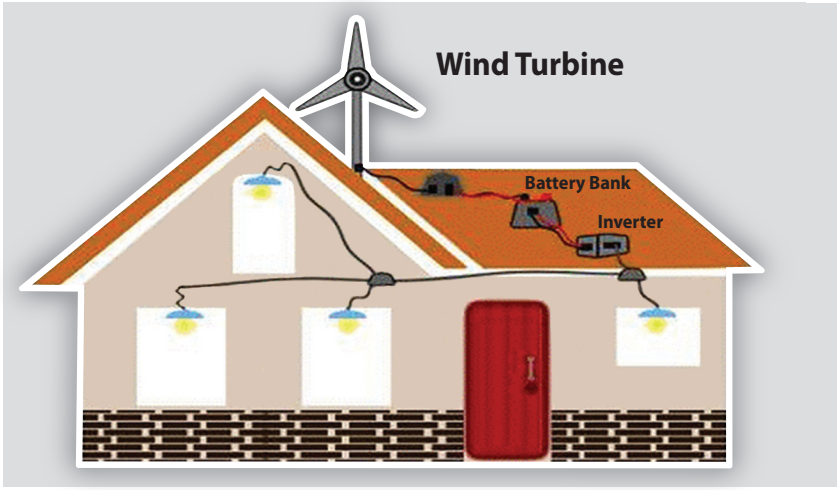
May a PV system cause roof overheating?
No, because PV panels do not "attract" the surrounding radiation, they just utilize the radiation that would anyway be directed to the specific area. In order to absorb the maximum solar radiation possible, solar panels have dark surface which in fact is covered by an anti-reflection layer to trap solar radiation. Moreover, thanks to this anti-reflective surface, PV panels do not "shine" and thus there are reduced glare phenomena that sometimes could be annoying. As shown by measurements, PV panels "shine" less than cars under direct sun light.

2. WIND ENERGY

2.1. Description of wind energy systems

A wind energy system transforms the kinetic energy of wind into mechanical or electrical power. They are used in a variety of applications such as charging batteries and pumping water or included in hybrid systems to provide electricity to remote islands and villages which are not connected to the mainland's electric grid.

Wind energy systems can be divided into two general categories depending on the direction of the turbine axis (horizontal – vertical) in relation to the ground. Horizontal axis turbines are used in 95% of the installed wind energy systems. Sub-systems include the blades, the rotating mechanism, the generator which converts kinetic energy to electricity and the supporting pillar. The most usual application of wind energy exploitation is the wind farms where a big number of wind turbines are installed to a remote area with specific characteristics. This is mainly due to high transportation and maintenance costs which are reduced as the number of wind turbines increases.



Poul la Cour (1846-1908), meteorologist, is considered as the pioneer of wind energy systems while the first commercial applications were implemented during the second World War by the Danish engineering company F.L. Smidth. The first wind farm was built in 1991 in Vindeby Denmark, comprised of 11 turbines installed in coastal shore of the Baltic Sea. This wind farm drew the attention of the international community and soon was copied in deferent locations.

Ideal sites for installing wind turbines are hill tops (high and frequent wind speeds) but the requirement of large spaces especially in countries with small geographic area have moved wind farms to coastal shores of even offshore areas where the increased installations costs are equated by the almost constant winds and thus higher productivity of the system. Wind energy offers many advantages, which explains why it is the most rapidly growing energy source in the world.

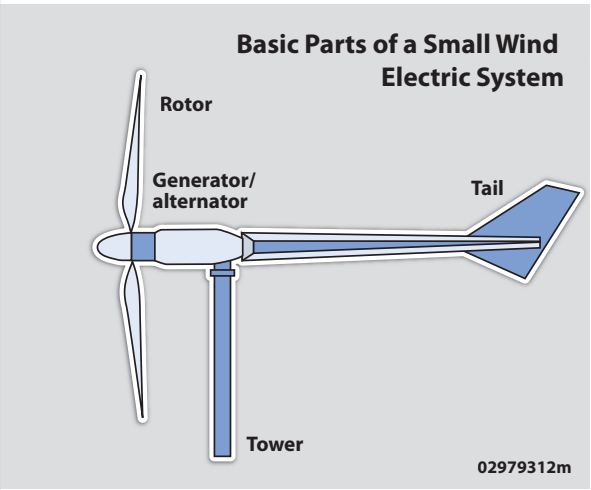
Advantages of wind energy

- Wind energy is a clean energy source. Wind energy does not pollute the atmosphere like power plants that rely on fossil fuels such as coal or natural gas. Wind turbines do not emit chemicals into the environment which cause acid rain or greenhouse gases.
- Wind energy is available almost everywhere and is free of charge. With the technology developed today wind turbines are the most cost effective renewable energy production method.
- Wind turbines can be built on farms, thus benefiting the economy of rural areas, where most of the best locations in terms of wind speeds exist. Farmers can continue to grow plant on their land as the wind turbines use only a small portion.

Disadvantages of wind energy

- Although wind energy is the cheapest renewable energy source it still struggles to compete conventional fuel and if environmental arguments are not considered, the only way to compete is with high average wind speeds.
- Although the cost of wind energy has fallen dramatically over the past 10 years, the technology requires an initial investment higher than that of generators burning fossil fuel.
- The strongest challenge when using wind as an energy source is that the wind is periodically interrupted and not always blows when electricity is needed. Wind energy can't be stored (unless batteries are used).
- Suitable areas for wind farms are often located in remote areas far from cities where electricity is needed.
- The development of the wind farm as a natural resource may be able to compete with other uses of land and those alternative uses may enjoy greater discretion than that producing electricity.
- Although wind farms have relatively little impact on the environment compared to other conventional power plants, there is a concern about noise generated by the blades of the electric motor (rotor), the aesthetic (visual) impact and birds sometimes have been killed. Most of these problems have been resolved or significantly reduced through technological development or by selecting suitable areas to establish wind farms.

The performance of a wind turbine depends on its nominal size and wind speed. The selection of the nominal size depends on the needs required to serve and vary from a few hundred to several million Watt. Typical dimensions of a 500 kW wind turbine is: diameter rotor, 40 m and a height of 40-50 meters, while that of 3MW dimensions are 80 and 80-100 meters respectively.



A typical horizontal axis wind **turbine** consists of the following **parts**:

- The rotor, consisting of two or three blades made of reinforced polyester. The fins, attached on a hub or fixed, or with the ability to rotate around its longitudinal axis by changing the step
- The drive system, consisting of the main shaft, bearings and propagation gearbox, which adjusts the speed of the rotor to the synchronous speed of the generator. The rotational speed remains constant during normal operation of the machine
- Electrical generator, synchronous or induction with 4 or 6 poles which connects the output of the gearbox through a tire or hydraulic coupling and converts mechanical energy into electrical energy. It is usually found on the tower of the turbine.
- Mechanical brake system which is a usual disc mounted on the main axis or shaft of the generator
- The orientation system, constantly forcing the rotation axis in a direction parallel to the wind
- The tower, which supports all of the above mentioned electromechanical installation. The tower is usually tubular or reticular and rarely reinforced concrete
- The electronic board and control panel, which is located at the base of the tower. The control system monitors, coordinates and controls all functions of the turbine, ensuring smooth operation.

2.2. Application of wind energy systems

Small Wind Turbines (SWT) have traditionally been used for remote small off-grid applications, this being the bulk of the market both in the developed and in the developing world. Only in the last few years has this trend changed, due to the growth of grid connections from SWTs.

Off-grid Applications

As mentioned before, most of the existing systems that include SWTs are isolated applications, as this has been the most traditional use for them. Among the possible isolated applications, the most common are rural electrification, professional applications (telecommunications, etc.) and pumping. From the technological point of view, three groups of isolated applications using SWT can be distinguished. These are covered in the following sections.

mal energy has more potential energy per mass unit of geothermal product, low depth geothermal energy advantage is that it is available and usable anywhere, it's pretty easy to exploit and can be combined with other renewable energy sources.

Low depth geothermal energy

The earth absorbs almost 50% of solar energy and remains constantly at a temperature of 10 to 21 ° C. The operating philosophy of a low depth geothermal system is based on constant temperature of soil and surface or underground aquifers which are utilized for air conditioning installations and space heating systems. The geothermal system transfers heat from the conditioned space at a lower temperature of the earth during summer and by inverting the cycle heat from the earth to the heated space during winter. In summary a geothermal system consists of three main parts, the ground heat exchanger (closed or open circuit), the heat pump and the internal distribution of heat in the building. The heat pumps is considered the heart of the system, its operation is similar to the known small air conditioners or even the common electric refrigerators and it has 4 main components: evaporator, compressor, condenser and relief device.

A full installation of shallow geothermal energy consists generally of the following sections:

a) geothermal heat pump,
b) geothermal heat exchanger. A closed system of pipes with a special liquid running through them, placed in the ground and usually made of high density polyethylene
c) internal heating installation and / or cooling of the building. (underfloor heating and cooling system, fan coils for heating and cooling, heating radiators etc
d) the automation system of the installation.

This geothermal system uses the ground temperature (10-21 ° C), using drilling techniques for drilling small diameter boreholes to a depth of 150 m and specific heat pumps can raise water temperatures up to 55 ° C. The drilling equipment consists of a network of buried polyethylene pipes. The tubes are connected to the heat pump where the circuit is completed. A special water solution circulates this pipe system usually containing environmentally friendly antifreeze (a solution, such as "paraflou ', which consists of 25% glycol and 75% water) transferring heat. The circuit can be horizontal or vertical, depending on the morphology of the subsoil.

The heat pump is practically nothing but a machine that can transfer heat from cold to warm room or in the language of engineers from the "warm pool" in the "cold tank". It is exactly the same operation that takes with the air conditioner where the warm and cold tanks can be set by the user. During summer we define the environment as the warm tank and cold tank the interior space (selecting cooling mode) and the machine transfers heat from the building to the environment. During winter we define the interior as the warm tank and the environment the cold tank (choosing heating mode) and the machine transfers heat from the environment to the building. Because the ground temperature in a few meters depth remains nearly constant throughout the year, regardless of external weather conditions, the above geothermal heating and air-conditioning systems consume 40-60% less electricity than air conditioners, thereby providing efficient heating, air conditioning and hot water in buildings, in an environmentally friendly manner. A geothermal heat pump is more efficient than a conventional cooling / heating system as for each 100 thermal units output 75 come from earth and only 25 from the electricity consumed.

3.2. Application of geothermic systems

High-enthalpy geothermal energy is mainly used to produce electricity. The installed capacity of geothermal power plants in the world amounts to approximately 6,000 MWe. The geothermal energy of low and medium enthalpy is used by many applications in agriculture, agro-industry, livestock, aquaculture and space heating. In this category, the technology required for exploitation of geothermal fluids has been developed significantly and a lot of commercial applications are expected in the near future.

The most common and wide spread is the use of low enthalpy geothermal energy solutions as geothermal low enthalpy potential can be found nearly everywhere. With current knowledge of drilling data and other evidence in geothermal fields, it is estimated that the total potential, certified low enthalpy geothermal energy (based on the discharge of water at temperatures around 25 ° C) is approximately 700-800 MWth in Greece alone.

The most common and cost effective applications of low enthalpy geothermal fluids are:

Very small systems.

These usually have a generating capacity smaller than 1 kW. The best-known applications for these configurations are mobile applications, such as boats and caravans, and wind home systems (the wind version of solar home systems) used for rural electrification. This configuration is based on DC connection, where the battery (usually a lead-acid battery) is the main storage and control component. Usually the system supplies DC loads as the consumed energy is very low.

Hybrid systems.

The term 'hybrid' has different meanings in the context of off-grid systems with renewable energy. In this case, 'hybrid systems' refers to systems including wind generation and other generation sources (usually photovoltaic). The power generation capacity for this configuration is in most cases less than 50 kW. A diesel generator is used in many systems in this configuration to supply back-up power. Traditionally, these systems have also been based on DC connection, with a battery (lead-acid in most cases) also playing the role of storage and control, and an inverter to generate AC power for the loads (common practice is to use only AC loads in this configuration). However, in recent years some solutions have been proposed using AC connection. This solution has been possible through the development of bi-directional converters that allow the flow from the DC bus to the AC bus and vice versa using only one stage of power electronics. The trend of technology for these systems is mainly in the development of modular and flexible power electronics, able to provide both the power quality and the supervisory control of the system.

Wind – diesel systems

Even though some hybrid systems include only wind and diesel generation, the configuration described as 'wind-diesel' (W/D) refers to those systems where the generator set plays a key role, not only as a back-up source but also as an essential component for the correct control and functioning of the system. This configuration is typical for larger isolated applications (> 50 kW), and some systems in the MW range have been reported. The storage system this configuration uses (if any) is a short-term storage one, commonly batteries or flywheels, which is used for power quality and control purposes only, but not for long-term energy balance.

Three different types of wind-diesel systems can be distinguished, according to the proportion of wind use in the system:

- Low penetration W/D systems, which do not require additional modifications to the diesel-only grid (usually an existing system) as the diesel engine runs continuously and its controls can cope with the control of the system in the W/D mode of operation without significant modification
- Medium penetration W/D systems, which require the inclusion of some control capabilities (usually the regulation of deferrable loads or the regulation of the wind generation) for the moments when wind generation is higher than load consumption.
- High penetration W/D systems, which require the addition of complex control strategies and devices in order to guarantee the stability of the system in the wind-only mode.

Low penetration systems can be found at a commercial level, whereas solutions for high-penetration W/D systems are at a demonstration level. Technology trends for this configuration include the development of robust and proven control strategies. Prospects for this configuration (mainly for high-penetration W/D systems) are very promising, as the cost of fuel is increasing.

Conditions for stand-alone wind turbine systems

- Installation site with average annual wind speeds of at least 4.0 meters per second (9 miles per hour)
- A grid connection is not available or can only be made through an expensive extension. The cost of running a power line to a remote site to connect with the utility grid can be prohibitive, ranging from 5,000€ to more than 10,000€ per kilometer depending on terrain.
- You have an interest in gaining energy independence from the utility
- You would like to reduce the environmental impact of electricity production
- You acknowledge the variable nature of wind power and have a strategy for using variable resources to meet your power needs

Grid-Connected Applications

Another market with great potential for small wind turbines is in grid-connected applications for residential, industrial or even, lately, urban environments. The so-called distributed wind applications are poised for rapid market growth in response to continuing energy price increases and increased demand for on-site power

generation. However, in order for distributed wind to reach its mainstream market potential, the industry must overcome several hurdles, primarily in system costs, quality of design, grid interconnection, and installation restrictions.

Wind power can also be used to generate electricity in an urban environment. This trend has mainly been seen in Europe, where the integration of SWTs in the built environment is being actively discussed. New wind turbines are under development for this application, which is looking mainly for quiet and efficient devices under turbulent and skewed wind flow. As well as the installation of wind turbines around and on buildings, there is also interest in 'building-integrated' wind turbines, where the turbine is part of the building structure. For these applications, due attention should be paid to the quality of available wind resource onsite prior to installation.

Conditions for grid connected wind turbine systems

- Installation site with average annual wind speeds of at least 4.5 meters per second (10 miles per hour).
- Utility-supplied electricity is expensive in your area
- The utility's requirements for connecting your system to its grid are not prohibitively expensive.
- Local building codes or covenants allow you to legally erect a wind turbine on your property.
- You are comfortable with long-term investments.

3 GEOTHERMAL ENERGY

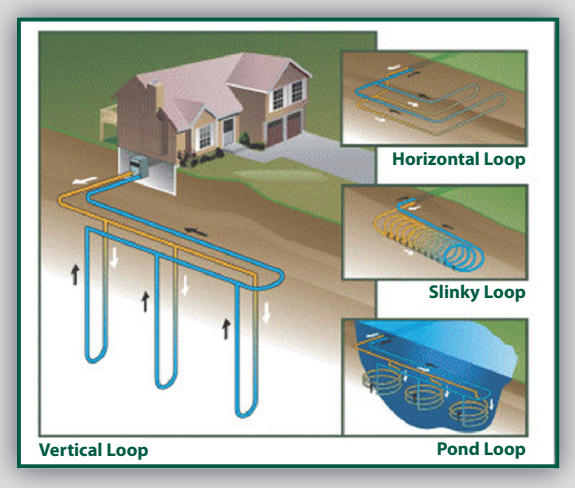
3.1. Description geothermic systems

In areas with relatively recent volcanic activity we usually observe the phenomenon of fiery material from the earth's interior to shift towards the surface and heat subsoil rocks. This heat is transferred to aquifers formations of the region. The water is heated and circulated through the rocks in many cases reaching up to the surface after having been enriched by the rock salt (hot springs, fumaroles), while other times the water remains trapped in impermeable rocks and get to temperatures in excess of 350 ° C.

Each geothermal field, however, is unique and requires specialized studies for optimal technical and economic exploitation. One the other hand geothermy is considered a renewable energy source as it is practically inexhaustible and free. The uncertainties and the associated investment risks associated with the identification and correct assessment of underground energy source (geothermal reservoir), are difficult problems to overcome but thanks to recent technological progress a variety solutions exist for the feasible exploitation of this renewable energy source. Geothermal field are categorized according to potential energy gain as follows:

1. Smooth geothermal energy: T <25 ° C, yield <2% (cooling - heating buildings)
2. Low enthalpy: T = 25 to 100 ° C, yield 2 -8% (domestic water)
3. Average enthalpy: T = 100 to 150 ° C, yield 2 -8% (power generation)
4. High enthalpy: T> 150 ° C, yield 8 to 18% (electricity production)

The exploitation of geothermal energy worldwide has grown considerably in recent years, while the prospects for further growth are very large, even with today's low oil prices. The largest geothermal project in the world is Geysers in Northern California. The installed capacity exceeds 1,300 MW and continuously increases through further investments.



The possibility of extracting power from geological or hydrological formations when the temperature or the formation is less than 25 ° C is of special interest as these kind of formations are meet almost everywhere. In such cases the drilling depth for exploitation is usually not more than 150m from the surface and therefore is characterized as low depth geothermal energy. The difference between the two forms is that the low depth geothermal energy comes mainly from solar radiation at the Earth's surface, while other forms of geothermal energy origin from heat transfer between magma of the Earth's core and the upper layers of soil. Although the later forms of geother-

District heating

The provision of heating for whole districts or small towns with the use of low enthalpy geothermy is applied in many countries with considerable environmental and financial benefits for the regions. The installation costs (per capita) are reduced but more importantly the operational costs are significantly lower. Thermal requirements depend on weather conditions and design temperatures are 18-20oC for homes and 17-18oC for offices. In order to develop a cost effective system for heating and hot water provision the temperature of the geothermal fluid should be at least 65oC. As a general rule, in order for a district heating system with the use of low enthalpy geothermal technology to be economical viable the cost of geothermal energy should correspond to 50-60% of the installation cost of a conventional heating system.

Desalination of seawater

Desalination of sea water with geothermal fluids used as heating medium may be achieved using the multistage vacuum evaporation (MES). In order for the desalination system to be economically viable the temperature of the geothermal fluid should be at least 60oC. The discharge temperature is planned to be 40-50oC meaning that geothermal energy can be further exploited for other uses (combined systems). As a general rule, in order for a distillation system with the use of low enthalpy geothermal technology to be economical viable the cost of geothermal energy should correspond to less than 60% of the distillation cost using conventional fuels.

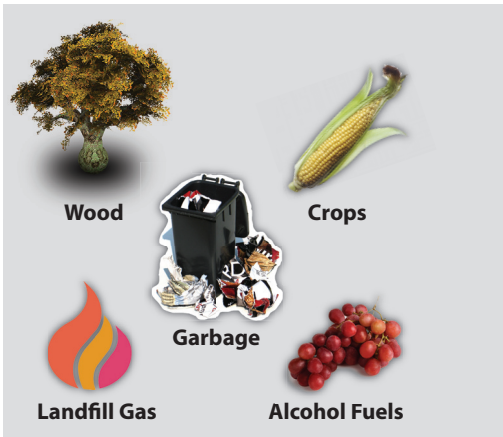
Heating greenhouses

The deferent uses and the size of greenhouses depends on the available geothermal energy, the climatic conditions, the greenhouse's construction materials and the type of crops cultivated. A very common case in Greece is heating tomato glass-greenhouses with the use of a geothermal heating medium of 40-55oC. In this case approximately 150.000 kcal / h hectare are required, for a heating period of, on average, 1.250 hours (Load Factor 14%) maintaining an internal air temperature of at least 14oC. The annual energy savings achieved in this case are about 24 tonnes of oil equivalent per hectare.

4 BIOMASS

4.1. Description of biomass energy systems

The term biomass includes any material produced by living organisms (such as wood and other forest products, crop residues, livestock waste, food industry wastes, etc.) and can be used as fuel for energy production. The most commonly used form is pellets which result from mechanical compression of sawdust with no addition of chemicals or adhesives.



The energy bound in plant substances comes from the sun, with the process of photosynthesis, plants transform solar energy into biomass. Animals perceive biomass energy with their food and store a part it in their body. After proper treatment and processing of residues this energy is transformed to biomass fuel. Biomass is the oldest and most widely used renewable energy source in a wide variety of forms (straw, sawdust, worthless fruit or kernels, manure, animal fat, useless fish, food scraps, paper, etc.). All the above materials, directly or indirectly derived from the plant world can be transformed into energy.

Unlike fossil fuels, biomass is renewable and requires only a short period of time for nature to replenish what is used as an energy source.
There are several terms used for biomass energy depending on its form. The term "bio-power" describes systems that use biomass instead of the usual fossil fuel (natural gas, coal) for power generation while the term "bio-fuels" describes mostly liquid transportation fuels to replace petroleum products (gasoline or diesel).

A key advantage is that biomass is a renewable energy source that provides energy stored in a chemical form. It can be exploited by transformation to a wide variety of products using different methods and relatively simple technology. Also biomass is considered an environmentally friendly fuel as production and conversion processes do not created ecological and environmental problems. On the other hand, biomass is characterized by diversity, low energy content when compared with fossil fuels, due to low density and / or high water content, seasonality, dispersal, etc. These characteristics imply additional, difficulties in collecting, transporting and storage. As a result, the cost of conversion to more usable forms of energy remains high.

However, research and technological progress made over the past decades have enabled the use of energy conversion technologies of biomass as extremely attractive economically and ecologically. The potential of bio-energy is becoming increasingly larger and more promising over the last years.

Biomass Advantages

- The combustion of biomass has a zero balance of carbon dioxide (CO2) and thus does not contribute to global warming (the amounts of carbon dioxide (CO2) released during combustion of biomass is counter balanced by plants to create biomass.
- The minimal presence of sulfur in biomass contributes significantly to reducing emissions of sulfur dioxide (SO2) which is responsible for acid rain.
- In the case when biomass comes from domestic sources, its use contributes significantly to reducing dependence on imported fuels and thus improves country's trade balance and secures energy supply.
- The use of biomass as energy source in a region increases employment in rural areas through the cultivation of alternative crops (various types of rape, sorghum, cane, kenaf) creating alternative markets for traditional crops (sunflower, etc.), thus contributing to socio-economic development of the region. Studies have shown that the production of liquid bio-fuels has a positive effect on employment in both rural and industrial areas.

Biomass disadvantages

- The increased volume and high moisture content, relative to fossil fuels hinder the use of biomass energy.
- The wide dispersion and seasonal production of biomass complicate the continuous supply of feedstock plants as row material for energy production units.
- Based on the above, difficulties exist in the collection, transportation, and storage of biomass which increases power production cost.
- Modern technology and improved techniques of biomass conversion require expensive investments compared with that of conventional fuels.

4.2. Application of biomass energy systems

The volume of the raw material required is an essential characteristic when producing energy from biomass. The energy generated is cost effective for "fixed point" consumers, and thus energy production must be local in nature with a maximum economic range from 5 to 10 kilometers.

This is an important criterion for the selection of biomass as energy source and favors certen applications in agro-animal farms or agricultural products processing plants, as power supply raw material and energy consumption are within economically acceptable limits. Energy from biomass can be used in populated forest areas, as well as in small scale for industrial units and vehicles.

Cogeneration of heat and electricity (CHP) in agricultural industries

Cogeneration is the simultaneous production of electricity and thermal energy from the same amount of fuel with significantly greater efficiency from the independent production of each of these energies. The greater efficiency of the application means less amount of fuel consumption for producing the same amount of energy with significant economic and environmental benefits. Example of industry sectors where the installation of biomass CHP successfully substituted, conventional fuels is ginning industries.

Heating greenhouses

The utilization of biomass in heat generators for heating greenhouses is a good proposal to reduce the production costs of greenhouse products. Today in Greece biomass boiler have been installed in 10% of the total area of greenhouses, using olive pits, straw and other crop residues for fuel. During the combustion of biomass, solar energy is transformed to heat and the CO2 which was bound to the biomass fuel during its production by the nature returns back into the atmosphere. The minerals contained in the ash enrich the soil with nutrients. So the overall procedure is considered environmentally friendly and has proven to be economical profitable.

District heating

District heating (or cooling) is the application of methods for centralized production of heat (or cooling) and distribution (usually in the form of hot or cold water) for heating or cooling in residential or other applications. Heat is transported through a network of pipes from the central station to the heated buildings. The advan-

tages of these technologies are environmental (better and easier control of combustion at central level) and also economical (central power generation is possible with many technologies and fuels, including a very important proportion of different types of biomass.

Energy crops

Energy crops are traditional crops that can be used to produce liquid bio-fuels, or plants currently not cultivated commercialy as miscanthus, cardoon and the pole which can be used for the production of energy and bio-fuels. Energy crops are divided into two categories which are:

- Annual: sugary or sweet sorghum (Sorghum bicolor), fibrin sorghum, kenaf (Hibiscus cannabinus), Rape-seed (Brassica napus) and (Brassica carinata)
- Perennial:

1. Agricultural: cardoon (Cynara cardunculus), reed (Arundo donax L.), miscanthus (Miscanthus xg iganteus), switchgrass (Panicum virgatum)
11. Forest: Eucalyptus (Eucalyptus camaldulensis Dehnh. & E. globulus Labill.), False acacia (Robinia pseudoacacia [10]).

Energy crops can provide fuel for other applications of biomass as reported in the previous paragraphs. The development of energy crops is a good solution to overcome the economic impasse felt by Europeans and especially the Greek farmers originating from the free importation of agricultural products with a view to abolishing traditional agricultural subsidies.

Bio-fuels

Crops containing starch as their main ingredient, such as potatoes and corn (through the process of hydrolyse which converts starch into sugar content), or cane crops (through the appropriate anaerobic biological process) convert sugar into alcohol content and finally ethanol is produced. The resulting ethanol can be used in transport, in internal combustion engines either directly in suitably modified engines or indirectly by the use of mixtures with gasoline without engine modification. Bio-fuels are also extracted from strains of plants common crops in Greece, such as cotton, sunflower, tobacco, cereals and maize.

Biogas Animal waste

Biogas produced from anaerobic digestion of livestock waste (effluents from pig and cow houses) consists of 65% methane and 35% carbon dioxide and can be exploited for energy production through internal combus-tion engines, burners or gas turbine in order to produce electricity and heat. Biogas, with proper processing and upgrading, can be used as a transport fuel, with a very competitive price. Furthermore, the upgraded biogas can be fed into the natural gas and used for electric and thermal energy.

The development and deployment of biogas is an alternative with significant advantages, offering environ-mentally friendly energy and simultaneously solve the growing problem of wastewater disposal. Another important economic benefit is the production of a product suitable for animal feed as a substitute of cotton flour, obtained by drying the treated material anaerobically at 65oC.

5. IMPLEMENTATION OF RENEWABLE ENERGY SYSTEM SOLUTIONS

Nowadays the average building covers heating needs with a conventional fuel boiler and other energy needs (including cooling) with electrical power coming from the grid. If you consider that one in two boilers is not maintained properly and that 90% of the electricity production in Greece comes from polluting fossil fuels such as lignite and oil, it is easily understood why the building sector contributes such an environmental problem.

Fortunately, things are changing. Technology has made leaps and the consumer now has a variety of options to meet energy needs through the use of renewable energy sources. The examples (case studies) given in the following paragraphs demonstrate that the use of Renewable Energy Sources solutions today:

- is decentralized (can be applied at the residence or industry)
- is easy to use
- is environmentally friendly
- is or can be cost effective

5.1. Supply electric power to remote buildings with PV systems

Nowadays, photovoltaic systems offer an attractive solution for a growing number of applications that require affordable and reliable power supply even under extremely harsh environmental conditions. With this technology we can produce electricity without consuming conventional fossil fuels, exploiting only renewable solar radiation which is supplied for free.

The key characteristic of today's PV systems (autonomous operation without the use of any fuel, high durability and reliability, and capacity to operate for long periods without maintenance) are making them appropriate solution for all types of applications located far from the grid, both economically and environmentally. One of the most common applications of photovoltaic systems, is the autonomous power supply of housing and settlements away from the existing electrical grid especially in the case when the connection to the grid is impractical or uneconomic.
Additionally, in the case of consumers already connected to the grid, the application of interconnected photovoltaic systems can reduce electricity bills.

A typical example of an autonomous hybrid system (a combination of photovoltaic panels, a wind turbine and an auxiliary gas generator) which provides electricity for a remotely located residence in Northern Greece is described below.
This system was designed to totally meet the needs of home consumption that was calculated as :

- During the winter: 14.369 Wh
- During the summer: 29.819 Wh

The sizing of the system was based on the following criteria:

- Modular structure of the energy production system and energy storage with full scalability, at any time after the initial installation.
- Saving fuel and reducing emissions and noise produced by the gas generator
- Full coverage of energy needs with maximum reliability and in an environmentally friendly manner.

Given the above requirements for energy and the solar-wind potential of the specific area a hybrid system was designed consisting of:

A. 18 photovoltaic panels of 110 Wp each (total 2KWp)
B. 1 wind turbine 900 W output at 12,5 m / s wind speed
C. 3 power inverters 3000W, 230V, 50 Hz sinusoidal waveform.
D. 12 batteries (capacity 960Ah /C12
E. 2 charges controllers 45A.
F. 1 battery charger by a generator 24V/100A
G. 1 Automation system (power management and data

The use of photovoltaic or hybrid systems (solar – wind) is the ideal solution for supplying electricity to isolated houses houses, pumping systems and other applications. The cost of an established autonomous, hybrid solar-wind system is approximately 10.000€ per KWp. The average energy output of such a system with the solar radiation conditions in Greece is about 4kWh/day and with the current energy cost the investment will break even after 3 years of operation. logger)

5.2. Agricultural Applications (Geothermal Greenhouse in Serres)

The most common application of geothermal energy in agriculture is the heating of greenhouses, which has been developed in many countries. The off-season (unfavorable climatic conditions) cultivation of vegetables and flowers can be cost effective with the use of this technology. There are several solutions to achieve optimal conditions for plant growth, based on the optimum temperature for each species, at the proper intensity of

light, the ideal concentration of CO2 in the greenhouse, the humidity of the soil and air and movement of air through the greenhouses. The use of geothermal heat in greenhouse heating significantly reduces operating costs, which in some cases account for 35% of production costs (vegetables, flowers, ornamental plants and shrubs).

The geothermal field of the thermal Sidirokastro of Serres stretches 10 km north of Sidirokastro and the certified area of the occupied 6 km2. The depth of the reservoir ranging from 30-400m with the temperature range 40-57oC, salinity 800 - 2200 ppm TDS and increased content of CO2, the likely potential of the field is estimated at 1000 m3 / h having production capacity of 28 MWth (discharge temperature to 250oC). In the area there ia a total installation of 17.5 acres of geothermal greenhouses with a total installed capacity of 6.64 MWth and the resulting energy savings are about 1180 equivalent tones of oil per year. A specific glass greenhouse of 415 Ksq.m. with a geothermal installation capacity of 1.9 MWth is fully exploiting all plantings per year with annual savings of 365.8 equivalent tones of oil per year.

The geothermal field of Sidirokastro Springs has several possibilities of exploitation, particularly for heating greenhouses. If used rationally, the certified potential of the field could provide energy for up to 50 acres of greenhouses.

5.3. Cogeneration of heat and electricity at a gin industry

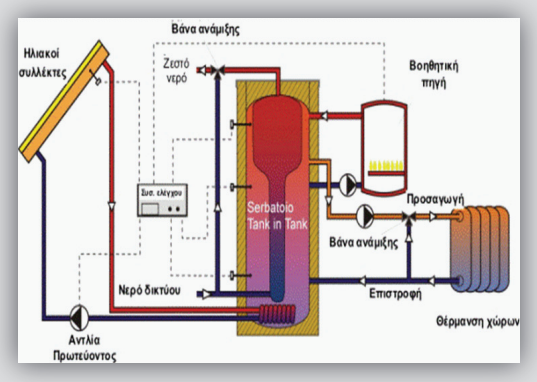
A gin industry in northern Greece processing 50.000 tn of cotton per year also produces about 4.000 tn of waste (or in the case o f biomass usage by-product) which previously burned in incinerators towers without taking the necessary measures, at great risk of ignition. The required drying of cotton before ginning was formerly done with the use of oil by channeling exhaust gases for drying cotton. Recently a biomass cogeneration system was installed including a biomass boiler with a 4.000.000 kcal / h capacity which produces steam at high pressure (10 bar). The steam forces its way through a steam turbine connected to a 500 KW electricity generator.

After expansion, the steam is led through pipes in heat exchangers, where the air is heated to 130oC, which is subsequently used for the drying of cotton in specialized towers. Another part of the hot steam is directed to the seed oil production unit where steamers used in the production of cotton oil.

With the use of this system the factory meets its overall needs of heat and a portion of its electricity needs. The energy savings reach 630 tn of oil per year resulting in decreased production cost. The initial investment was around 1 million Euros and the breakeven point was reached after only 7 ginning periods.

5.4. Hybrid solar – biomass space heating

The need for saving energy and reducing CO2 emissions requires the expansion of renewable energy applications in new areas. Solar systems that assist in space heating although not yet well known are continuously increasing their market share. Such a hybrid solar – biomass heating unit is installed by the Centre for Renewable Energy Sources (CRES) and provides heating for one of the buildings in Pikermi Attica.



The unit is designed to meet the heating needs of the building 100% from renewable sources (solar energy - biomass), giving priority to solar energy. Biomass is used as an auxiliary system in case of cloudy weather conditions.

In this arrangement, two storage containers are used both for heat transfer and storage.

The main system components are:

- A biomass boiler (35 kW capacity) with the ability to burn olive pits, seeds, wood pellets and fire-wood.
- Solar collectors (13.5 m^2 surface) mounted with a south orientation and a 60o degrees inclination
- Storage tank capacity of 500 lt, with internal heat exchanger.
- Pre-existing system of 5 fan coils (originally fueled by heat pumps)
- A three-way mixing valve to maintain the flow temperature constant at 40 ° C

One of the advantages of the system is that it can be combined with conventional radiators and thus may interfere with an already installed system replacing the conventional source of energy (eg oil).

The combination of the two energy sources is an interesting and feasible prospect. It is an entirely renewable solution for space heating and production of hot water. The initial results are encouraging as the solar system provides up to 40% of the total heat requirements and the total emissions avoidance is estimated at 753kg.

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Reducing energy and maintenance cost in production lines

Project

Cross Border Implementation of innovative cost cutting technologies
CROSS-INNO-CUT

Author: Ioannis Komninos

CHAPTER 2

CHAPTER 2

Project

"Cross Border Implementation of innovative cost cutting technologies – CROSS-INNO-CUT"

Reducing energy and maintenance cost in production lines

CBM* = Condition Based Maintenance

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1. REDUCING ENERGY CONSUMPTION IN A PRODUCTION LINE (High Cost Area 1 Solutions)

A production line contains many different types of equipment and machinery. Non-efficient equipment operation result in high energy consumption and thus high costs. One should aim to cut down these costs by minimizing the amount of energy being wasted by non-efficient equipment operation. For each of the equipment family that is examined in the audits, there are specific measures to be taken that can result in an energy efficient operation of the equipment and thus cut down their energy signature and energy costs. The proposed solutions described further bellow, are a combination of actions and technology applications that can provide the information required not only for identifying the operational status of the equipment but also the amount of potential savings that can be achieved.

1.1. ENERGY SAVING METHODOLOGY

As each equipment has a unique operational status and functionality, there is no specific step by step methodology that can be applied to all equipment to save energy and therefore reduce costs. One can only apply specific techniques for each equipment family that may exist in a production line according to the following guideline:

- Identify the energy hungry equipment
- Collect existing equipment operational data such as power, load, voltage, current, temperature etc.
- Note Original Equipment Manufacturer (OEM) operational data
- Determine annual potential savings for each case based on the data collected and the ORM recommendations.

The above can be applied to the three major equipment families that are examined in the audits and will be the focus in any future recommendations for energy saving applications. How the problem of energy saving can be tackled and specific use cases for each equipment family is provided in the following document sections.

1.2. ENERGY SAVING IN MOTORS

1.2.1. Problem Identification & Solution

Motor efficiency depends heavily on the load applied to them. In some cases their efficiency stays constant even if they operate at 50% of their rated load capability. The real issues that can reduce their efficiency are the excessive friction due to bad alignment or poor lubrication or bad maintenance and the misalignment of the electricity phases that drive each motor leg. In both cases one should have means of identifying the problem when this exists. Fixing the problem is easy in both cases. To identify the problem of excessive friction one can use infrared thermography to look for temperature changes in motor bearings, couplings, gears, pulleys, conveyors and chain drive systems. This can be doe easily by the use of infrared thermal cameras and appropriate software that will analyze each thermal image.

To identify potential misalignment of electricity phases in two or three phase driven motors one can conduct an infrared survey by once again use thermal camerasto identify potential high temperature areas and then measure the loaded current of each phase and compareit to the rated one.

Another way to identify phase misalignment is to measure the voltage of each of the three phases and then calculatemotor efficiency versus voltage imbalance. This can be easily accomplished by using voltage meters or sensors.

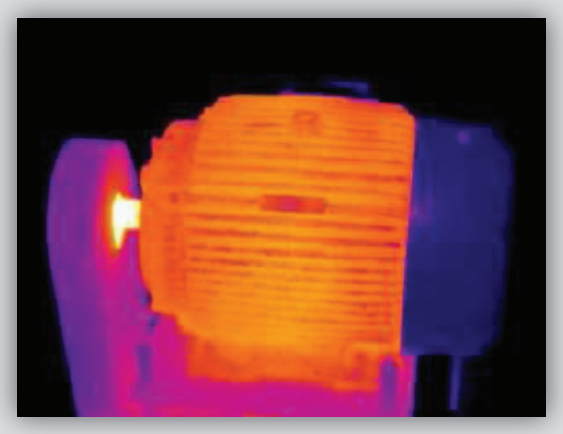


Figure 1: Infrared Image of a Motor.
Source:
D.P. Smith, "Predictive Maintenance Centralization for Significant Energy Savings", Predictive Services LLC

Figure 2: Infrared Image of a Motor Circuit Breaker with Temperature Anomaly.
Source: D.P. Smith, "Predictive Maintenance Centralization for Significant Energy Savings", Predictive Services LLC

In each case conducting measurements and surveys may not be cost effective as this requires experienced personnel. It is advised that such measurements to be conducted in an automated way by introducing wireless sensor networks (WSN) incorporating infrared cameras and voltage / current meters. The WSN technology has low initial installation cost and can be operated at all times with no extra cost. Also a great advantage of the particular technology is that data is always available and saved in databases and so any irregularities that may appear in the measured data can trigger alarms that can initiate corrective actions.

1.2.2. Examples – Case Studies

Calculating annual savings in the case of electrical phase misalignment through infrared thermography

Assume that an infrared survey has identified that one of the three phases of a loaded motor of 0,87 power factor and 100 HP is 95 degrees Celsius hotter than the other two. Each phase is rated at 480 Volts. Further analysis by measuring the loaded current consumption shows that the hotter leg or phase draws 45 Amps compared to the other two which draw 30 Amps. The motor operates at an average of 8000 hours per year. By fixing the phase misalignment one can have the following annual savings.

Power Waste (kW) = (480 Volts x 15 Amps Difference x 0,87 (power factor)) / 1000 = 6,264
Annual Savings = 8000 hours x 0,087 Euro / kW x 6,264 kW = **4359,74 Euro**

Note that the electricity cost is based on the Greek cost per kW as charge by the Greek national electricity provider – DEH.

Calculating annual savings in the case of electrical phase misalignment through voltage misalignments

Assume that voltage analysis of the same motor as above through voltage measurement of the three phases that drive the motor shows an imbalance of 220, 225 and 230 Volts. In this case the percentage of voltage imbalance is:

Voltage Imbalance (%) = (Average Voltage – Lowest Voltage) / Average Voltage =
= [(225 – 220) / 225] x 100 = 2,2 %

By using the following table one can then estimate the motor efficiency drop due to the voltage phase imbalance and then calculate, using the equation provided bellow, the annual savings if this imbalance is corrected.

Motor Efficiency* Under Conditions Of Voltage Unbalance			
Motor Load % of Full	Motor Efficiency, %		
	Voltage Unbalance		
	Nominal	1%	2,5%
100	94,4	94,4	93,0
75	95,2	95,1	93,9
50	96,1	95,5	94,1

Table 1: Motor Efficiency Under Conditions of Voltage Unbalance.
Source: US Department of Energy, Energy Tips – Motor Systems, Motor systems Tip Sheet #7, Sep 2005

Annual Savings = (Motor HP x Hours of operation x Electricity cost) / Motor Efficiency =
= [(100 HP x 0,746) x 8000 Hours x 0,08 Euro] / 93 = **513 Euro**

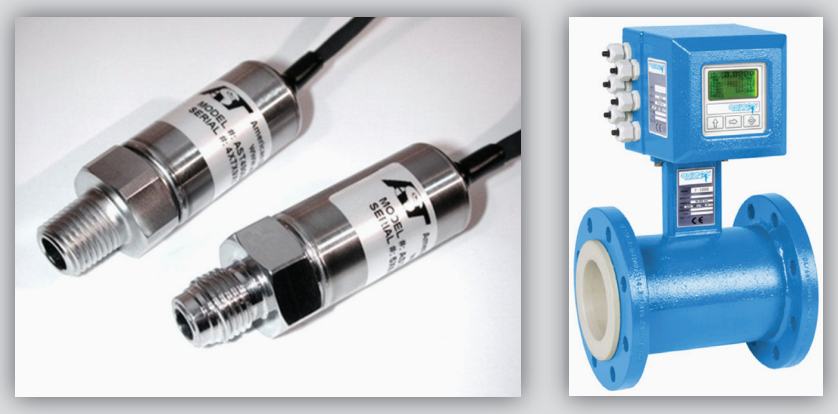
where,
100 HP x 0,746 is the motor power in kW assuming that the average power requirement to produce one brake horse power = 0,746

1.3. ENERGY SAVING IN FANS & PUMPS

1.3.1. Problem Identification & Solution

Pumps and fans are very dependent on flow and pressure. Most of their efficiency issues are related to one or both of these physical parameters. As for a given rpm point of operation there is always a optimal point of flow and / or pressure. So it is evident that if any of the two parameters change so is the efficiency of the fan or pump. Needless to say that altering the fan or pump efficiency results in energy waste and so higher operational cost. As fan and pumps are equipment that operate at low efficiencies that may vary from 50% to 80%, it is very important that are operated in an energy efficient way.
Identifying the problem is easy as both flow and pressure are physical parameters that can be easily measured and monitored by sensors. There are many available sensor technologies that can be used such ultrasonic or electromechanical sensors for flow measurements and capacitive, optical, piezoelectric or potentiometric sensors for pressure measurements. Other technologies are also available and their application depends on the characteristics of the specific fan or pump that needs to be monitored.

Figure 3:
Typical Flow and Pressure Sensors for Industrial Applications



A solution to the problem of keeping flow and pressure at specific levels that are optimal for a specific equipment is to tune the speed at which a fan or rpm operates. For example if a motor drives a specific fan through sheaves, these can be modified to alter the rmp's. Another solution is for one to install two or three speed motor. In some cases more energy can be saved be controlling flow rather than keeping it at an optimum level. But this has its constraints. For systems that have variable flow controls, one must make sure that the flow is not reduced so much that the system's pressure is build up to a level that more energy is required to generate the required flow. Once again both flow and pressure can be easily monitored and using the flow controls set to an optimal point for efficient operation of the fan or pump.
If the system can operate at an efficient way even with reduced pressure then reducing flow can save energy as this is seen in the table below.

Percent of Flow	Percent of Energy Saved
100%	0%
90%	19%
80%	36%
60%	64%
50%	75%
40%	84%

Table 2: Percent of Energy Saved Related to Percent of Flow Drop in a System that can be Operated Efficiently at Low Pressure Conditions
Source: C. Milan, "Industrial Audit Guidebook", Bonneville Power Administration.

1.3.2. Examples – Case Studies

Annual Savings Example by Optimizing Flow and Pressure using Speed Control

Assume that a fan delivers 20.000 cfm, at 21,6 cfm/W and runs for 2000 hours per year. By optimizing its flow and pressure through speed control, the fan now delivers 25.000 cfm, at 12,6 cfm /W. The cost of electricity is 0,087 Euro / W.

Annual Savings = **170 Euro / year** approximately.

If the fan has a life span of 25 years then the total savings could be 4250 Euro.

1.4. ENERGY SAVING IN COMPRESSED AIR SYSTEMS

1.4.1. Problem Identification & Solution

Compressed air systems are accountable for a big chunk of the total energy consumption of a production area and can have extremely low operational efficiency compared to other equipment families. The major issue with this kind of equipment is the various leaks. Companies are often forced to shut down entire production lines so that compressed air systems can be turned off and leaks are found and fixed. Leaks can be identified easily using techniques such as visual inspection, ultrasound survey or infrared survey.
The visual inspection technique is not always cost effective as it requires a lot of man-hours to be conducted. This is due to the fact that for a visual inspection of the system, the whole system must be broken down into sections and each section must be examined thoroughly for leaks. Also not all compressed air system sections are easily reachable, a fact that makes the visual inspection even more difficult and time consuming. A good solution is for one to install ultrasound sensors that can pick up the noise due to leaks even in cases in which these noises are beyond human hearing by detecting sound waves with frequencies above 20 kHz. Each of the ultrasonic sensors can be then be part of a wireless sensor network and measurements and thus detection of leaks can be done in an automated way.
Ultrasonic sensors must be placed in specific locations so that to cover the whole compressed air system. So a good practice is for one to gather information and construct diagrams showing the whole compressed air system that will include all pipes and valves starting from the compressor and moving forward until the end of the system.

When a compressed system involves hot air or steam rather than cold air, then the most common problem that cost energy and thus money is a failed or damaged trap. A trap is a valve of a hot air compressed system that allows condensation to return back to the boiler for re-use. A damaged trap not only reduces the efficiency as the condensed air is not fed back to the boiler but also is the cause of corrosion as the water vapor sits and damages pipes and components.

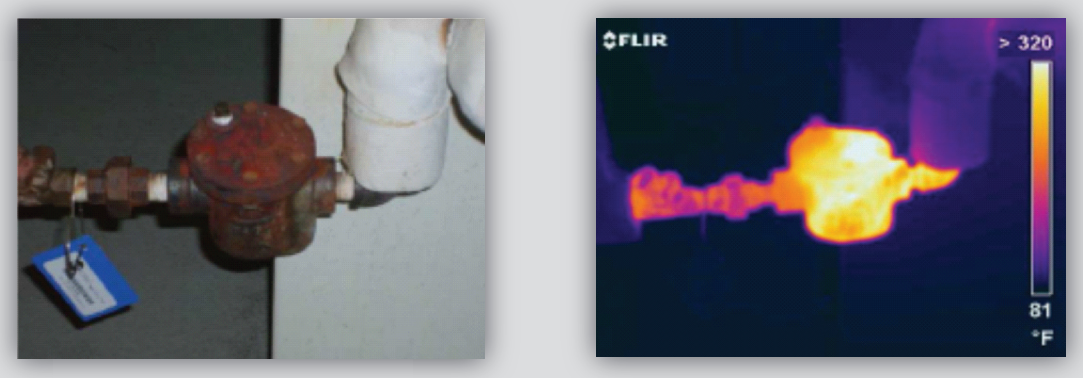


Figure 4: Steam Trap and Infrared Image Showing Its Temperature.
Source: D.P. Smith, "Predictive Maintenance Centralization for Significant Energy Savings", Predictive Services LLC

To identify problems with traps there are three recommended methods to do so: ultrasonic probing, infrared imaging and visual inspection. For first two methods can be applied in conjunction with wireless sensor networks as both probes attached to each trap and infrared cameras installed can be easily be part of such networks acting as sensors.

1.4.2. Examples – Case Studies

Calculating annual savings in the case of repairing leaks of a compressed air system that were identified with the use of ultrasonic sensors

Assume that an installed ultrasonic sensor system picks up noise that comes from various leaks. The noise generated is between 20 and 30 dB per leak and the system operates at 100 PSIG for 8000 hours per year. The system compressor runs at 80% efficiency and the sensors pick up a total of 20 leaks. Using the following table one can calculate the "cfm" losses at each decibel level.

Readings / Noise Level	CFM @ 100 PSIG System	CFM @ 75 PSIG System
10 dB	0,5	0,3
20 dB	0,8	0,9
30 dB	1,4	1,1

Table 3: Example of Relationship of Noise Level, System PSIG and CFM

Annual Energy Savings for 20dB leaks=

= {[Air Loss (cfm) / 4,2]*0,746*(Hours of Operation)*(Energy cost)}/ Compressor Efficiency =

= [(0,8/4,2)*0,746*8000*0,087] / 80 = **124 Euro** per leak or **2472 Euro** for all leaks

Calculating annual savings in the case of a damaged trap of a compressed steam system using both ultrasonic probing and infrared imaging

Assume a failed trap blowing at 100 PSI with a 3/16 inches orifice. The trap is part of a system operating 8000 hours per year and the cost of generating steam is 12 Euro / 1000 pounds of steam generated. Using the following table one can identify the amount of steam lost per hour.

Orifice Diameter	10 PSI	25 PSI	50 PSI	75 PSI	100 PSI	125 PSI	150 PSI	200 PSI	300 PSI
1/32	0,58	0,94	1,53	2,12	2,7	3,3	3,9	5,1	7,4
1/16	2,3	3,8	6,1	8,5	10,8	13,2	15,6	20,3	29,8
3/32	5,3	8,45	13,8	19,1	24,4	29,7	35,1	45,7	67
1/8	9,4	15	24,5	34	43,4	52,9	62,4	81,3	119
5/32	14,6	23,5	38,3	53,1	67,9	82,7	97,4	127	186
3/16	21	33,8	55,1	76,4	97,7	119	140	183	268

From the table above one can see that 97,7 pounds of steam is wasted per hour. So by repairing the trap one can save the following:

Steam wasted per year = 97,7*24*30*12 = 844.128 pounds

Annual savings = (Steam cost)* (Steam Wasted) = (12 / 1000) * 844.128 =

= **10.129 Euro**

1.5. IMPLEMENTATION COST & ACTION PLAN

For one to calculate the implementation cost of any of the energy saving techniques that were described in the previous sections, he must first identify the sources of energy waste and then decide on the course of action to be taken in each case. So cost and implementation time of any proposed solution depends heavily on the equipment that exists in the production line. For the equipment that solutions were proposed some general information on cost and implementation time is provided in the tables below.

Equipment	Parameter to be examined	Monitoring Means	Cost of infrastructure	Implementation time
Motors	Temperature	Temperature sensor	100 Euro	1-2 days
		Infrared imaging	1000 euro	1 day
	Voltage	Voltage meter	200 Euro	1 day
Fun & Pumps	Pressure	Pressure sensor	150 Euro	1-2 days
	Flow	Flow meter	300 Euro	1-2 days
Compressed Air Systems	Pressure	Pressure sensor	150 Euro	1-2 days
	Temperature	Temperature Sensor	100 Euro	1-2 days
		Infrared imaging	1000 euro	1 day
	Noise	Ultrasonic sensor	300 Euro	1 day

Table 4: : Cost & Implementation Time of Monitoring Equipment Physical parameters

Apart of the cost of the sensor related equipment one must add the cost required for installing the infrastructure for sensor data collection through either wired or wireless solution and also the cost of data analysis.

Data Collection	Basic Infrastructure	Cost of Infrastructure	Implementation time
Wireless	WSN Node	400 Euro	1-2 weeks
	WSN Gateway	450 Euro	
	Host PC or Server	700 Euro	
	Data Analysis S/W	-	
Wired	Cabling	3 Euro / meter	2-4 weeks
	Data Collectors/ Loggers	500 Euro / Unit	
	Data Analysis S/W	-	

Table 5: Example of Relationship of Noise Level, System PSIG and CFM

One should note that the cost per sensor in Table 4 is just an indication and it is based on the lowest available commercial heavy duty sensoring equipment. Since the unique equipment characteristics will ultimate define the specifications of the sensors, the infrastructure cost may increase. Also it should be noted that this cost is one time only.
To provide some indication of the total infrastructure cost, assuming that a motor needs to be examined for potential energy waste, one should require a minimum of 4000 Euro for the required inspection equipment and a period of up to 4 weeks for installing the equipment and determine energy waste if any. Given the fact that the potential annual energy saving cost for a motor may rise above 4000 Euro (See example in Section 1.2.2), it is evident that the proposed action in this case is worth the effort.

2. REDUCING EQUIPMENT FAILURES IN A PRODUCTION LINE (High Cost Area 2 Solutions)

The second biggest high cost area in a production line after operational energy waste or non-efficient energy usage is equipment failures. Equipment will always fail at some point or another as they have parts with given life expectancy. Failures can be random, due to wear out, fatigue, early mortality and bad maintnance. Whatever the reason behind failures, these can be predicted by applying a combination of the correct preventive maintenance strategy via monitoring critical equipment parameters using sensors. To achieve both of these goals one must apply Condition Based Maintenance (CBM).
When equipment fails in a production line the usual case is that the production line is halted for repairs to take place. This has an immediate impact on many areas such as cost of idle human capital, cost in idle production supply chain process, cost in production delayed delivery, and of course the actual cost of repairs. By applying CBM, failures can be eliminated and production halting as maintenance can be scheuled to be conducted in off-peak hours or even during periods that the production line may be stopped such as night periods, holidays and weekends. Also CBM help to organize and procure all the required parts and replacements of equipment that are scheduled for maintenance, lifting a load from the part of the supply chain and logistics that is required to handle such requests.
Incorporating Wireless Sensor Networks (WSN) into the CBM processes adds automation, autonomy and collaboration to them. Automation because WSN technologies enable the use of advanced monitoring tools, remote measurement of physical parameters, remote performance evaluation and remote process optimization that removes the human intervention in most of the CBM process. Autonomy because the WSN technologies are based in smart sensors and data collectors that promote autonomous awareness of the status of the equipment monitored that promote autonomous decision making related to providing alarms and status reports which are part of a CBM process. Collaboration because WSN technologies provide the means for all persons involved not only in the CBM process but in all production area fields to act as a single team in the decision making processes of CBM activities.

2.1. CBM METHODOLOGY IMPLEMENTATION

As saving money and reducing costs is the goal of predicting and avoiding equipment failures one must look into applying Condition Based Maintenance (CBM) through a step by step methodology as shown in the figure bellow. Each of the steps is described in detail in the following document sections.

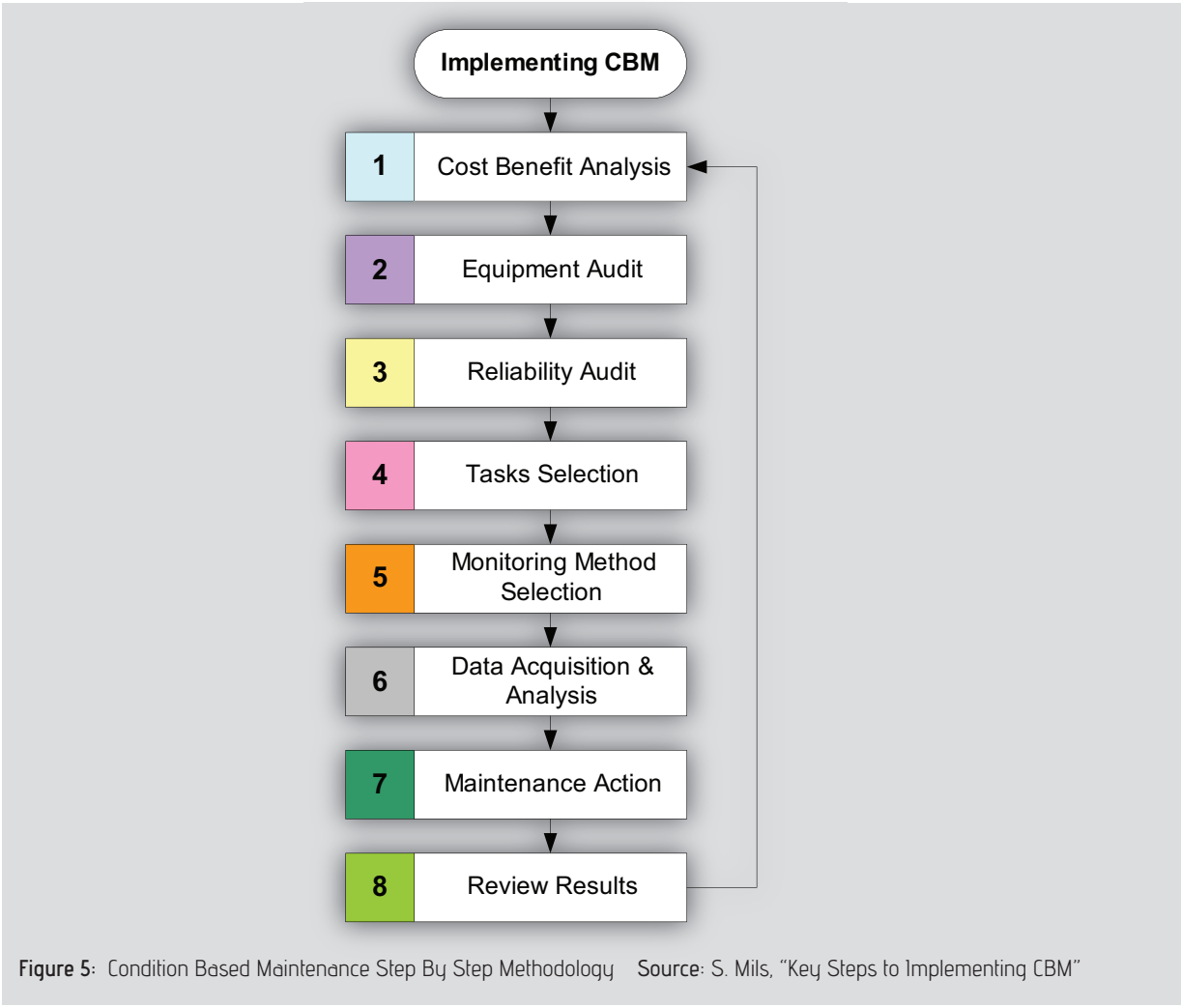


Figure 5: Condition Based Maintenance Step By Step Methodology **Source:** S. Mils, "Key Steps to Implementing CBM"

2.1.1. Cost Benefit Analysis

The first step of a CBM process is a Cost Benefit Analysis. One must examine whether applying CBM is actually going to reduce costs and where the reduction is expected to be made. For example: one must examine the life cycle cost of the equipment to be monitored and CBM applied to them, examine the cost of failures, examine the cost benefit of avoiding failures, examine the cost of CBM infrastructure and see the available budget in hand. Only if after completing the task the benefits are greater than the costs then one should proceed to the next step of the CBM methodology which is the equipment audit.

2.1.2. Equipment Audit

This task is often overlooked and under estimated during the CBM process although it is one of the most important ones. The goal here is to identify all assets that must be inserted into the CBM process so that all equipment are included in the process and no CBM activities are later on compromised. During this task one must create an asset database that will include all production line equipment. Through the database codes and

labels must be provided to each equipment according to its unique characteristics, its operational functionality and its critical physical parameters that are going to be monitored later on in the CBM process. For example in the case of a motor, its power, efficiency, normal operational load and temperature, annual number of hours in operation etc must be noted and inserted in the database. Also sub – assets such as equipment that are part of larger machinery must also be included in the database.

2.1.3. Reliability Audit

This audit can be conducted separately or as part of the equipment audit. The goal of this task is to enrich the asset database with equipment reliability information. A CBM process is an advanced preventive maintenance process that relies on the historical data of each equipment failure to work. So for each equipment in the asset database, one must identify its reliability and availability. For example information on types of failures, the mean time to repair them (equipment downtime) and the mean time between failures are important parameters that one should look into at this point. If no historical data are available then the information required can be gathered by two different sources: the Original Equipment Manufacturer (OEM) data and the actual CBM process. In the first case most OEM's provide statistical data on the reliability of their equipment in datasheets that accompany each equipment on installation. In the second case (and this only applies when no data what so ever are available) one must apply the CBM process and then rely on the data gathered over a period of time during the application of the process.
The reliability audit can provide useful information that is going to be used in the CBM process but also information that in no other circumstances would be available to the production line personnel. For example combining the mean failure time of specific equipment with the type of each failure one can get the following graph.

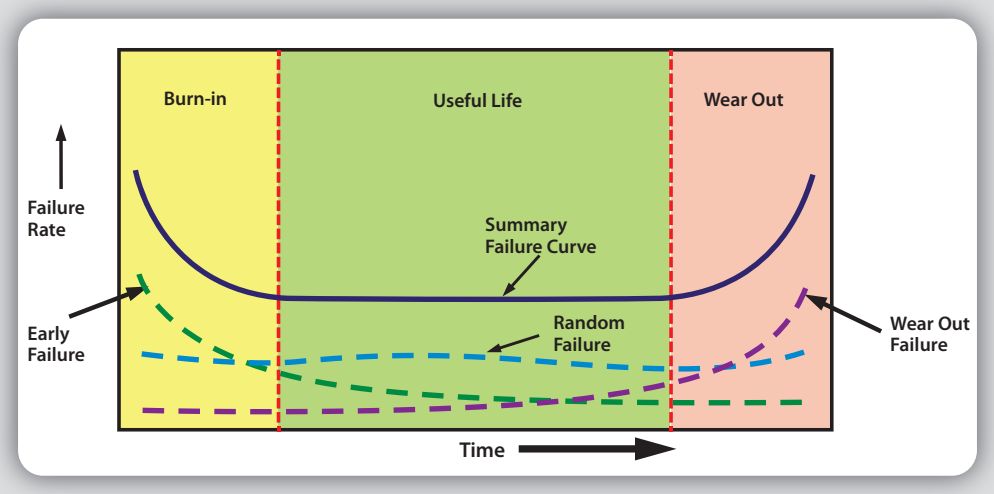


Figure 6: Equipment Failure Profile Graph **Source:** S. Mils, "Key Steps to Implementing CBM"

2.1.4. Tasks Selection

After identifying all assets (equipment or machinery), noting their characteristics (functional or otherwise) and examining their reliability, the next step in the CBM process is to select specific maintenance tasks for each case. One must note that not all maintenance tasks can be applied through a CBM process. For example a misaligned or badly installed pump can be included in the maintenance strategy and tasks. But an equipment lamp failure cannot as its repair is most cost effective to be conducted as a "one time – when it occurs" action. So selecting the required tasks to be applied during the CBM process depends heavily on the type of equipment and the type of failure. The maintenance tasks that can be selected in this stage fall into 5 categories depending on the failure root cause. These are:

- **Condition monitoring task.** When maintenance is decided after monitoring the operational status of the equipment.
- **Inspection task.** When maintenance is decided after random or scheduled inspection of the equipment.
- **Preventive task.** When maintenance is decided scheduled according to the failure historical data of the equipment and its operational life cycle.

- **Corrective task.** When a random failure occurs and maintenance is decided to be conducted at once or as soon as possible.
- **Re-design task.** When failures are due to bad initial design or original installation and maintenance can be scheduled according to operational status.

2.1.5. Monitoring Method Selection

Next in the CBM process methodology is the selection of the monitoring method. Based on the data gathered during the earlier stages of the process and are included in the asset database, the monitoring method of each recorded parameter can now be selected. The best parameters to be monitored must be identified and the equipment failure characteristics must be tied to the monitored parameters. Doing so, one can select the best measurement technique for each case, and the best sensors or transducers to do the job. This exercise will lead in the formation of simple tables that will relate the failure symptom to a physical parameter to me measured and monitored.

Machine type: Pump	Symptom or Parameter Change									
Fault	Fluid leakage	Length measure-ment	Power	Pressure or vacuum	Speed	Vibration	Tempera-ture	Coast Down Time	Oil Deons	Oil Leakage
Damaged Impeller		✓	✓	✓	✓	✓	✓	✓	✓	
Damaged seals	✓	✓		✓	✓	✓				✓
Eccentric impeller			✓	✓	✓	✓	✓	✓		
Bearing damage		✓	✓		✓	✓	✓	✓	✓	✓
Bearing wear		✓				✓	✓	✓	✓	
Mounting fault						✓				
Unbalance						✓				
Misalignment		✓				✓				
✓	Indicates symptom may occur or parameter may change if fault occurs									

Table 6: Example of a Failure / Parameter Table for a Pump **Source:** S. Mils, "Key Steps to Implementing CBM"

After creating similar tables such as the one provided above for the case of a pump then which of the parameters and the method of monitoring them can be chosen. The most often used techniques of parameter monitoring in a CBM process are:

- Thermal monitoring (Using infrared imaging or temperature measurements)
- Vibration monitoring (Using 2 or 3 axis accelerometers)
- Ultrasonic monitoring (Using ultrasonic sensors)
- Current or voltage monitoring (Using current or voltage meters)
- Pressure or flow monitoring (Using pressure sensors and flow meters)
- Oil monitoring
- Humidity monitoring (Using humidity sensors)
- Gases monitoring (Using CO, CO2, CH4 or other gases sensors)

2.1.6. Data Acquisition and Analysis

Step 6 of the CBM process is data acquisition and analysis. This is where WSN plays a great role and can provide flexibility, automation and autonomy in the process. One of the major characteristics of WSN is their ability to form mesh networks and be expanded at any given time. So even if one starts off with a small includes

only a few sensors and transducers, this can always expand to include more sensors or other equipment. Another WSN characteristic is low cost and ease of installation. The wireless feature of the network means that the cost of installing the system has minimum cost of wiring. Also WSN applied security is another thing equally important that can ensure that all data collected are secured and their quality is guaranteed. A typical architecture of such a network is provided in the figure bellow.

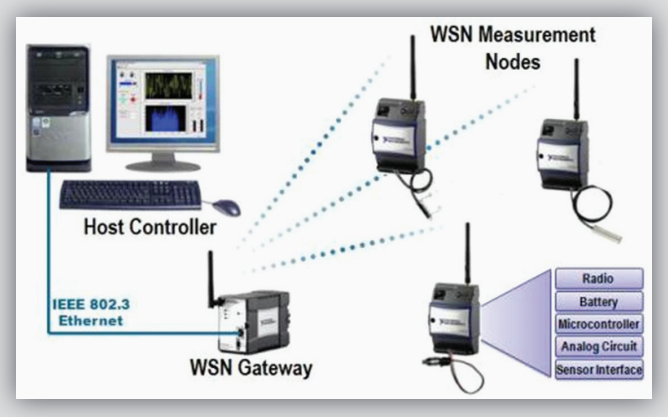


Figure 7: Basic WSN Architecture

As seen a typical WSN consists of several measurement nodes that are all connected to a WSB gateway through a wireless interface protocol. Usually this protocol is the so called ZigBee protocol that is based on the 802.15.4 IEEE communications protocol. Each sensor is connected to a node node and the measured data is transferred through the nodes and the gateway to a host either via an Ethernet wired connection or a wireless connection based on the 802.11b/g IEEE protocol. Both wireless protocols provide high data security.
Data analysis is then performed on the host which may be either a simple PC or a dedicated server. The analysis involves examination of the quality of data, identification of potential errors (for example sensor faults and poor readings) and reviewing of the data to provide alarms and reports according to pre-defined rules. If intelligence is included in the system, then data is presented to a user only in the case that these are required for troubleshooting failures. In all other cases the system can handle data and can have the ability to issue alarms if something is wrong with the monitored equipment.
Statistical review of the measured data can reveal the potential time for equipment failure also known as Estimated Time to Failure (ETTF). This is why it is important that statistical data or the failure history of each monitored equipment is recorded in the asset database in step 3 of the CBM process. The results of such a review or analysis lead to the next step of the process which is the determination of the required maintenance action.

2.1.6.1. Sensors & Transducers

There are a number of sensors or transducers that can be used and be part of a large or small WSN that can be used in the CBM process. Depending on the equipment family and the physical parameter to be monitored the most common sensors that are used are provided in the table below.

Equipment	Physical Parameter	Sensor
Electric Motors	Temperature Phase Voltage Current	Temperature Sensor Infrared Sensor Voltage Meter Amp Meter
Fans	Current Flow Pressure	Amp Meter Flow Meter Pressure Sensor
Pumps	Temperature Pressure	Temperature Sensor Infrared Sensor Ultrasonic Sensor
Compressors	Temperature Pressure Flow	Temperature Sensor Infrared Sensor Ultrasonic Sensor
Generators	Temperature Voltage Current Vibration	Temperature Sensor Infrared Sensor Voltage Meter Amp Meter Accelerometers
Gearboxes	Temperature Vibration	Temperature Sensor Accelerometers
Mixers	Temperature Vibration	Temperature Sensor Accelerometers

Table 7: Sensors per Equipment and Monitored Physical Parameter

2.1.7. Maintenance Action

The required maintenance action is the output of the whole CBM process that has been described so far. According to the data in hand, the history of the equipment and the type of potential failure, one can now choose the appropriate action to perform scheduled maintenance that will prevent any future equipment failures. Also the information in hand will enable a CBM process user to identify the root cause of the failure and so either predict any other failures or fix the problem once and for all.
Any action taken or to be taken must be properly recorded to add intelligence and experience into the process. So when a similar failure is foreseen than the action to be taken is already ready to be proposed. Action reporting must contain the equipment label or id (that has been allocated in the asset database), the alarm status, the failure or fault type, the priority of the failure or fault, the supporting measurements and proposed schedule or repair or maintenance.
So for example repairing a leaking pipe on a compressed air system may be of high priority and must be dealt at once and a high operational temperature of a motor due to friction may be of medium priority and can be dealt with in 1 week of problem identification. Usually 4 priority categories are applied: High (action to be taken at once), medium (action to be taken within 1 week), low (action to be taken within1 month – routine maintenance) and None (no action to be taken at this time).

2.1.8. Review Results

The last stage of a CBM process is the review of the results of the process and evaluate process effectiveness. The CBM process is a continuous process in the sense that as technology and techniques change so that the process must change. So frequent review of the whole process is a important step of the whole procedure. In some cases one must examine whether the initial cost benefit analysis still holds after a period of time at which new equipment have been added to the production line and the technology offers new ways to detect and monitor parameters that can reveal more for potential failures.

2.1.9. CBM Suitable Equipment

Since all steps of a CBM process are defined and described the next question to answer is on which production line equipment can a CBM process be applied to. The following table provides a family of equipment and their features that their physical parameters can be monitored and so a CBM strategy can be easily applied.

Equipment	Features / Type
Electric Motors	Fixed and variable speed
Fans	Supply, exhaust, air
Pumps	Water, steam, product, vacuum
Compressors	Screw, scroll, centrifugal
Generators	Diesel, gas, AC or DC power
Gearboxes	-
Mixers	Screw, orbital, ribbon

Table 8: Table of Equipment that CBM can be applied to

2.1.10. CBM Case Study

Source: A. Sundberg, SPM Instrument AB, "Management Aspects on Condition Based Maintenance – The New Opportunity for Maritime Industry", ICMES 2003, Helsinki University, May 2003

This case study was made at Hallsta paper mill in Hallstavik, Sweden and an example how the contribution from a CBM program can be analyzed. The mill produces 785.000 tons of paper per year. The key performance indicators that were selected are:

- No. of machines included in CBM (condition based maintenance)
- No. of measuring points per inspector
- Pre warning time

Result:

- In total there are 8 inspectors that covered 16.000 measuring points at the mill. The applications consist of some 800 rolls and 4.000 auxiliary machines in the plant.
- In total this makes an average of 2.000 points/ inspector.
- In order to evaluate the pre warning time from the first detection of damage to the time when the component was changed the data base covering 6200 measuring points was analyzed. It consisted of 2300 machines and covered the period between 1993 to1999. Some of the machines that were studied consisted of: 74 fans, 1070 el. Motors, 103 pumps.

The average pre-warning time from detection to corrective activity is 69 days and 95% were changed within the period of 59 to 78 days. The differences in pre warning time for the various applications can also be seen in the following graph.

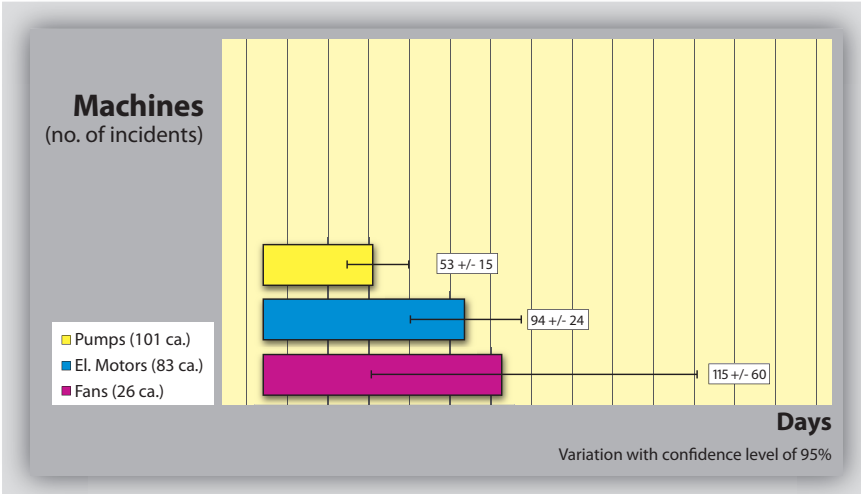


Figure 8:
Case study on pre warning time for bearings

During this period there were no catastrophic failures on the equipment that was included in the CBM program, so all incidents could be detected and failures avoided.

2.2. IMPLEMENTATION COST & ACTION PLAN

All companies and industrial plants actually apply some form of maintenance. A CBM program must be considered as part of the maintenance process and its cost and benefits can be determined through the overall maintenance costs. This is due to the fact that a CBM process is not eliminating the actual maintenance activities but it can help on preventing failures and faults that add costs to the company. The only added costs comparing a current maintenance strategy to an advanced maintenance strategy such as a CBM program are the costs related to the monitoring equipment, data analysis and data review. These costs are more or less equivalent to the ones referred in Section 1.5 of the current document except of the case of the data analysis, where the cost for a CBM program will be considerable. This is due to the fact that the system will not only have to collect and analyze the data but also it will have the ability to issue automated alarms and reports that will be used to activate any preventive or corrective maintenance actions.

The maintenance costs usually relates to 10% of the production line annual operating costs. Noting the above, for a CBM program to run, one should add another 2-3% of the overall production line operating costs to the usual maintenance costs.

The implementation period depends on the number of machinery or equipment to be included in a CBM program and it can vary from few weeks to 2-3 months. The implementation plan and action strategy must be the same or similar to the step-by-step procedure of the CBM activities described in the previous sections. It may involve a large number of persons from various departments and teams but the overall required man-months are estimated to be low as most of the activities may run in semi-parallel fashion.

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ABC analysis for controlling excessive tied up capital in supply chain

Project
Cross Border Implementation of innovative cost cutting technologies
CROSS-INNO-CUT

Author: Sotiris Zygiaris

CHAPTER 3

CHAPTER 3

Project
"Cross Border Implementation of innovative cost cutting technologies – CROSS-INNO-CUT"

ABC analysis for controlling excessive tied up capital in supply chain

1. DESCRIPTION

The scope of inventory management concerns the fine lines between replenishment lead time, carrying costs of inventory, asset management, inventory forecasting, inventory valuation, inventory visibility, future inventory price forecasting, physical inventory, available physical space for inventory, quality management, replenishment, returns and defective goods and demand forecasting. Balancing these competing requirements leads to optimal inventory levels, which is an on-going process as the business needs shift and react to the wider environment. There are three basic reasons for keeping an inventory:

- Time - The time lags present in the supply chain, from supplier to user at every stage, requires that you maintain certain amounts of inventory to use in this "lead time." However, in practice, inventory is to be maintained for consumption during 'variations in lead time'. Lead time itself can be addressed by ordering that many days in advance.
- Uncertainty - Inventories are maintained as buffers to meet uncertainties in demand, supply and movements of goods.
- Economies of scale - Ideal condition of "one unit at a time at a place where a user needs it, when he needs it" principle tends to incur lots of costs in terms of logistics. So bulk buying, movement and storing brings in economies of scale, thus inventory.

All these stock reasons can apply to any owner or product.

1.1. What is ABC analysis

ABC Stock Analysis is a method of classifying stock items according to a ranking criterion that determines their importance. The ranking procedure groups stock items on user selectable performance criteria, such as cost, sales, profitability, turn-over, or a user defined ranking. This allows a firm to focus attention on inventory based on the relative importance of those items to the organization. ABC ranking systems are useful because many types of businesses find that the '80/20' rule may be applied to them. For example, that 80% of all sales are generated from around 20% of stock holdings. For obvious reasons it is important to be able to distinguish between the top performing items from other items in your inventory pool.

The first step in an ABC Analysis procedure is to identify what criteria is appropriate for your organization for stock rankings. For example, if you purchase inventory from manufacturers (either locally or from overseas) and sell this inventory to other resellers or directly to the end-user, then total sales turn-over may be the most important ranking criteria. This will allow you to rate your inventory based on its importance to your organization in terms of its income generating capacity. If your business was primarily focused on product distribution (e.g., the bulk of your income was generated by delivering goods rather than selling goods), then your stock ranking might be based on turn-over (units moved) rather than sales.

In any business that deals with inventory, more careful monitoring and control is needed for fast moving, high value stock items, then for low value, slow moving stock items. In particular, for slow moving stock items, close monitoring may actually be more costly than the income generated from such items. ABC Stock Analysis is a straightforward way in which to separate your important inventory from your less important inventory. The ABC analysis is a business term used to define an inventory categorization technique often used in materials management. It is also known as Selective Inventory Control. It stands for Always Better Control. Policies based on ABC analysis:

A ITEMS: very tight control and accurate records

B ITEMS: less tightly controlled and good records

C ITEMS: simplest controls possible and minimal records.

ABC Stock Analysis uses a simple, user configurable, ranking code system to classify stock items. Highest priority stock items are ranked 'A', the next highest 'B' and so on. You may have as many different ranking classifications as you wish, up to ranking code 'Z'. This allows for 2-26 different classifications for your inventory. While you may find different industries utilizing varying "rule sets" for grouping parts – typically the bands will follow close to a 70%, 90%, 100% groups. A typical ranking system might take the following form:

Ranking Code

(Class)	Rating %	Meaning
A	70	Top 70%
B	20	Next best performing 20%
C	10	Worst performers 10%

Could also include more extended classification D, E, F....

A class parts typically require close monitoring and tight control – they tend to be complex expensive parts and while they will amount to a large costs may probably represent a small percentage of your overall inventory volume (which is where the similarities with Pareto occur).

B class whilst lower grade than A class parts still require more control than consumables and will require some management effort.

C class require the least controls, and will typically make up the largest volume of your stock ABC analysis is a basic stock management principle that when applied can have direct impact on the policies and procedures that govern your inventory. Take a look at your ERP system – ERP's will typically contain functionality to both carry out an ABC analysis but also store it as a control mechanism within the system itself.

ABC Stock Analysis Ranking criteria

Cost

Select Cost as your ranking criteria if you wish to rank inventory based on its cost value to you. Cost calculations always exclude any tax related charges.

Sales

Select Sales as your ranking criteria if you wish to rank inventory based on its sales value to you. Sale calculations always exclude any tax related charges.

Profitability

Select Profitability as your ranking criteria if you wish to rank inventory based on its profitability. Profitability is determined as sales ex tax minus recorded costs ex tax as at the time of the sale.

Units

Select Units as your ranking criteria if you wish to rank your inventory based on its turn-over. These are units moved through your system in sale related and other activities.

Classification of items into A, B and C categories

The logic behind this kind of analysis is that the management should study each item of stock in terms of its usage, lead time, technical or other problems and its relative money value in the total investment in inventories. Critical items i.e., high value items deserve very close attention and low value items need to be devoted minimum expense and effort in the task of controlling inventories. The Material Manager by concentrating on "A" class items is able to control inventories and show visible results in a short span of time. By controlling "A" items and doing a proper inventory analysis, obsolete stocks are automatically pinpointed. ABC analysis also helps in reducing the clerical costs and results in better planning and improved inventory turnover. ABC analysis has to be resorted to because equal attention to A, B and C items will not be worthwhile and would be very expensive. The following steps will explain to you the classification of items into A, B and C categories.

1. Find out the unit cost and the usage of each material over a given period.
2. Multiply the unit cost by the estimated annual usage to obtain the net value.
3. List out all the items and arrange them in the descending value. (Annual Value)
4. Accumulate value and add up number of items and calculate percentage on total inventory in value and in number.
5. Draw a curve of percentage items and percentage value.
6. Mark off from the curve the rational limits of A, B and C categories.

1.2. Methodology. Implementation steps of ABC analysis?

The typical ABC process isn't overtly complex and consists of a small number of steps – you'll usually need record the information onto a spreadsheet to simplify the analysis.

1. Gathering the data. Typically ABC Analysis is reviewed by gathering, as a minimum
    a) a list of part numbers from the ERP system
    b) Obtaining the cost data for each part
    c) Obtaining it's consumption volume over a specific period
    d) Calculating the consumption value for each part

2. Calculating the consumption value. The consumption value is calculated by multiplying the item cost by the quantity used in the period.

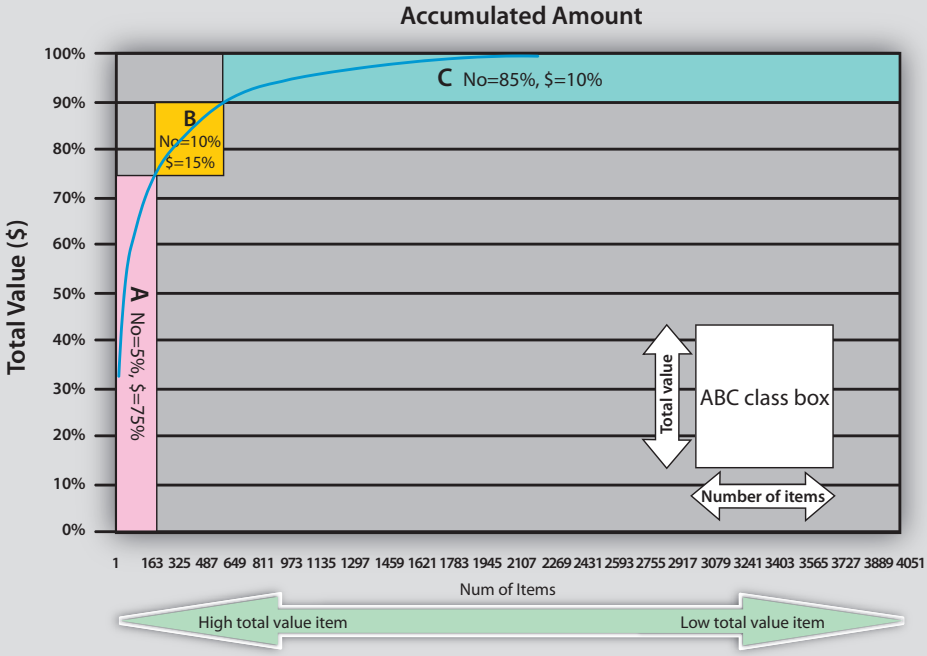
3. Grouping your parts. Parts are grouped by the consumption value and typically split into 3 bands (note the %'s used here are for indicative purposes and your own organization may benefit from different bands).
    a) Band A – Material where the consumption value represents approximately 70% of the total consumption value –this will be typically your high cost items
    b) Band B – Material where the consumption value represents approximately 20% of the overall value
    c) Band C – Material where the consumption value represents approximately 10% of the overall value.

ABC Analysis – Next steps

Once you have classified your parts (and in many ERP systems you are able to populate the classification data against the part in the parts master record). You are can use this data to drive key materials management activity. For example coordinating your perpetual inventory management activity – you may routinely verify your Category A parts on a monthly basis but only review your category C parts twice a year. You may use scheduled orders for your Category C parts but may require detailed purchase orders and negotiation for your Category A parts.

Example of using ABC analysis

Actual distribution of ABC class in the electronics manufacturing company with 4051 active parts.



Distribution of ABC class

ABC class	Number of items	Total amount required
A	5%	75%
B	10%	15%
C	85%	10%
Total	100%	100%

Using this distribution of ABC class and change total number of the parts to 4000.

- Uniform Purchase

When you apply equal purchasing policy to all 4000 components, example weekly delivery and re-order point (safety stock) of 2 week supply assuming that there are no lot size constraints, the factory will have 16000 delivery in 4 weeks and average inventory will be 2.5 week supply.

Application of Weighed Purchasing condition

Iniform condition		Weighed condition	
Items	**Conditions**	**Items**	**Conditions**
All items 4000	Re-order point=2 week supply Delivery frequency= weekly	A-class items 200	Re-order point=1 week supply Delivery frequency=weekly
		B-class items 400	Re-order point=2 week supply Delivery frequency=bi-weekly
		C-class items 3400	Re-order point=3 week supply Delivery frequency=every 4 weeks

- Weighed Purchase

In comparison, when weighed purchasing policy applied based on ABC class, example C class monthly (every 4 week) delivery with re-order point of 3 week supply, B class Bi-weekly delivery with re-order point of 2 weeks supply, A class weekly delivery with re-order point of 1 week supply, total number of delivery in 4 weeks will be (A 200x4=800)+(B 400x2=800)+(C 3400x1=3400)=5000 and average inventory will be (A 75%x1.5weeks)+(B 15%x3weeks)+(C 10%x3.5weeks)=1.925 week supply.

Comparison of "Equal" and "Weighed" Purchase (4 weeks span)

			Equal purchase		Weighed purchase		
ABC class	**No of items**	**% of total value**	**No of delivery in 4 weeks**	**average supply level**	**No of delivery in 4 weeks**	**average supply level**	**note**
A	200	75%	800	2.5 weeks	800	1.5 weeks[a]	same delivery frequency, safty stock redused from 2.5 to 1.5 weeks[a], require tighter control with more man-hours.
B	400	15%	1600	2.5 weeks	800	3 weeks	increased safety stock level by 20%, delivery frequency reduced to half. Less man-hour required.
C	3400	10%	13600	2.5 weeks	3400	3.5 weeks	increased safety stock from 2.5 to 3.5 week supply, delivery frequency is one quarter. Drastically reduced man-hour requirement.
Total	4000	100%	16000	2.5 weeks	5000	1.925 weeks	average inventory value reduced by 23%, delivery frequency reduced by 69%. Overall reduction of man-hour requirement.

1.3. Benefits from the application of ABC analysis.

The ABC inventory control method determines the importance of inventory items based on usage, sales or costs criteria. This inventory control method provides companies the ability to give individual stock keeping units (SKUs) different levels of inventory control based on the SKUs relative importance. Companies perform a Pareto analysis to determine ABC item classifications. The ABC inventory method offers advantages over non-classification methods in the areas of cost-control, SKU level management and order fulfillment.

Control

Utilizing the ABC inventory method gives a company more control over the inventory it stores. A company that uses annual costs of goods sold (COGS) as its basis for the ABC classification method stocks less of the "A" class items (identified as having higher annual COGS) and stocks more of the "B" and C" class items (identified as having lower annual COGS). On the other hand, a company that uses annual usage as its basis for classification stocks more of the "A" class items because of their higher usage and less of the lower use "C" class items. Stocking a better mix of the right inventory allows a company to control over-supply and under-supply of important SKUs.

Costs

Because the ABC inventory method makes use of Pareto's law (the basic 80/20 rule), companies can focus on containing the cost of the 20% of items that make up 80% of a companies annual spend. Once a company has determined which items fall into each ABC category it can establish cost-reduction initiatives at the SKU level. These initiatives can include reducing the SKU's lead-time, reducing safety-stock levels and negotiating reduced pricing with suppliers. Additionally, even without implementing cost-savings initiatives a company experiences cost-reductions from eliminating excess stock for less important, but sometimes-costly SKUs.

Improved service

One of the greatest benefits comes from the improvement in customer service levels and order fulfillment. ABC analysis provides a company with information to stock the right-mix of inventory. If a company uses customer demand as its basis for analysis, it ends up stocking a better mix of the items customers require. When a company has the right inventory at the right time it reduces backorders and unfilled orders. This has a positive impact on customer service and gives a competitive advantage to the company that uses this methodology.

Warehouse

ABC inventory extends to warehouse management has well. Companies utilizing ABC analysis in the warehouse give priority space to faster moving SKUs. This allows workers to rapidly find, pick and pack fast moving items. Implementing ABC inventory management in the warehouse reduces labor cost and increases productivity.

2. DURATION AND IMPLEMENTATION COST OF ABC ANALYSIS

Step 1: Gathering the data. (1 month to formulate datasets in case of that an ERP does not exist)

Step 2: Calculating the consumption value (Calculations require and data verification it might take two weeks to be conclusive)

Step 3: Grouping inventory into ABC stocks. (Grouping inventory and decision about the level of ABC limits might take two weeks)

Step 4: ABC Analysis-perform inventory management decision making regarding tied up capital reduction. (To optimize decision making process it might take one month).

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Balanced Score Card

Project
Cross Border Implementation of
innovative cost cutting technologies
CROSS-INNO-CUT

Author: Sotiris Zygiaris

CHAPTER 4

CHAPTER 4

Balanced Score Card (BSC)

1. DESCRIPTION

Balanced Score Card is a strategic planning and management system used to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organizational performance against strategic goals. The balanced scorecard has evolved from its early use as a simple performance measurement framework to a full strategic planning and management system.

1.1. What is Balanced Score Card

Balanced scorecard is a management system (not only a measurement system) that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results. When fully deployed, the balanced scorecard transforms strategic planning from an academic exercise into the nerve centre of an enterprise. The balanced scorecard is a management system (not only a measurement system) that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results. When fully deployed, the balanced scorecard transforms strategic planning into the nerve centre of an enterprise.

Strategy Mapping

Strategy maps are communication tools used to tell a story of how value is created for the organization. They show a logical, step-by-step connection between strategic objectives (shown as ovals on the map) in the form of a cause-and-effect chain.

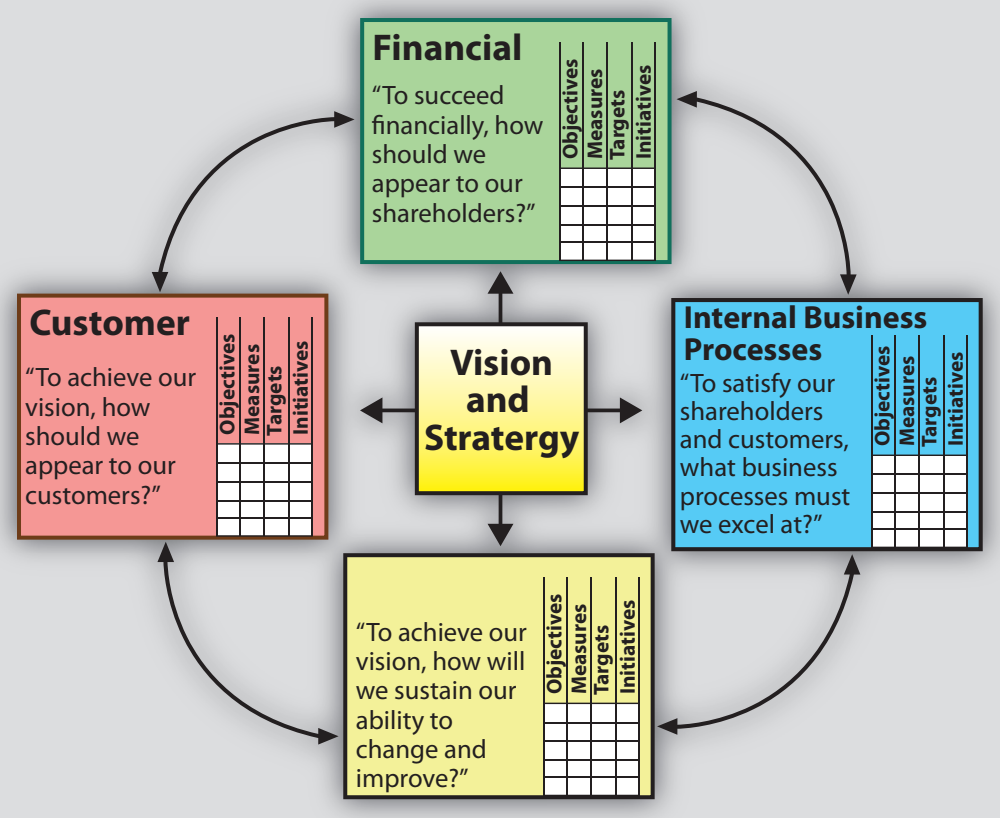

Figure 1:
BSC process. Adapted from Robert S. Kaplan and David P. Norton, "Using the Balanced Scorecard as a Strategic Management System," Harvard Business Review (January-February 1996): 76.

Generally speaking, improving performance in the objectives found in the Learning & Growth perspective (the bottom row) enables the organization to improve its Internal Process perspective Objectives (the next row up), which in turn enables the organization to create desirable results in the Customer and Financial perspectives (the top two rows). Grouped under each perspective should be your "critical few" objectives – the 8-10 most important organizational goals (in short, verb-noun format) from this year's strategic plan. These articulate what you want to achieve, so it is important to determine these before proceeding to the measures. Too many businesses jump into the measures without first framing the objectives. After determining your organization's objectives, identify measures that will best determine if you are on track to achieve each objective. These are also called KPIs (Key Performance Indicators) or metrics. As with objectives, focus is key. You should select only 1-3 measures per objective, which should be the best indicators of achievement for that strategic goal.

To exercise BSC:

- We need for a clear sense of direction: where is the organization headed?
- Managers must have a profound understanding of the business model: is the organization doing all the things it needs to be doing?
- An ability to focus and priorities: how to strike the balance between long-term development and short-term operational pressures?

A Balanced Scorecard framework can provide:

Focus	Ensures an organization is doing the right things - not simply doing things right (helps avoid concentrating on perfecting a process that has little impact on critical outcomes).
Alignment	Creates links between and across levels of your organization (particularly helpful to improve an issue that cuts across functional silos).
Accountability	Spans departments and individuals (identifies what is strategically important, what performance level is needed, and who is responsible).
Communication	Translates your high-level strategy into words that are meaningful and relevant throughout the organization.

Perspectives

The balanced scorecard suggests that we view the organization from four perspectives, and to develop metrics, collect data and analyze it relative to each of these perspectives:

The Learning & Growth Perspective: This perspective includes employee training and corporate cultural attitudes related to both individual and corporate self-improvement. In a knowledge-worker organization, people -- the only repository of knowledge -- are the main resource. In the current climate of rapid technological change, it is becoming necessary for knowledge workers to be in a continuous learning mode. Metrics can be put into place to guide managers in focusing training funds where they can help the most. In any case, learning and growth constitute the essential foundation for success of any knowledge-worker organization.

Kaplan and Norton emphasize that 'learning' is more than 'training'; it also includes things like mentors and tutors within the organization, as well as that ease of communication among workers that allows them to readily get help on a problem when it is needed. It also includes technological tools; what the Baldrige criteria calls "high performance work systems."

The Business Process Perspective: This perspective refers to internal business processes. Metrics based on this perspective allow the managers to know how well their business is running, and whether its products and services conform to customer requirements (the mission). These metrics have to be carefully designed by those who know these processes most intimately; with our unique missions these are not something that can be developed by outside consultants.

The Customer Perspective: Recent management philosophy has shown an increasing realization of the importance of customer focus and customer satisfaction in any business. These are leading indicators: if customers are not satisfied, they will eventually find other suppliers that will meet their needs. Poor performance from this perspective is thus a leading indicator of future decline, even though the current financial picture may look good.
In developing metrics for satisfaction, customers should be analyzed in terms of kinds of customers and the

kinds of processes for which we are providing a product or service to those customer groups.

The Financial Perspective: Kaplan and Norton do not disregard the traditional need for financial data. Timely and accurate funding data will always be a priority, and managers will do whatever necessary to provide it. In fact, often there is more than enough handling and processing of financial data. With the implementation of a corporate database, it is hoped that more of the processing can be centralized and automated. But the point is that the current emphasis on financials leads to the "unbalanced" situation with regard to other perspectives. There is perhaps a need to include additional financial-related data, such as risk assessment and cost-benefit data, in this category.

1.2. Objectives of Balanced Score Card?

The benefits that can be obtained from a Balanced Scorecard depend on what it is used for, how well it is designed, and how it is applied. There are many organizations using Balanced Scorecard, in many different formats, however, in this report we focus on two distinctly different applications: operational control and strategic management. The two applications require substantially different design and development processes, and provide different benefits to a management team.

There have been many attempts to quantify the benefits of the implementation of a Balanced Scorecard but there is little empirical evidence – in part because collecting such evidence is hard. We summarize the prospective benefits of well-designed and implemented Balanced Scorecards of each type.

Operational control involves asking the following questions:

What process do we want to monitor?
What aspects of the process do we want to measure?
What is considered best practice?

The purpose of this application is to help managers monitor and control the delivery of a pre-defined set of activities – often with a view toward achieving "best practice" performance levels.

Balanced Score cards help prevent organizations "drowning" in measures. Technology makes it easy to measure 'everything', demanding that management teams actively choose what to measure – which in turn demands that the teams reach consensus about what is important. Choosing is hard, and when this doesn't happen organizations end up with too many measures, and crucially they lack the ability to separate out information that informs on key activities from things that are less important.

By helping management teams identify a concise set of operationally focused measures across Balanced Score card perspectives, the framework makes it easier to highlight the key information needed – typically reflecting customer satisfaction and the impact of innovation and improvement activities in addition to more typical financial and operational measures. The benefits arising from using Balanced Scorecard for operational control purposes include:

- Increased understanding, awareness and alignment about operations across the whole management team arising from the discussions during the design process;
- Wider and more effective monitoring of performance improvement initiatives; Improved understanding of the links between measures improves understanding and makes target setting easier;
- A single concise management report describes operational performance across perspectives.

1.3. Methodology. Implementation steps of Balanced Scorecard?

The balanced scorecard institute proposes nine steps as a disciplined, practical approach to developing a strategic planning and management system based on the balanced scorecard. Training is an integral part of the framework, as is coaching, change management, and problem solving. Emphasis is placed on "teaching clients to fish, not handing them a fish", so the scorecard system can be sustained. A key benefit of using a disciplined framework is that it gives organizations a way to 'connect the dots' between the various components of strategic planning and management, meaning that there will be a visible connection between the projects and programs

that people are working on, the measurements being used to track success, the strategic objectives the organization is trying to accomplish and the mission, vision and strategy of the organization

Figure 2:
Balanced Scorecard Institute,
Nine Steps to Success

Step One: Assessment- BSC Development Plan- Strategic Elements- Change Management

Step One of the scorecard building process starts with an assessment of the organization's Mission and Vision, challenges (pains), enablers, and values. Step One also includes preparing a change management plan for the organization, and conducting a focused communications workshop to identify key messages, media outlets, timing, and messengers.

Step Two: Strategy- Customer Value - Strategic Themes - Strategic Results

In Step Two, elements of the organization's strategy, including Strategic Results, Strategic Themes, and Perspectives, are developed by workshop participants to focus attention on customer needs and the organization's value proposition

Step Three: Objectives- Strategy Action Components

In Step Three, the strategic elements developed in Steps One and Two are decomposed into Strategic Objectives, which are the basic building blocks of strategy and define the organization's strategic intent. Objectives are first initiated and categorized on the Strategic Theme level, categorized by Perspective, linked in cause-effect linkages (Strategy Maps) for each Strategic Theme, and then later merged together to produce one set of Strategic Objectives for the entire organization

Step Four: Strategy Map- Cause-and-Effect Links

In Step Four, the cause and effect linkages between the enterprise-wide Strategic Objectives are formalized in an enterprise-wide Strategy Map. The previously constructed theme Strategy Maps are merged into an overall enterprise-wide Strategy Map that shows how the organization creates value for its customers and stakeholders.

Step Five: Performance Measures- Performance Measures – Targets – Baselines

In Step Five, Performance Measures are developed for each of the enterprise-wide Strategic Objectives. Leading and lagging measures are identified, expected targets and thresholds are established, and baseline and benchmarking data is developed

Step Six: Initiatives- Strategic Projects

In Step Six, Strategic Initiatives are developed that support the Strategic Objectives. To build accountability throughout the organization, ownership of Performance Measures and Strategic Initiatives is assigned to the appropriate staff and documented in data definition tables.

Step Seven: Automation- Software – Performance Reporting – Knowledge Sharing

In Step Seven, the implementation process begins by applying performance measurement software to get the right performance information to the right people at the right time. Automation adds structure and discipline to implementing the Balanced Scorecard system, helps transform disparate corporate data into information and knowledge, and helps communicate performance information. In short, automation helps people make better decisions because it offers quick access to actual performance data.

Step Eight: Cascade- Alignment – Unit & Individual Scorecards

In Step Eight, the enterprise-level scorecard is 'cascaded' down into business and support unit scorecards, meaning the organizational level scorecard (the first Tier) is translated into business unit or support unit scorecards (the second Tier) and then later to team and individual scorecards (the third Tier). Cascading translates high-level strategy into lower-level objectives, measures, and operational details. Cascading is the key to organization alignment around strategy. Team and individual scorecards link day-to-day work with department goals and corporate vision. Cascading is the key to organization alignment around strategy. Performance measures are developed for all objectives at all organization levels. As the scorecard management system is cascaded down through the organization, objectives become more operational and tactical, as do the performance measures. Accountability follows the objectives and measures, as ownership is defined at each level. An emphasis on results and the strategies needed to produce results is communicated throughout the organization.

Step Nine: Evaluation- Strategy Results – Revised Strategies

In Step Nine, an Evaluation of the completed scorecard is done. During this evaluation, the organization tries to answer questions such as, 'Are our strategies working?', 'Are we measuring the right things?', 'Has our environment changed?' and 'Are we budgeting our money strategically?'

1.4. Benefits from the application of Balanced Scorecard.

According to Advanced Performance Institute the following benefits occur when applying BSC.

Better Strategic Planning – The Balanced Scorecard provides a powerful framework for building and communicating strategy. The business model is visualized in a Strategy Map which forces managers to think about cause-and-effect relationships. The process of creating a Strategy Map ensures that consensus is reached over a set of interrelated strategic objectives. It means that performance outcomes as well as key enablers or drivers of future performance (such as the intangibles) are identified to create a complete picture of the strategy.

Improved Strategy Communication & Execution – The fact that the strategy with all its interrelated objectives is mapped on one piece of paper allows companies to easily communicate strategy internally and externally. We have known for a long time that a picture is worth a thousand words. This 'plan on a page' facilities the understanding of the strategy and helps to engage staff and external stakeholders in the delivery and review of strategy. In the end it is impossible to execute a strategy that is not understood by everybody.

Better Management Information – The Balanced Scorecard approach forces organizations to design key performance indicators for their various strategic objectives. This ensures that companies are measuring what actually matters. Research shows that companies with a BSC approach tend to report higher quality management information and gain increasing benefits from the way this information is used to guide management and decision making.

Improved Performance Reporting – companies using a Balanced Scorecard approach tend to produce better performance reports than organizations without such a structured approach to performance management. Increasing needs and requirements for transparency can be met if companies create meaningful management reports and dashboards to communicate performance both internally and externally.

Better Strategic Alignment – organizations with a Balanced Scorecard are able to better align their organization with the strategic objectives. In order to execute a plan well, organizations need to ensure that all business and support units are working towards the same goals. Cascading the Balanced Scorecard into those units will help to achieve that and link strategy to operations.

Better Organisational Alignment – well implemented Balanced Scorecards also help to align organisational processes such as budgeting, risk management and analytics with the strategic priorities. This will help to create a truly strategy focused organization

2. APPLICATION

2.1. Where the technique has being applied.

BSC van be applied to any organization whether is profit, or non-profit, public or private industrial or commercial. As long as there is strategic plan to be implemented BSC helps to formulate and monitor this plan. Some examples referred by the Balanced Scorecard Institute are:

Ann Taylor Stores	Retail	USA
AT&T Canada Long Distance	Telecommunications	Canada
Bank of Tokyo-Mitsubishi	Banking	Japan
Blue Cross Blue Shield of Minnesota	Health Care	USA
BMW Financial Services	Financial Services	Germany
Boston Lyric Opera	Entertainment	USA
British Telecommunications Worldwide	Telecommunications	UK
Carleton University	Higher Education	Canada
Caterpillar, Inc.	Manufacturing	USA
Daimler Chrysler	Manufacturing	Germany
DuPont	Manufacturing	USA
Entergy	Energy	USA
Siemens AG	Manufacturing	Germany
Skyline College	Higher Education	USA
Southern Gardens Citrus Processing Corp.	Food Processing	USA
St. Michael's Hospital	Health Care	Canada
T. Rowe Price Investment Technologies, Inc.	Financial Services	USA
Texas Education Agency	Education	USA
The Handleman Company	Wholesale Distribution	USA
The Thompson Corp.	Information Systems	USA
UK Ministry of Defence	Goverment	UK
Unicco Service Co.	Industrial Services	USA
United Way of Southeastern New England	Humanitarian	USA
University of California	Higher Education	USA
UPS	Shipping	USA
US Army Medical Command	Health Care	USA
Us West	Telecommunications	USA
Volvofinans	Financial Services	Sweden
Walt Disney World Company	Entertainment	USA

2.2. Size of firms that can be applied

C. W. Von Bergen indicates that many large organizations have identified the BSC methodology as their chosen approach for deploying strategic direction, communicating expectations, and measuring progress towards corporate objectives. According to a recent survey by Bain & Company, approximately 50% of Fortune 1,000 companies in North America and about 40% in Europe use a version of the BSC. However, the benefits of the BSC can be just as significant for small businesses, who focus mostly on financial goals, because they are often fighting for survival and it is difficult to make plans for the future when most of the effort is directed to making ends meet in the present. Most small firms require lower volumes of information to carry out their operations and evaluate their performance than do their larger counterparts. Nonetheless, the value of the information, and the communication of that information within the small firm, is crucial to the success of the small firm.
Therefore, while the scope and magnitude of performance evaluation across the firm may be less in the small firm, the need for, and the benefits of, an effective system of performance evaluation is vital to all firms. Small firms enjoy innate advantages in their ability to achieve consensus and impart to employees news of change. The smaller number of interested internal parties reduces challenges to effective communication and facilitates corporate-wide team participation. It is easier to get ten people on board than it is to get ten thousand people on board, and it is easier to identify a party or parties not on board within a group of ten than within a group of ten thousand.
The underpinnings of the BSC approach are as relevant to the small firm as to the large. Small firms have employees performing operational tasks and processes. If the employees are effective and efficient (i.e., sufficiently trained and motivated), then internal business processes will be efficient. Efficient operations run by effective employees should generate higher quality output, which will attract and keep satisfied customers. Repeat customers contribute marginally more to the firm's bottom line than do new customers who must be wooed. In short, the BSC can work as well for the small firm as for the large firm. The BSC's complexity may be diminished and its formality may be dampened in the context of a small firm, but neither its importance nor its utility suffers negative consequences related to firm size.

2.3. Duration and implementation cost of BSC

For an average size SME (around 20 staff members) the initial formulation of the tool (step one to step 8) should consume a time period of three (3) months with support of an experienced BSC consultant.

Step One:	Assessment- BSC Development Plan- Strategic Elements- Change Management (month 1)
Step Two:	Strategy- Customer Value - Strategic Themes - Strategic Results (month 1)
Step Three	Objectives- Strategy Action Components (month 1)
Step Four:	Strategy Map- Cause-and-Effect Links (month 2)
Step Five:	Performance Measures- Performance Measures - Targets - Baselines (month 2)
Step Six:	Initiatives- Strategic Projects (month 2)
Step Seven:	Automation- Software - Performance Reporting - Knowledge Sharing (month 3)
Step Eight:	Cascade- Alignment - Unit & Individual Scorecards (month 3)
Step Nine:	Evaluation- Strategy Results - Revised Strategies

Step nine is a continuous process of evaluating and revising the initial strategic plan.

The cost of the consultants and support staff should be around the cost of a three person of an experienced consultant (5.000 per person month) plus around 5.000 euro for support services. The total of 20.000 euro is considered to be the average cost of an average case implementation of BSC.

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Lean supply chain development process

Project
Cross Border Implementation of
innovative cost cutting technologies
CROSS-INNO-CUT

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CHAPTER 5

CHAPTER 5

Lean supply chain development process

1. DESCRIPTION

Lean has evolved from just in time manufacturing to lean manufacturing and to a lean enterprise. In each of these stages there was an addition to the scope of lean manufacturing. For an example from the early manufacturing focus, lean manufacturers started looking at their full organization in the process of value creation. Then the lean manufacturers extend their boundaries to their customers and suppliers in order to create value.

Lean manufacturing is all about eliminating wastes form the system. A system contains many components in it. Any components when taken isolated from other components, has wastes which are born within those components. But there are many other wastes generated in the interaction points of these components. For an example in the manufacturing context, manufacturers themselves generate wastes. Over manufacturing, waiting for bulk manufacturing are some of them. On the other hand wastes are generated in the supply chain itself. For an example if the suppliers of the manufacturer is supplying only in bulks and if the lead times are longer, then the time of the manufacturer is wasted. The end result would be lengthening the lead time of the customer who sits in the other end of the supply chain and may be the cost of the products. Even the customers can contribute to the wastes in supply chain. For an example if the necessary information to the manufacturers is not passed on time, manufacturers and the suppliers to them will have to suffer consequences of to and ultimately will affect the customer himself apart from the other members in the chain. You can refer to my previous articles on lean manufacturing customers and suppliers for more thoughts on this topic.

So it is clear that a single unit in the supply chain can do very little in eliminating the wastes in the system. To effectively remove wastes from the system and gain value everyone throughout the supply chain must contribute. Everyone must be aligned to the needs of each other and must accept other as their partners. This will help all the parties including suppliers, manufacturers and the customers to achieve low costs, higher quality standards and lower lead times. Apart from these main business indicators reduction of wastes is an absolute requirement in today's world. There are no resources to be wasted. Although lean thinking is typically applied to manufacturing lean techniques and focus are applicable anywhere there are processes to improve, including the entire supply chain. A lean supply chain is one that produces just what and how much is needed, when it is needed, and where it is needed.

The underlying theme in lean thinking is to produce more or do more with fewer resources while giving the end customer exactly what he or she wants. This means focusing on each product and its value stream. To do this, organizations must be ready to ask and understand which activities truly create value and which ones are wasteful. The most important thing to remember is that lean is not simply about eliminating waste—it is about eliminating waste and enhancing value.

1.1. What is lean supply chain process

Many businesses have complex purchasing operations. Large companies often have corporate purchasing groups as well as local purchasing. This can lead to vendors being given multiple contracts leading to variations in prices depending on location. Companies that practice lean supply chain management reduce their procurement function so that each vendor has one point of contact, one contract and offers one price for all locations. Businesses are looking to new technologies to assist them in improving procurement processes. These include internet based purchasing that allows re-questioners to purchase items from vendor's catalogs containing company wide contract prices. Changes in payment options to vendors can also streamline processes.
Companies that use a two-way match, which is payment on receipt rather than payment on invoice, will reduce resources in their purchasing department as well as improve supplier relationships.

Manufacturing

Lean supply chain management gained popularity in the manufacturing area as this is where significant improvement can be achieved. Manufacturing processes can be improved to reduce waste and resources while maintaining operational performance. Companies who have adopted lean supply chain practices have examined each of their routings, bill of materials and equipment to identify where improvements can be achieved.

Warehousing

Warehouse processes should be examined to find areas of eliminating waste of resources and non-value added steps. One area the companies should always be working on is the reduction of unnecessary inventory. The

accumulation of inventory requires resources to store and maintain it. By reducing unnecessary inventory, a company can minimize warehousing space and handling, in turn reducing overall costs.

Transportation

Businesses who want to implement lean processes often look to their transportation procedures to see where they can be streamlined. In many instances companies find that their efforts to improve customer satisfaction leads to poor shipping decisions. Orders are shipped without combining additional orders to minimize costs or expensive shipping options are selected because of a customer request. Businesses often find that they are using a number of shippers unnecessarily when they could be reducing their shipping options and reduce overall costs.
Lean supply chain management requires businesses to examine every process in their supply chain and identify areas that are using unnecessary resources, which can be measured in dollars, time or raw materials. This will improve the company's competitiveness as well as improve the company's overall profitability.

1.2. Methodology. Implementation steps of lean supply chain?

The center for Technology, Policy and Industrial Development of MIT has developed the lean supply chain roadmap. The roadmap tool provides a structured process for designing, developing and managing lean supplier networks. The tool is organized around six major building blocks that are linked together in the form of a closed-feedback loop system. These six major building blocks consist of the following:

1.0 Define vision
2.0 Develop supplier network strategic plan
3.0 Establish lean culture and infrastructure
4.0 Create and refine lean implementation plan
5.0 Implement lean initiatives
6.0 Strive for continuous improvement.

Each of these six major building blocks contains a series of specific implementation steps. Both the building blocks and the specific implementation steps associated with each block are presented in figure 1. in addition, a set of "roadmap explorations" are provided for each building block, based on group discussions. The purpose of the "roadmap explorations" discussion is to convey a number of practical considerations identified by the team developing the roadmap tool. these considerations, expected to be of interest to users of the tool, include: inputs required for each building block, expected outputs, barriers to implementation, enablers for overcoming these barriers, metrics, tools and methods, and a series of explorations revolving around questions such as why, what, who, how, where, and when. in each case, various types of tensions likely to arise (i.e., possible negative consequences, reactions, "downsides" and similar tensions) are identified and suggestions are made on how they may be effectively addressed.
The major building blocks making up the roadmap consist of both "slower-cycle" and "faster-cycle" components. "Slower-cycle" here means the activities are strategic in nature and the metrics used to track them may involve time cycles spanning one or more quarters. "faster-cycle" means implementation activities involving day-to-day, weekly or monthly execution cycles. the upper-level building blocks (define vision; develop supplier network strategic plan; establish lean culture and infrastructure) represent the relatively slower-moving-cycle components. they are comparatively more stable than the lower-level building blocks (create and refine lean implementation plan; implement lean initiatives; strive for continuous improvement). The lower-level blocks move at a relatively faster speed in the sense that the well-known Deming Plan-Do-Check-Act (PDCA) cycle for them is completed and monitored more frequently than that for the upper-level blocks. The terms "slower-cycle" and "faster-cycle," referring to planning and execution cycles within enterprises, are relative terms and may differ for different organizations.

There is an on-going feedback loop connecting the lower-level building blocks, as lean implementation plans are created and refined, lean implementation initiatives are executed, and continuous improvement programs are monitored and carried out to achieve established performance metrics. As a result of the performance results, the strategic plan is re-calibrated, as necessary, on an on-going basis. These performance results may also be used periodically to help modify the vision definition, as appropriate.

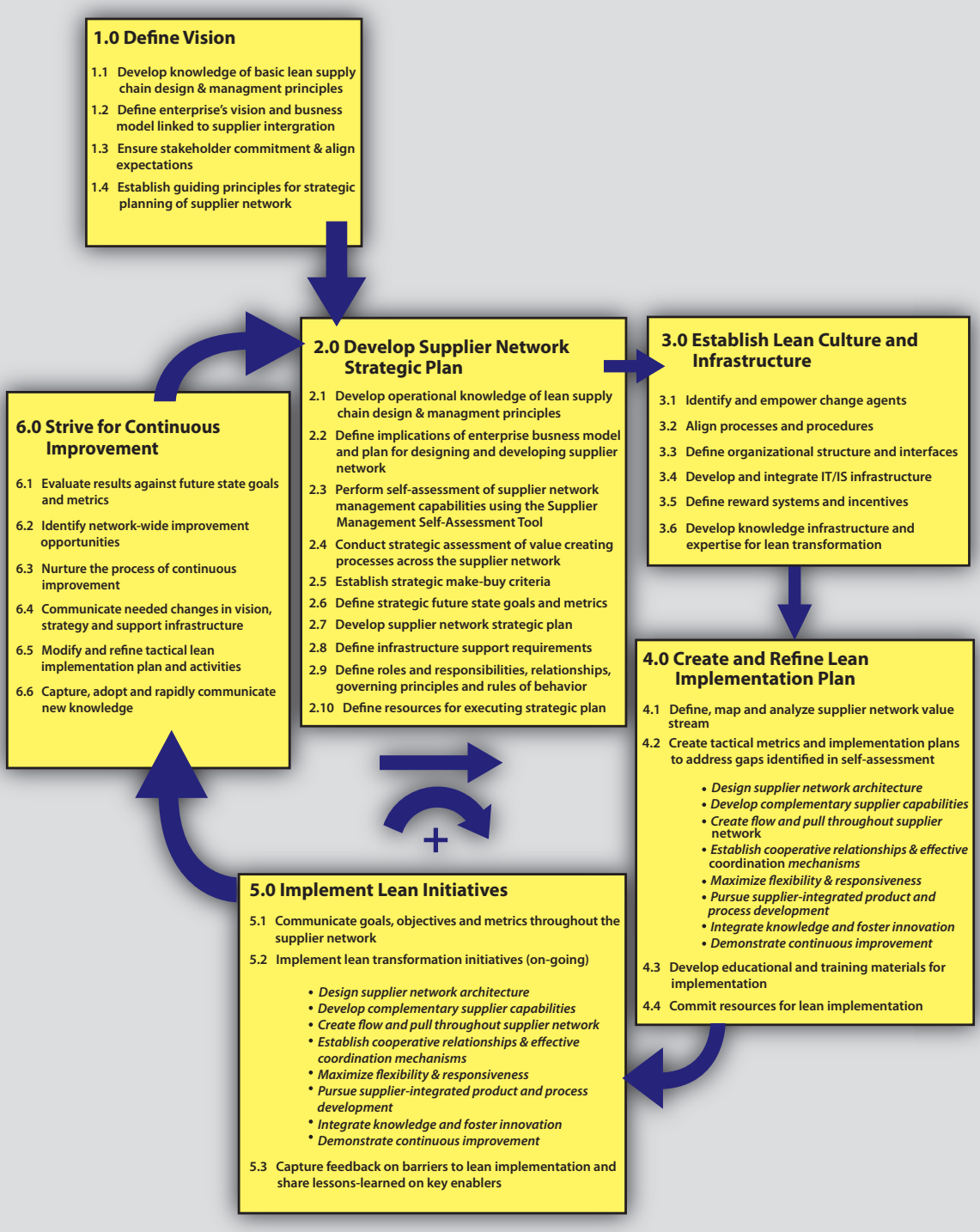
The roadmap is not created as a stand-alone tool; it is, in fact, firmly embedded in enterprise-level lean transition

plans and actions as outlined in the "Transitioning to a Lean Enterprise: A Guide for Leaders" (TTL) document (also referred to as the "Transition to Lean Model"). As such, definition of the enterprise's vision guiding supply chain management activities, the enterprise's business model, development of the supply chain strategic plan, and creation of the necessary lean infrastructure are accomplished through close coordination of supply chain management activities throughout the enterprise. The development and execution of the roadmap for building lean supplier networks takes the whole enterprise.

The roadmap is developed to meet the needs of enterprises just starting to evolve lean supply chain management capabilities as well as those of companies that are well along in their lean journey. as detailed below, one of the implementation steps in block 2.0 – develop strategic plan calls for self-assessment using the supplier management self-assessment tool. This would enable an enterprise to define its current state in the domain of lean supply chain management. it is expected, using the tool, that a future state would also be defined (at least on a provisional basis), reflecting the enterprise's performance improvement goals and objectives. Having thus defined its "as-is" and "to-be" states, an enterprise can then proceed to implement the strategic, tactical and operational steps laid out in the rest of the roadmap, within each of the linked blocks.

The roadmap is constructed after careful review of transformational change initiatives in many aerospace companies documented in the course of developing the Transition to Lean (TTL) Model. One of the key lessons-learned was that those enterprises that skip the upper-level blocks that require an enterprise-level systems perspective and instead concentrate directly or solely on lean implementation in one or more of the lower-level blocks often run into considerable implementation difficulties. Two main reasons can be cited for these difficulties. The first is that the full benefits of lean implementation are frequently not realized because one or more of the key enablers of lean implementation are ignored or overlooked. The second reason is that isolated lean implementation that may result in local optimization or islands of success, does not lead to global (enterprise-wide) optimization for lack of a systems view of the enterprise transformation process. This is not to suggest that enterprises should follow, in a lockstep fashion, the various roadmap blocks as outlined here. but it is strongly suggested that enterprises striving to build lean supplier networks should consider the action steps encompassed in these building blocks and the order in which they might best be executed.

Figure 1:
The lean supplier building blocks. Adopted from MIT, Center for Technology, Policy and Industrial Development


1.0 Define Vision
1.1 Develop knowledge of basic lean supply chain design & managment principles
1.2 Define enterprise's vision and busness model linked to supplier intergration
1.3 Ensure stakeholder commitment & align expectations
1.4 Establish guiding principles for strategic planning of supplier network
2.0 Develop Supplier Network Strategic Plan
2.1 Develop operational knowledge of lean supply chain design & managment principles
2.2 Define implications of enterprise busness model and plan for designing and developing supplier network
2.3 Perform self-assessment of supplier network management capabilities using the Supplier Management Self-Assessment Tool
2.4 Conduct strategic assessment of value creating processes across the supplier network
2.5 Establish strategic make-buy criteria
2.6 Define strategic future state goals and metrics
2.7 Develop supplier network strategic plan
2.8 Define infrastructure support requirements
2.9 Define roles and responsibilities, relationships, governing principles and rules of behavior
2.10 Define resources for executing strategic plan
3.0 Establish Lean Culture and Infrastructure
3.1 Identify and empower change agents
3.2 Align processes and procedures
3.3 Define organizational structure and interfaces
3.4 Develop and integrate IT/IS infrastructure
3.5 Define reward systems and incentives
3.6 Develop knowledge infrastructure and expertise for lean transformation
4.0 Create and Refine Lean Implementation Plan
4.1 Define, map and analyze supplier network value stream
4.2 Create tactical metrics and implementation plans to address gaps identified in self-assessment
• Design supplier network architecture
• Develop complementary supplier capabilities
• Create flow and pull throughout supplier network
• Establish cooperative relationships & effective coordination mechanisms
• Maximize flexibility & responsiveness
• Pursue supplier-integrated product and process development
• Integrate knowledge and foster innovation
• Demonstrate continuous improvement
4.3 Develop educational and training materials for implementation
4.4 Commit resources for lean implementation
5.0 Implement Lean Initiatives
5.1 Communicate goals, objectives and metrics throughout the supplier network
5.2 Implement lean transformation initiatives (on-going)
• Design supplier network architecture
• Develop complementary supplier capabilities
• Create flow and pull throughout supplier network
• Establish cooperative relationships & effective coordination mechanisms
• Maximize flexibility & responsiveness
• Pursue supplier-integrated product and process development
• Integrate knowledge and foster innovation
• Demonstrate continuous improvement
5.3 Capture feedback on barriers to lean implementation and share lessons-learned on key enablers
6.0 Strive for Continuous Improvement
6.1 Evaluate results against future state goals and metrics
6.2 Identify network-wide improvement opportunities
6.3 Nurture the process of continuous improvement
6.4 Communicate needed changes in vision, strategy and support infrastructure
6.5 Modify and refine tactical lean implementation plan and activities
6.6 Capture, adopt and rapidly communicate new knowledge

SECTION III – MAJOR BUILDING BLOCKS

This section presents a description of each of the major building blocks, provides a summary description of the specific implementation steps within each block, and outlines a set of practical considerations of interest to users of the tool.

1.0 DEFINE VISION

Description: Define the attributes of a lean supplier network that would ensure the efficient creation of value for multiple enterprise stakeholders by enabling the enterprise to provide products and services to market in shorter times, with high quality, best value, increased performance, and greater customer satisfaction. The vision of the supplier network represents a direct extension of the corporate vision, goals and objectives. The size, structure and composition of the supplier network are governed by the enterprise's defined vision and business model. They drive enterprise-wide strategic initiatives, which must be shared throughout the supplier network. The vision statement and the business model reflect the enterprise's view of its portfolio of core competencies and how it proposes to align core competencies throughout the supplier value stream. Ultimately, the enterprise's supplier vision represents, in itself, a central core competence to enhance the enterprise's competitive advantage.

Key considerations:

- Are you and your enterprise's top management sufficiently familiar with basic Lean Thinking and Six Sigma concepts governing the design and management of supplier networks?
- Do you have an explicitly defined enterprise vision and business model guiding your supply chain design and management strategies and activities?
- Is your top management committed to adoption of lean principles?
- Do you have a well-defined, robust value, proposition with your key suppliers spelling out mutual expectations concerning value exchanges? Is your value proposition differentiated for different categories of suppliers?
- How would you evaluate the degree of integration between your supply chain design and management activities across your enterprise and your enterprise-wide lean transition initiatives [say, on a scale of zero (poor) to five (excellent)].
- Where is your enterprise on its lean journey (i.e., at what level of transition is your enterprise at this time)? You may want to consult the results of your enterprise's use of the Lean Enterprise Self-Assessment Tool (LESAT). Do you have hard evidence supporting your conclusions?

2.0 DEVELOP SUPPLIER NETWORK STRATEGIC PLAN

Definition: The strategic plan should identify the current state of the supplier network, define a desired future state, and provide a recommended course of action to achieve the development of a lean supplier network. It should identify the improvement opportunities, barriers, and costs and benefits associated with the implementation of the strategic plan. The plan should identify a single point of contact for its achievement and the individual(s) with the organizational responsibility and resources to accomplish the specific elements of the plan within budgetary constraints.

Key considerations:

- Do you have a structured process for linking your enterprise's vision and business model to your strategic planning of your supplier network design and management activities?
- Do you have a working familiarity with strategic lean concepts and practices governing lean supply chain design, development and management?
- Do you know the current state of your internal lean supply chain management capabilities? Do you know the current state of the degree of leanness of your key suppliers?
- Do you have a clear understanding of the desired future state for your internal supply chain management capabilities, as well as of the desired future state of your supplier network in terms of its degree of leanness?
- In defining the desired future state, have you considered your enterprise's strategic make-buy criteria, key value-creating processes across your enterprise value stream, your enterprise's future need in terms of required core competencies, and how best to optimize these core competencies across your supplier network?

3.0 ESTABLISH LEAN CULTURE AND INFRASTRUCTURE

Definition: Create the lean culture and develop the infrastructure necessary for implementing lean principles and practices to evolve lean supplier networks. This task involves the establishment of physical systems (e.g., information technologies and systems, facilities, equipment), organizational structures, lean behavior (e.g., relationships, incentive systems), and development of support systems (e.g., training materials, tools and methods). It is necessary to establish the conditions conducive to lean transformation of the supplier network. Lean principles and practices must be learned and internalized. Mass production principles and practices must be abandoned. Incentives must be rationalized to foster the new lean culture in the enterprise. Processes and practices, driven by lean behavior, should drive change, leading to concrete performance improvements. Establishing lean culture and infrastructure is critical for putting "muscle" behind the creation and implementation of lean initiatives aimed at transforming the enterprise's supplier network.

Key considerations:

- Are you committed to making the necessary investments in terms of infrastructure, training and education to develop the necessary lean supply chain management culture, structures and tools?
- Have you aligned critical processes and procedures across your enterprise, as well as between your enterprise and your supplier network?
- Is your enterprise ready for doing business in the Internet age, at Internet speed, with your suppliers? Have you ensured that your lower-tier suppliers, as well, are linked electronically to your key suppliers to ensure visibility and responsiveness throughout your supplier network?
- Do you have the right incentives and reward systems both internally and across your supplier network to make sure that the entire network (including your enterprise) operates as efficiently and effectively as possible so that your enterprise can create and deliver value to your multiple stakeholders?

4.0 CREATE AND REFINE LEAN IMPLEMENTATION PLAN

Description: This block of activities represents the beginning of translating the organization's supplier network lean vision and strategies developed earlier into reality. The previous block set the stage by developing the IT/IS infrastructure, organizational structures, incentives mechanisms, and technical and business processes necessary for implementing the tasks ahead. This block of activities entails the creation and refinement of lean implementation activities. Necessary steps include supplier value stream mapping and analysis, the identification and prioritization of lean implementation initiatives to bridge the "gap" between the "current state" and the desired "future state," the deployment-ready development of implementation tools and methods as well as the provision of the needed training programs, and the commitment of resources for implementation. Here, suppliers are segmented into categories based on strategic criteria, and differentiated supply chain management approaches are defined to minimize transaction costs and maximizing value creation. Where appropriate, joint lean deployment plans are developed with key suppliers. Information is shared with suppliers regarding costs, risks, and potential gains, as well as how to incentivize suppliers to continuously drive down cost while enhancing value delivered to the end-user or customer. Strategic supplier relationships and alliances are defined. Concrete procurement plans are developed, including Internet-enabled procurement of parts and materials. The lean toolset is developed and/or assembled to meet the needs of the next block of actual implementation of lean initiatives.

This block starts the beginning of the "short term cycle," which is best represented as "annual operating plans" (AOPs) by most aerospace companies. In fact, this block of activities can serve as the cornerstone of the enterprise -level AOPs. There are strong tactical relationships between the activities in this block and those in the enterprise-level Transition-to-Lean (TTL) block of activities (i.e., Create and Refine Implementation Program; Implement Lean Initiatives).

It is important to underscore the importance of developing a comprehensive implementation plan that addresses all of the overarching (and related enabling) practices identified in the SUPPLIER MANAGEMENT SELF -ASSESSMENT Tool:

1.0 Design supplier network architecture
2.0 Develop complementary supplier capabilities
3.0 Create flow and pull throughout the supplier network
4.0 Establish cooperative relationships and effective coordination mechanisms

5.0 Maximize flexibility and responsiveness
6.0 Pursue supplier-integrated product and process development
7.0 Integrate knowledge and foster innovation
8.0 Demonstrate continuous performance improvement.

Key considerations:

- Have you established structured processes internally to evolve integrated improvement action plans in cooperation with the product development, manufacturing, quality improvement and other major processes and process owners across the enterprise?
- Does your tactical implementation plan consider all of the overarching and enabling practices outlined in the SUPPLIER MANAGEMENT SELF-ASSESSMENT Tool and how these practices would shape your specific processes, functions and activities across the enterprise?
- Have you developed a system of metrics for developing your internal supply chain management capabilities as well as for evolving a lean supplier network?
- Are you familiar with value stream mapping concepts and techniques?
- Have you given explicit attention to the development of the required educational and training materials and initiatives?
- Have you developed the necessary implementation tools?

5.0 IMPLEMENT LEAN INITIATIVES

Description: This block of activities encompasses specific strategies, steps, actions and events that are undertaken to implement the plan developed earlier. The implementation activities span all actions across the extended enterprise (i.e., both internally and across the supplier network) aimed at developing the required capabilities and integrating the supplier network in order to achieve the enterprise-level vision and strategic objectives, supported by the lean infrastructure system. The implementation of the plan embraces the coordination, synchronization and integration of all engineering, manufacturing and assembly, subcontracting, procurement, material and quality functions, and further includes off-site manufacturing support, contract manufacturing, third-party logistics and customer support functions.

The implementation activities must be governed by the overarching (and related enabling) practices identified in the SUPPLIER MANAGEMENT SELF-ASSESSMENT Tool. All of these practices show the path forward in terms of how to improve existing processes, functions and activities. It may be helpful to map out the interactions between the planned implementation activities (and the processes and functions they are designed to improve) and the various overarching (and related enabling) practices. This will help ensure that the specific implementation activities are driven by the overarching (and related enabling) practices. For example, such a mapping exercise might readily demonstrate that much of the existing supplier development activities concentrate on one or two of the eight overarching practices and largely omit the rest. For instance, too little emphasis might be placed on pursuing supplier-integrated product and process development, or on maximizing the flexibility and responsiveness of the supplier network, or on integrating knowledge and fostering innovation across the supplier network.

Typically, not enough resources are available for reaching most of the enterprise's suppliers and some hard, informed, choices must be made. To allocate the available scarce resources effectively, a two-step process may be adopted, for example, in supplier development. The first might entail a quick audit of supplier capabilities. This may involve web-based or paper-based assessments, based on questionnaire surveys. They may also involve site-visits, following the completion of such questionnaire surveys and a review of output reports. The questionnaire surveys -- in addition to helping to develop an informative profile of the supplier's capabilities -- can be designed to flag certain issues, inconsistencies, and improvement opportunities. The second step might then involve more resource-intensive activities focusing on selected suppliers. These activities might involve supplier qualification or certification, training and development, and kaizen events.

In implementing lean initiatives internally within the enterprise, senior managers must be both committed and must lead. They must help remove barriers and facilitate the deployment of enablers. They must ensure the participation of all people who can make a contribution to the needed change process. Communication is critical in this process. It is important to identify, demonstrate and reinforce results visibly throughout the organization. Rewards should be provided to recognize both individual and team performance towards achieving the estab-

lished metrics. Conflicts between "old" and "new" ways of doing business must be managed. Constancy of intent and purpose must be communicated widely and consistently to discourage skepticism and to fend off uncooperative behavior reflecting the misplaced feeling that the lean change process is yet another "flavor-of-the-month" initiative.

Key considerations:

- Do you have in place a comprehensive set of prioritized improvement initiatives driven by the overarching (and related enabling) practices governing lean supply chain management? Are these initiatives fully integrated with the priorities of the product development, manufacturing and other groups within the enterprise?
- Have you established specific lean implementation teams, timelines, milestones and outcome measures?
- Is there a shared understanding of the various lean implementation initiatives across the respective deployment teams? Are the implementation initiatives clearly communicated to the affected suppliers? Are those suppliers fully "on board" on these initiatives?
- Have you anticipated the various barriers that may impede the various lean implementation initiatives? Are there mitigating courses of action in place for overcoming such barriers?

6.0 STRIVE FOR CONTINUOUS IMPROVEMENT

Description: This block of activities involve the application of systems, practices, methods and tools for on-going monitoring, measurement and assessment of progress being made by the enterprise on its lean journey toward the development of lean supplier networks. The focus here is on performance by both internal operating entities and by external suppliers, to ensure continuous learning, adaptation and improvement enabling the creation of value for multiple enterprise stakeholders, by delivering best lifecycle value to the customer. Beyond relatively routine on-going tasks involving the measurement of how well the enterprise is performing toward meeting its stated vision, objectives and performance metrics, an essential task entails the capturing, adoption and sharing of new knowledge and "lessons learned" throughout the supplier network. A critical task involves continuous nurturing of a virtuous cycle of learning and improvement throughout the supplier network and the institutionalization of a continuous process of prime-supplier performance improvement.

Key considerations:

- Do you have a structured process in place for evaluating results against future state goals and metrics on an on-going basis?
- Does this structured process enable you to identify opportunities for continuous improvement across the extended enterprise (your enterprise plus the entire supplier network)?
- Do you have in place a proactive process for nurturing continuous improvement throughout the extended enterprise?
- Do you communicate needed changes in your enterprise's vision, strategy and support infrastructure based on your continuous improvement activities?
- Do you on a regular basis modify and refine your tactical implementation plan and activities as a result of lessons learned in the course of your continuous improvement activities?
- Do you capture, adopt and rapidly communicate new knowledge gained through your continuous improvement activities throughout your supplier network?

Lean supply chain action plan

Inputs	Outputs
• Flow down of the enterprise vision (e.g., from the Transition-to-Lean (TTL) Guide). • Enterprise goals for supply chain activities (e.g., cycle-time-to-market; cost-to-market; quality) that are customer-derived and competition-driven. • Stakeholder inputs.	• Vision of future state, consisting of a vision statement describing where the enterprise would like to be in the future, compared with an assessment of the current state indicating where the enterprise is today.
Barriers	**Enablers**
• Lack of supplier involvement. • Lack of trust. • Lack of management commitment. • Resources (money, time, people). • Fear. • Lack of knowledge. • Lack of processes (organizational, business, change processes) • Attitude. • Lack of long-term commitment. • Lack of enterprise long-range vision, business model or plan.	• Obtain inputs from key suppliers. • Initiate trust-building steps with suppliers to overcome potential resistance. • Obtain top-level management commitment and allocation of the necessary resources. • Develop and share the requisite knowledge on lean principles. • Stress transparency and clearly communicate goals and vision to overcome fear and "not invented here" attitude • Emphasize long-term goals, vision, business model and communicate their importance.
Metrics	**Tools and Methods**
• Focus on the degree of integration with enterprise-level lean transition initiatives and activities. Determine where your enterprise is on its lean journey (e.g., using the Lean Enterprise Self-Assessment Tool -- LESAT).	• Educational material for enterprise leadership related to basic concepts and benefits of building lean supply chain design and management; business case (costs and benefits) • Benchmarking results; outside consultants; Supplier Advisory Council. • Implementation tools developed by Lean Aerospace Initiative.
• Why	• Tensions
• Establish common direction and goal -- Make sure that the vision, goals and objectives driving supply chain management is an integral part of the enterprise's vision, goals and objectives. • Provides foundation for your strategic plan -- Ensure that the size, structure and composition of the supplier network reflects the enterprise's vision and make-buy strategy; further ensure that the design of the supplier network reflects a proactive effort to balance in-house capabilities with supplier-based core competencies. • Creates shared purpose (internal and external to the core enterprise) -- Communicate a consistent vision throughout the supplier network; adopt a lean perspective on supply chain management, make sure to communicate the vision that supply chain management is a lot more than minimizing transaction costs – it is about creating best lifecycle value for enterprise stakeholders.	• Does this mean the enterprise had no vision beforehand, or that it just was not good enough? • Why do we need a vision? How about just slightly modifying the current vision? • What about the link between the new vision and the need for changing the existing culture? It may be pointless defining a new vision when the existing culture itself may be so entrenched that all we will have is a paper vision. • This may limit daringness. • This could constrain entrepreneurial risk taking. • There may arise both internal and external conflicts between the enterprise's new vision and the current culture.

What	Tensions
• Desired direction and future state -- Define and build a shared vision of what the enterprise's supply chain management capabilities would look like if it adopted lean principles. • Motivates people -- The vision, goals and objectives should be explicit and clear. • Promotes goal alignment. • Represents the value proposition.	• Can polarize the organization. • Can act as a lightning rod for naysayers. • Keep in mind that having defined the vision, goals and objectives driving supply chain management is just the beginning of the road – one has to follow-through and make it happen. • How explicit or detailed should the vision be? • You can't impose a vision on many independent companies making up the supplier network. How do we make sure that they buy into such a vision and work together to make it happen?
Who	**Tensions**
• Enterprise leadership in collaboration with stakeholders– supply chain design and management involves the whole enterprise. It would be a serious mistake to act narrowly and delegate this responsibility to the traditional procurement or purchasing department. • Outside help (consultants). • Supplier stakeholders should be involved.	• Some people may be left out -- How do you decide who should be involved in crafting the enterprise's vision, goals and objectives pertaining to supply chain management? • Ideas left unheeded may create unwanted resentment. • This may result in possible leadership disruption or disruption of organizational change process. • How do you obtain the support of those who are not asked to participate in this process? • Should we seek a consensus? How do we deal with possible conflicts among the views of the various participants?
How	**Tensions**
• Learn -- Consult lean principles and practices; read the pertinent lean literature on transforming supplier networks. • Consider inputs from stakeholders. • Align mutual expectations. • Visit successful companies. • Attend workshops, seminars and conferences (e.g., organized by Lean Aerospace Initiative) • Institute a participatory process seeking the active engagement of the key stakeholders across the extended enterprise.	• How do you define participation? • How do you avoid insular vision? • How do you avoid a "too detailed" or "too vague" definition of the enterprise's vision? • How do you make sure that the enterprise's vision can be achieved (e.g., by applying successful practices observed elsewhere)? • How do you overcome the "not invented here" type of resistance to new ideas? • Is the "how" question really separable from the "who" question?
Where	**Tensions**
• Enterprise-wide; across the various functional, process and program groups/entities • Integration with enterprise vision requires engagement at the top enterprise leadership level. • Both top-down and bottom-up participation required to achieving an internally-consistent set of goals and objectives means multi-level inputs within the enterprise	• What do you do if there are incompatible domain specific visions generated along the way? • How is the vision translated into metrics and actions at different levels? • How do you make sure that the vision, in reality, does not get narrowly relegated to the procurement or purchasing department and everybody else's presumed responsibility in achieving it soon becomes forgotten?
When	**Tensions**
• The first step in striving to transform the supplier base; after adopting the lean paradigm at the enterprise and prior to strategic planning. • Progressively refined -- An iterative process where the enterprise's strategic vision, goals and objectives shape, and are shaped by, the vision, goals and objectives driving the design and management of the supplier network. • Not a "one-time-only" step; periodically re-visited and modified, as appropriate, based on the actual enterprise progress made in light of changing external conditions, threats and opportunities.	• Competing priorities may get in the way. • Limited lean exposure, knowledge or experience -- How can you develop a lean vision, as well as goals and objectives, governing the enterprise's supply chain management strategies and actions when there has been little prior lean experience? Doesn't this represent a big "leap of faith"? • How often should the vision, goals and objectives be reviewed and modified without creating a mountain of metrics and paperwork? • How do you allow for an evolutionary process of lean learning and implementation? Isn't there a risk of jumping too fast, only to falter and then blame "lean" for failing to make the desired progress?

2. DURATION AND IMPLEMENTATION COST OF LEAN SUPPLY CHAIN

For SME the following time cost constrains are applicable:

1. Design supplier network architecture (Month 1)
2. Develop complementary supplier capabilities (Month 1)
3. Create flow and pull throughout the supplier network (Month 2)
4. Establish cooperative relationships and effective coordination mechanisms (Month 2)
5. Maximize flexibility and responsiveness (Month 2)
6. Pursue supplier-integrated product and process development (Month 3)
7. Integrate knowledge and foster innovation (Month 3)
8. Demonstrate continuous performance improvement. (Month 3)

The cost of the consultants and support staff should be around the cost of a three person months of an experienced consultant (5.000 per person month) plus around 5.000 euro for support services. The total of 20.000 euro is considered to be the average cost of an average case implementation of lean supplier.

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Business Process Re-engineering(BPR)

Project
Cross Border Implementation of
innovative cost cutting technologies
CROSS-INNO-CUT

Author: Sotiris Zygiaris

CHAPTER 6

CHAPTER 6

Project

"Cross Border Implementation of innovative cost cutting technologies – CROSS-INNO-CUT"

Business Process Re-engineering (BPR)

IMT* = Innovation Management Technique

1. DESCRIPTION

Business Process Reengineering involves changes in structures and in processes within the business environment. The entire technological, human, and organizational dimensions may be changed in BPR. Information Technology plays a major role in Business Process Reengineering as it provides office automation; it allows the business to be conducted in different locations, provides flexibility in manufacturing, permits quicker delivery to customers and supports rapid and paperless transactions. In general it allows an efficient and effective change in the manner in which work is performed.

1.1. What is the Business Process Re-engineering IMT

The globalization of the economy and the liberalization of the trade markets have formulated new conditions in the market place which are characterized by instability and intensive competition in the business environment. Competition is continuously increasing with respect to price, quality and selection, service and promptness of delivery. Removal of barriers, international cooperation, technological innovations cause competition to intensify. All these changes impose the need for organizational transformation, where the entire processes, organization climate and structure are changed. Hammer and Champy provide the following definitions:

- Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance such as cost, quality, service and speed.
- Process is a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an organization. (Davenport 1993).

Each process is composed of related steps or activities that use people, information, and other resources to create value for customers as it is illustrated in the following example.

An example of a business process: Credit card approval in a bank.

An applicant submits an application. The application is reviewed first to make sure that the form has been completed properly. If not, it is returned for completion. The complete form goes through a verification of information. This is done by ordering a report from a credit company and calling references. Once the information is verified, an evaluation is done. Then, a decision (yes or no) is made. If the decision is negative, an appropriate rejection letter is composed. If the decision is positive, an account is opened, and a card is issued and mailed to the customer. The process, which may take a few weeks due to workload and waiting time for the verifications, is usually done by several individuals.

Business processes are characterized by three elements: the inputs, (data such customer inquiries or materials), the processing of the data or materials (which usually go through several stages and may necessary stops and that turns out to be time and money consuming), and the outcome (the delivery of the expected result). The problematic part of the process is processing. Business process reengineering mainly intervenes in the processing part, which is reengineered in order to become less time and money consuming.
The term "Business Process Reengineering" has, over the past couple of year, gained Increasing circulation. As a result, many find themselves faced with the prospect of having to learn, plan, implement and successfully conduct a real Business Process Reengineering endeavour, whatever that might entail within their own business organization. Hammer and Champy (1993) define business process reengineering (BPR) as:

"The fundamental rethinking and radical redesign of the business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed".

An example of BPR application.

A typical problem with processes in vertical organizational structure is that customers must speak with various staff members for different inquiries. For example, if a bank customer enters into the bank determined to apply for a loan, apply for an ATM card and open a savings account, most probably must visit three different desks in order to be serviced, as illustrated in figure 1. When BPR is applied to an organization the customer communicates with only one person, called "case manager", for all three inquiries, shown in figure 2.

Figure 1: Three inquiries three waiting queues

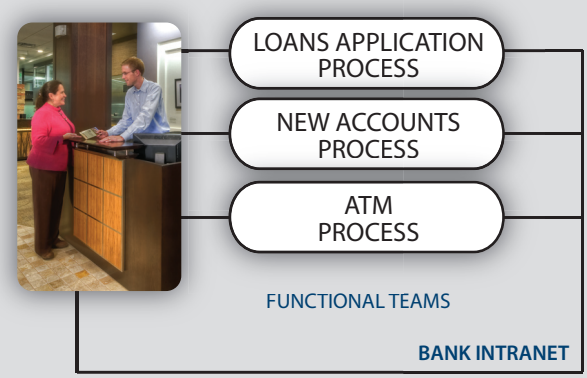

Figure 2: One Stop Service for all three inquiries

The implementation of "One Stop Shopping" as a major customer service innovation requires the close coordination with a team of staff assigned to a process powered by IT for exchanging information and documents in order to service the customer's request. For instance a customer applying for a loan "triggers" a team of staff assigned to service a loan application. The case manager completes an application for a loan in electronic form, which in turn is submitted through the network to the next team member, the credit control director, who examines the credit status of the customer. If the credit status is not satisfactory the rejection of the loan is approved by the credit manager and a rejection form is filled and it is returned to the case manager. The case manager explains to the customer the reason that his application was rejected.

On the other hand, if the credit status of the customer is satisfactory, the application is submitted electronically to the next team member, who calculates interest rates and payment tables. The application is then submitted to the credit manager for approval using a digital signature. The approval of the application along with the payment table is delivered to the customer by the case manager.

Most importantly, while the loan application team was processing the loan application, the case manager "triggered" the account team to open a savings account and the ATM team to supply the customer with an ATM card. The customer leaves the bank having a response for his loan application, a new savings account and an ATM card. And all these without having to move around the desks for signatures and documents. All the customer's requests were satisfied at the same time in parallel motion.

The difference between the vertical organization (figure 1) and the cross functional organization (figure 2) lies in the way businesses are organized internally. The vertical organization is organized based on functional units (e.g. the sales, the accounting department). In cross-functional organizational units the main organizational unit is the process. Since "doing business" is mainly running processes, it would be very logical to organize companies based on processes. For instance, the ordering process crosses different departments. The sales department for order taking, the accounting department for credit control and invoicing, the logistics department for inventory control and distribution, and the production department for producing the order.

An everyday business, customer conversation

Assuming a customer calls the company to ask why his order has not yet arrived to its premises.

"Let me transfer you to **the** accounting department to check if the order was invoiced" responds the telephone operator.

The customer must explain his problem to the accounting department again. "We had invoiced your order, but I don't now if already shipped to you. You need to call **the** logistics department; unfortunately I could not transfer you since **they** are located in another city".

The customer calls the logistics department and explains the situation again. The logistics manager responds "that although the order should have been distributed to you, I haven't yet received the order from **them** in the production department". "Please hold on a minute, I will try to talk to **them** to find out what happened". The inventory manager tried to help out the situation, since he felt that the customer was getting aggravated from the other side of the phone. After a while he said "Sir I am sorry, **it is the finish department's fault. Somebody** had forgotten your order in the finish storage. I will have it send out to you as soon as possible." After this odyssey the customer was seriously considering whether he would place another order.

Throughout the conversation there is an emphasis on department functions. Each employee is satisfied with the fact that "I have done my job but I do not know what the others did". (See bold characters in the conversation". Nobody would like to take total responsibility. While this situation seems awkward, it is the most usual case in most organizations. Most of the times it is up to the good will of some employees, like the logistics manager, for the customer to receive some type of service.

Using BPR the company will be organized based on processes. The company will organize an order processing team, breaking the departmental barriers. The team would be composed of a case manager to respond to the customer's requests, and employees from the accounting department, the logistics department and the production department. The process must be designed to trace an order step by a step electronically and provide an answer back to the customer quickly. THE CUSTOMER MUST SPEAK WITH ONE PERSON, the case manager. All internal controls are the responsibility of the order processing team.

BPR focuses on team building operations around processes and building a company mentality to personnel. The objective of the technique is to build customer-oriented effective organizations. The customer does not care if the accounting department works adequately; he wants to see his order processed as it should be.

If the management of the company overheard this conversation, they would be desperately seeking for a solution to the problem. Most frequently they would change around the organizational chart and would replace people in the company hierarchy or would modify the roles and responsibilities of some employees. Businesses continuously are overcoming some major or minor changes in the way they operate without having the desired outcome. Their effort is crashed on the departmental barriers and the employee mentality to protect their personal or functional interests.

How can BPR be applied to an organization?

When British Telecom had announced their Business Plan, all competitors were eager to find out who would be the new CEO of the organization. To the surprise of all the new CEO it was the customer. The company had decided to transform all the operations of the organization the way customers wanted them to operate. The most important action in applying BPR is the company's strategic goal to provide customer oriented services. BPR is a technique used to implement this type of organizational structure.

Having the management commitment for change, another very important factor for implementing BPR, is the enabling role of Information Technology. The way that businesses are organized around departments is very logical since, for instance, there were physical barriers in the communication of the accounting department with production department. (The warehouse could be in another location in another part of the city). So it wasn't possible for a cross-functional team to communicate efficiently. In the 90s when telecommunication technologies were becoming abundant and low costing BPR was becoming a world-wide applicable managing technique for business upgrade, enabled by the technology. Employees can easily operate as a team using intranets/extranets, workflow and groupware applications, eliminating distances. We can work together even though we are located in different places.

Empowering people. Empowerment means giving people the ability to do their work: the right information, the right tools, the right training, the right environment, and the authority they need. Information systems help empower people by providing information, tools and training.

Providing Information. Providing information to help people perform their work is a primary purpose of most information systems although they provide information in many different ways. Some systems provide information that is essential in informing a business process, such as the prices used to create a customer's bill at a restaurant. Other systems provide information that is potentially useful but can be used in a discretionary manner, such as medical history information that different doctors might use in different ways.

Providing Tools. In addition to providing the right information, empowering people means giving them the right tools. Consider the way planning analysts produce consolidated corporate plans based on plans of individual divisions and departments. If the plans are submitted on paper, it is a major task to add up the numbers to determine the projected corporate bottom line. When the plan is changed during a negotiation process, the planning analyst has to recalculate the projected results. With the right tools, the numerical parts of the plans arrive in a consistent, electronic format permitting consolidation by a computer. This leaves the analyst free to do the more productive work of analyzing the quality of the plan.

Providing Training. Since information systems are designed to provide the information needed to support desired work practices, they are often used for training and learning. As shown by an expert system and a decision simulator, they sometimes provide new and unique training methods.
IBM developed an expert system for fixing computer disk drives. The expert system was an organized collection of the best knowledge about fixing these disk drives, and it fostered rapid and efficient training. Before the system was developed, technicians typically took between 1 and 16 months to become certified, but with the expert system, training time dropped 3 to 5 months.

Eliminating Unproductive Uses of Time. Information systems can reduce the amount of time people waste doing unproductive work. A study of how professionals and managers at 15 leading U.S. corporations spent their time concluded that many professionals spent less than half of their work time on activities directly related to their functions. Although the primary function of salespeople is selling, the time breakdown for salespeople averaged 36 percent spent on prospecting and selling, 39 percent spent on prospect in an selling, 3 percent on servicing accounts, 19 percent on doing administrative chores, and 6 percent on training. Better use of information systems could save much of their unproductive time performing chores such as collecting product or pricing information, determining order status for a customer, resolving invoice discrepancies, and reporting of time and expenses.

Eliminating Unnecessary Paper. One common way to improve data processing is to eliminate unnecessary paper. Although paper is familiar and convenient for many purposes, it has major disadvantages. It is bulky, difficult to move from place to place, and extremely difficult to use for analyzing large amounts of data. Storing data in computerized form takes much less physical space and destroys fewer forests, but that is only the beginning. It makes data easier to analyze, easier to copy or transmit, and easier to display in a flexible format. Compare paper telephone bills with computerized bills for a large company. The paper bills identify calls but are virtually impossible to analyze for patterns of inefficient or excessive usage.

Eliminating Unnecessary Variations in the Procedures and Systems. In many companies, separate departments use different systems and procedures to perform essentially similar repetitive processes, such as paying employees, purchasing supplies, and keeping track of inventories. Although these procedures may seem adequate from a totally local viewpoint, doing the same work in different ways is often inefficient in a global sense. Whenever the systems must change with new technology, new regulations, or new business issues, each separate system must be analyzed separately, often by someone starting from scratch.

Minimizing the Burden of Record Keeping, Data Handling, and General Office Work. Since processing data is included in most jobs, improving the way people process data is an obvious place to look for information system applications. Focus on basic data processing tasks: Reducing the burden of record keeping means being more efficient and effective with the six components of data processing. Those components are capturing, transmitting, storing, retrieving, manipulating, and displaying data. Capture data automatically when generated: Capturing data automatically at the time of data generation is especially important in minimizing the burden of record keeping.

In depth, BPR assumes that the current processes in a business are inapplicable and suggest completely new processes to be implemented by starting over. Such a perspective enables the designers of business processes to disassociate themselves from today's process, and focus on a new process. The BPR characteristics - outcomes include the following:

- Several jobs are combined into one.
- Decision-making becomes part of the job of employees (employee empowerment).
- Steps in the processes are performed in natural order, and several jobs get done simultaneously.
- Processes have multiple versions. This enables the economies of scale that result from mass production, yet allows customization of products and services.
- Work is performed where it makes the most sense.

- Controls and checks and other non-value-added work are minimized.
- Reconciliation is minimized by cutting back the number of external contact points and by creating business alliances.
- A single point of contact is provided to customers.
- A hybrid centralized/decentralized operation is used.

BPR is achieving dramatic performance improvements through radical change in organizational processes, re-architecting of business and management processes. It involves the redrawing of organizational boundaries, the reconsideration of jobs, tasks, and skills. This occurs with the creation and the use of models. Whether those are physical models, mathematical, computer or structural models, engineers build and analyze models to predict the performance of designs or to understand the behaviour of devices. More specifically, BPR is defined as the use of scientific methods, models and tools to bring about the radical restructuring of an enterprise that result in significant improvements in performance.

Redesign, retooling and re-orchestrating form the key components of BPR that are essential for an organization to focus on the outcome that it needs to achieve. The outcome pursued should be an ambitious outcome (as for instance, are a 24 hour delivery to any customer anywhere in the world, approval of mortgage loans within 60 minutes of application, or ability to have on-line access to a patient's medical records no matter where they are in any major city in the world). These types of visionary goals require rethinking the way most organizations do business, careful redesign. They will additionally need very sophisticated supporting information systems and a transformation from a traditional organizational structure to a network type organization.

In resuming, the whole process of BPR in order to achieve the above mentioned expected results is based on key steps-principles which include redesign, retool, and re-orchestrate. Each step-principle embodies the actions and resources as presented in the table below.

REDESIGN	RETOOL	REORCHESTRATE
Simplify	*Networks*	*Synchronize*
Standardize	*Intranets*	*Processes*
Empowering	*Extranets*	*IT*
Employeeship	*Workflow*	*Human resources*
Groupware		
Measurements		

The 3 Rs of re-engineering

Creating the new enterprise involves considerable change in virtually everything to do with people's working lives. Rather than fixing the old, we set out to create the new. There is a fundamental transformation occurring in business - in terms of its structure, processes, people, and technology. The table following presents the changes in that occur in the business under BPR.

SOURCE: Based on Hammer and Champy, 1993.

CHANGES IN THE WORLD OF WORK	
From Conventional	**To BPR**
Functional departments	*Process Teams*
Simple tasks (division of labour)	*Empowered employees*
Controlled people (by management)	*Multidimensional work*
Training of employees	*Education of employees*
Compensation for skill and time spent	*Compensation for results*
Pay raises based on promotions and seniority	*Low pay plus high performance-related bonuses*
Advancement based on ability	*Advancement based on performance*
Protective organizational culture	*Productive organizational structure*
Managers supervise and control	*Managers coach and advise*
Hierarchical organizational structure	*Horizontal (flat) structure*
Executives as scorekeepers	*Executives as leaders*
Separation of duties and functions	*Cross-functional teams*
Linear and sequential processes	*Parallel process*
Mass production	*Mass customization*

1.2. Objectives of BPR

When applying the BPR management technique to a business organization the implementation team effort is focused on the following objectives:

Customer focus. Customer service oriented processes aiming to eliminate customer complaints.

Speed. Dramatic compression of the time it takes to complete a task for key business processes. For instance, if process before BPR had an average cycle time 5 hours, after BPR the average cycle time should be cut down to half an hour.

Compression. Cutting major tasks of cost and capital, throughout the value chain. Organizing the processes a company develops transparency throughout the operational level reducing cost. For instance the decision to buy a large amount of raw material at 50% discount is connected to eleven cross check-ins in the organizational structure from cash flow, inventory, to production planning and marketing. These check-ins become easily implemented within the cross-functional teams, optimizing the decision making and cutting operational cost.

Flexibility. Adaptive processes and structures to changing conditions and competition. Being closer to the customer the company can develop the awareness mechanisms to rapidly spot the weak points and adapt to new requirements of the market.

Quality. Obsession with the superior service and value to the customers. The level of quality is always the same controlled and monitored by the processes, and does not depend mainly on the person, who servicing the customer.

Innovation. Leadership through imaginative change providing to organization competitive advantage.

Productivity. Improve drastically effectiveness and efficiency.

In order to achieve the above mentioned adjectives the following BPR project methodology is proposed.

1.3. Methodology of a BPR project implementation / alternative techniques.

BPR is world-wide applicable technique of business restructuring focusing on business processes, providing vast improvements in a short period of time. The technique implements organizational change based on the close coordination of a methodology for rapid change, employee empowerment and training and support by information technology. In order to implement BPR to an enterprise the followings key actions need to take place:

- Selection of the strategic (added-value) processes for redesign.
- Simplify new processes - minimize steps - optimize efficiency - (modelling).
- Organize a team of employees for each process and assign a role for process coordinator.
- Organize the workflow - document transfer and control.
- Assign responsibilities and roles for each process.
- Automate processes using IT (Intranets, Extranets, Workflow Management)
- Train the process team to efficiently manage and operate the new process
- Introduce the redesigned process into the business organizational structure

Most reengineering methodologies share common elements, but simple differences can have a significant impact on the success or failure of a project. After a project area has been identified, the methodologies for reengineering business processes may be used. In order for a company, aiming to apply BPR, to select the best methodology, sequence processes and implement the appropriate BPR plan, it has to create effective and actionable visions. Referring to 'vision' we mean the complete articulation of the future state (the values, the processes, structure, technology, job roles and environment)

For creating an effective vision, five basic steps are mentioned below.

- the right combination of individuals come together to form an optimistic and energized team
- clear objectives exist and the scope for the project is well defined and understood
- the team can stand in the future and look back, rather than stand in the present and look forward
- the vision is rooted in a set of guiding principles.

All methodologies could be divided in general 'model' stages:

The Envision stage: the company reviews the existing strategy and business processes and based on that review business processes for improvement are targeted and IT opportunities are identified.

The Initiation stage: project teams are assigned, performance goals, project planning and employee notification are set.

The Diagnosis stage: documentation of processes and sub-processes takes place in terms of process attributes (activities, resources, communication, roles, IT and costs).

The Redesign stage: new process design is developed by devising process design alternatives and through brainstorming and creativity techniques.

The Reconstruction stage: management technique changes occur to ensure smooth migration to the new process responsibilities and human resource roles.

The Evaluation stage: the new process is monitored to determine if goals are met and examine total quality programs.

Alternatives techniques to BPR

Total Quality management, often referred to as total quality management (TQM) or continuous improvement process (CIP), refers to programs and initiatives that emphasize incremental improvement in work processes and outputs over an open-ended period of time. In contrast, **Reengineering** refers to discrete initiatives that are intended to achieve radically redesigned and improved work processes in a bounded time frame. The differences between the two management techniques extend to the organizational structure, the implementation time and results achieved and to the basis upon which the whole procedure towards change and improvement is elaborated, as shown in the table below.

Comparing TQM and Reengineering

SOURCE: Gulden and Ewers, 1997.

	TQM	BPR
Case for action	*Assumed to be necessary*	*Compelling*
Goals	*Small-scale improvements in many places with cumulative effects*	*Outrageous*
Scope and focus	*Attention to tasks, steps, and processes across the board*	*Select but broad business processes*
Degree of change	*Incremental and continual*	*Order of magnitude and periodic*
Senior management involvement	*Important up front*	*Intensive throughout*
Role of information technology	*Incidental*	*Cornerstone*

In opposition with the other existing approaches on business process improvement, which suggest gradual and incremental improvements, as for instance the Total Quality Management approach, BPR does propose dramatic changes. The major differences between process innovation through BPR and incremental improvement through TQM are mentioned on the table that follows.

Process Innovation vs. Incremental Improvement

	Process Innovation	Incremental Improvement
Change	*Abrupt, volatile*	*Gradual, constant*
Effects	*Immediate, dramatic*	*Long-term, more subtle*
Involvement	*A few champions*	*From few to everybody*
Investment	*High initially, less later*	*Low initially, high to sustain*
Orientation	*Technology*	*People*
Focus	*Profits*	*Processes*

SOURCE: Merlyn V., Ernst and Young, private communication.

1.4. Expected Results / Benefits

The expected results for a company that implements business process reengineering are the following:

- Reallocation of jobs and processes so as to be combined into fewer, to be executed in natural order, simultaneously and by the least possible number of employees.
- Reorganization of the company's structure (downsizing) and employee empowerment.
- Jobs and processes become flexible so as to be executed according to the needs of each case, company's and customer's need's (hybrid centralized/decentralized operations)

The above changes will bring reductions of costs in the company, better quality (as far as price, promptness of delivery and offerings of related services) in the products and services provided to the customers. BPR shows that there is 'more than one way to skin a cat' and enables a fresh view without ingrained prejudice affecting judgment. It can produce huge initial savings where a business is struggling and often has the affect of turning around an unprofitable operation. Also, it leaves the business with a fully documented model of the operation, which is invaluable if embarking on a quality program.
The expected outcome from a successful BPR process should the desired one for the favour of the business concerned. The dramatic changes that are caused involve people's jobs and working relationships as it is very often that jobs are eliminated and the entire process is not as beneficial for all.

1.5. Characteristics of firms and service providers

Several surveys and benchmarking findings reveal the essential role of consultants in the BPR process. Consultants' help and guidance may be extremely beneficial in all stages of the BPR procedure. This is due to the fact that consultants have the following attributes:

- They are objective and immune to internal politics.
- They have followed the process before.
- They bring information and best practices from other companies.
- They are good communication paths between front line workers and customers, and the leaders of the company or organization.

Consultants, besides their beneficial qualities, can also unintentionally create barriers by:

- having the solution being viewed as "theirs" and not "yours"
- taking too strong a lead role and disengaging the organization.

The consultants may play different roles in the BPR procedure, and this is a matter for the company to decide always taking into account the organizations needs and the specific BPR approach chosen. The role of consultant may be:

- a strong facilitator and experienced practitioner who brings a methodology with them.
- a team member; can be an objective and unbiased contributor to the solution;
- a subject-matter expert with knowledge of performance levels and best practices of similar organizations and processes; able to perform specific tasks for the team.

2. APPLICATION

2.1. Where the technique has being applied

Many public and private sector organizations and SMEs Word-wide had undergone major reengineering efforts. The technique was applied first to multinational co-operations, such as IBM, AT&T, SONY, GENERAL ELECTRIC, WALL MART, HEWLLET PACKARD, DEC, KRAFT FOODS having as a result major downsizing in their organizational structures.

Later, the banking sector began to reengineer with a great degree of success such as CITIBANK, NORTHWESTERN BANK, BANK OF AMERICA and others. Major utility companies used reengineering as a technique to improve service like OTE, ELTA. BPR is also being used to change the organizational structure of public services. First the government cabinet of Egypt reengineered its processes along with many Municipals in Europe. The public health sector is undergoing a major re-engineering in Europe using the CORBA methodology.

As the technique was becoming well known to the business sector smaller enterprises were using the technique for organizational upgrade. Today most SMEs are investigating the re-engineering technique and a lot of them are applying re-engineering, since the technique is applicable and affordable to almost all SMEs. This is proved by the increasing demand for BPR consultants in Greece and worldwide.

Most of the times re-engineering is applied as a "must" when innovative IT tools are introduced to SMEs. Tools such as SAP, BAAN and various ERP systems that promote the horizontal organizational structure are the vehicles for re-engineering the organizational structure in order to adapt to the horizontal operational subsystems of the tools. For the first time we can say "that IT does not only support management, IT changes the organizational structure". Today 120 businesses from small to medium size in Greece and thousands in Europe have installed such types of IT systems reengineering also their organizational structure.

2.2. Types of firms / organizations that BPR can be applied.

BRP could by implemented to all firms (manufacturing firms, retailers, services, etc.) and public organizations that satisfy the following criteria:

- **Minimum Number of employees**: 20 (at least 4 in management positions).
- Strong management commitment to new ways of working and innovation.
- Well formed IT infrastructure (requirements are presented in paragraph 2.4).

Business Process Reengineering could be applied to companies that confront problems such as the following:

- High operational costs
- Low quality offered to customers
- High level of "bottleneck" processes at pick seasons
- Poor performance of middle level managers
- Inappropriate distribution of resources and jobs in order to achieve maximum performance, etc.

2.3. Duration and implementation cost of BPR

The BPR technique, in general, is not a time consuming process. The duration of each BPR project varies from 6 to 10 months. This variation relates to the kind of business and the extend to which BPR is going to be implemented. Moreover, it depends on the techniques and methodology that each consulting company (that usually participates in the procedure) is using. Using the RE-engineering Methodology Oriented towards Rapid Adaptation (REMORA) proposes the following time schedule:

	MONTHS					
BPR PROJECT STAGES	**1**	**2**	**3**	**4**	**5**	**6**
Preparation & coordination for BPR						
Business modelling & measurements						
Management of change & controls						
Technical design of the solution						
Personnel adjustment & training						
Realization & transfer of changes						

SOURCE: Merlyn V., Ernst and Young, private communication.

Implementation Cost.

The implementation of a BPR project consists of two stages:

1 The process management and redesign study and consulting stage.
2 The implementation of the redesigned process using IT tools including employee training and introduction of the new processes to the company organizational structure.

The cost of a BPR for projects applied to SMEs for selective processes varies depending on the complexity of the business environment and the number of processes for reengineering In general, the following cost is applicable for each stage.

STAGE	Description	Cost in Euro
1	The process management and redesign study and consulting.	*From 4000 to 7000*
2	The implementation of the redesigned process using IT tools including employee training and introduction of the new processes to the company organizational structure	*From 5000 to 9000*
Total		***From 9000 to 16000***

2.4. Conditions for implementation (infrastructures required etc.)

Infrastructure requirements:

- An operating transactional and accounting computerized system inclosing the commercial part of the transactions.
- A network that connects all key personnel.
- Workstations with Windows NT or Windows 1995 system or latest version.
- An exchange server (MS outlook, or MS back office or Lotus Notes)

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- High level of "bottleneck" processes at pick seasons
- Poor performance of middle level managers
- Inappropriate distribution of resources and jobs in order to achieve maximum performance, etc.

2.5. European Organizations Supporting the Implementation of BPR

The importance and the need for Business Process Reengineering in the small and medium enterprises and to bigger companies as well, is great. The European Commission has acknowledged this situation and promotes BPR and supports the efforts of SMEs to proceed to reengineering. Under the **ESPRIT** and the latest **IST** programmes, there is a number of projects such as the COBRA (URL www.imsqrp.com), and ROCHADE (URL www.gsm.ch/rochade).

BPR supporting organizations

WARIA. The Workflow And Reengineering International Association. URL http://www.waria.com
BPRC. Business Processes Resource CentreURL:http://bprc.warwick.ac.uk/index.html

3. IMPLEMENTATION PROCEDURE OF BPR

3.1. Steps / Phases of a BPR project

A BPR project consists of specific steps aiming at a successful outcome. The necessary steps in a rapid re-engineering methodology are the following as they presented in figure 3.

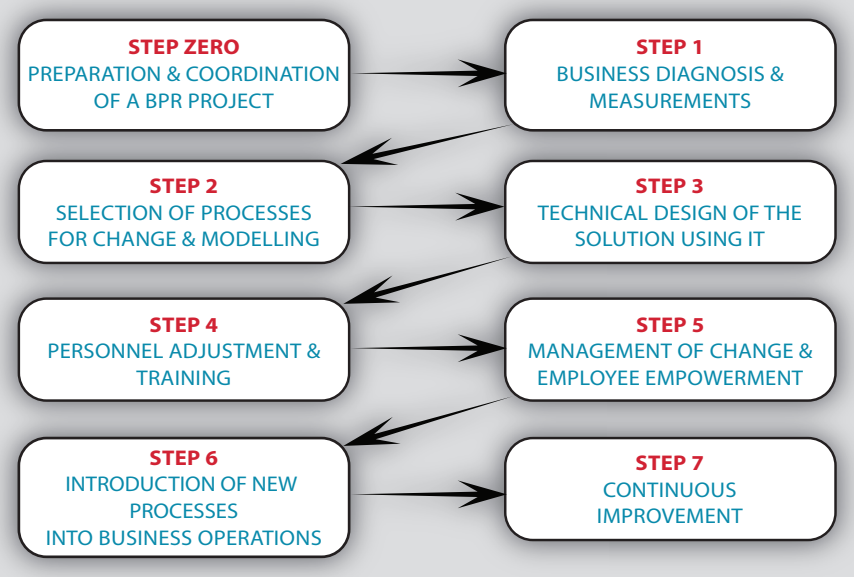

Figure 3: Steps in the implementation of a BPR project

STEP ZERO – Preparation and coordination of the project.

Duration: Two days **Participants:** BPR team, BPR consultants.

Objectives:

- To establish a strong management support
- To explain to the members of the BPR implementation team the implementation details of the project and their role in the successful outcome in the BPR effort.

Actions taken:

- Explain to the top level management the necessity to commit to the BPR project.
- Allocate the most capable employees to the BPR implementation team and assign roles for each one of them.
- Run an 8-hour workshop having as participants the members of the BPR implementation team. The consultants will present the project step by step, as well as, the role of the implementation team in the success of the project.

STEP 1 – Business diagnosis & measurements.

Duration: 4 weeks **Participants:** BPR team, BPR consultants, personnel involved with processes

Objectives:

- To diagnose & identify problematic areas in the current processes
- To measure the performance characteristics of the current processes based on measurable factors such as average cycle time, delays, number of mistakes or number of customer complaints.

Actions taken:

- Diagram each process using a process management tool such as OPTIMA, ADONIS or BONAPART
- Record physical on the site measurements for each step of a process related to time, resources spent or efficiency
- Input all measurements in the process management tool for further evaluation and analysis.
- Identify added value processes that have a major impact on customer service.

STEP 2 – Selection of processes for change and modelling.

Duration: 7 weeks **Participants:** BPR team, BPR consultants.

Objectives:

- To identify the strategic processes that are feasible to change
- To redesign and model the selected processes

Actions taken:

- Set the characteristics of the processes that are more important to the organizational goals
- Based on the characteristics identify the processes that will change based on the added value they provide and their feasibility for change.
- Redesign processes based on the characteristics that serve the organizational goals
- Simulate the processes in running environment using the process management tool
- Model the new process using the diagramming tool of the process management tool

STEP 3 – Technical design of the solution.

Duration: 10 weeks **Participants:** BPR team, BPR consultants, IT experts.

Objectives:

- To automate modelled business processes (step 2) using networks and workflow tools
- To redesign and model the selected processes

Actions taken:

- Establish network connections between process team members.
- Prepare intranet applications to exchange forms and documents between team members.
- Prepare workflow application that will implement each step in the redesigned process automatically.

STEP 4 – Personnel adjustment & training.

Duration: 10 weeks **Participants:** Process team members, process coordinator, trainers.

Objectives:

- To train personnel in the new ways of working using IT in the redesigned processes
- To redesign and model the selected processes

Actions taken:

- Adjust each position according to skills needed in the new process.
- Provide training in the operation of new processes, so employees will feel comfortable in the changing job environment

STEP 5 – Management of change & employee empowerment.

Duration: 1 week **Participants:** BPR team, BPR consultants, process team, executive management

Objectives:

- To establish a positive attitude for the change between employees
- To minimize the resistance to change between employees by empowering their position based on performance appraisal and bonus systems.

Actions taken:

- Establish executive management determination for change and determinate any attempts of resistance to change.
- Facilitate the change process outlining the positive effects of change

STEP 6 – Introduction of new processes into business operations.

Duration: Day and time are set by executive management **Participants:** The whole business organization

Objectives:

- To set the time and date of operating under the new processes, emphasizing the fact that working under the old processes is not an acceptable practice.

Actions taken:

- Prepare and test all background resources (IT, documents, equipment)
- Set time and date for operating under the new processes.
- Do not allow any non-conformities in the operations of new processes

STEP 7 - Continuous improvement.

Duration: Runs dynamically and continuously after the end of the project

Participants: BPR implementation team

Objectives:

- To capitalize from the BPR project and develop internal experts for other BPR projects

Actions taken:

- Periodically evaluate the performance of business processes
- Plan the time and the resources for the next reengineering project.

3.2. Partial techniques and tools included in each step

The tools and techniques are explained in each step in paragraph 3.1.

3.3. Related Software

There are two categories of software used in implementing a BPR project

1. Process management tools, used for the design, performance evaluation of process.
2. Workflow applications for implementing modelled processes.

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Social Media marketing

Project
Cross Border Implementation of innovative cost cutting technologies
CROSS-INNO-CUT

Authors: Paraskevi Tarani

CHAPTER 7

CHAPTER 7

Project
"Cross Border Implementation of innovative cost cutting technologies – CROSS-INNO-CUT"

Social Media marketing

1. DESCRIPTION

1.1. Social Media characteristics

Social media is best understood as a group of new kinds of online media, which share most or all of the following characteristics:

Participation: social media encourages contributions and feedback from everyone who isinterested. It blurs the line between media and audience.

Openness: most social media services are open to feedback and participation. They encourage voting, comments and the sharing of information. There are rarely any barriers to accessing and making use of content – password – protected content is frowned on.

Conversation: whereas traditional media is about "broadcast" (content transmitted or distributed to an audience) social media is better seen as a two-way conversation.

Community: social media allows communities to form quickly and communicate effectively. Communities share common interests, such as a love of photography, a political issue or a favourite TV show.

Connectedness: Most kinds of social media thrive on their connectedness, making use of links to other sites, resources and people.

1.2. Definitions of social media

Here is how Wikipedia[1] defined "social media" on friday, January 12, 2008: Social Media: Participatory online media where news, photos, videos, and podcasts are made public via social media websites through submission. Normally accompanied with a voting process to make media items become "popular."

Social Media Expanded Definition: Social media is the democratization of information, transforming people from content readers into content publishers. It is the shift from a broadcast mechanism to a many-to-many model, rooted in conversations between authors, people, and peers. Social media uses the "wisdom of crowds" to connect information in a collaborative manner. Social media can take many different forms, including Internet forums, message boards, weblogs, wikis, podcasts, pictures and video. Technologies such as blogs, picture-sharing, vlogs, wall-postings, email, instant messaging, music-sharing, group creation and voice over IP, to name a few. Examples of social media applications are Google (reference, social networking), Wikipedia (reference), MySpace (social networking), Facebook (social networking), Last.fm (personal music), YouTube (social networking and video sharing), Second Life (virtual reality), and Flickr (photo sharing).

How does social media differ from traditional media? Social media has a number of characteristics that make it fundamentally different from traditional media such as newspapers, television, books, and radio. Note that this does not mean "use instead of" but rather implies a different set of tools that can be used to complement what you are doing now. Again from Wikipedia: "The audience can participate in social media by adding comments or even editing the stories themselves."
At this time, there are basically six kinds of social media. Note, though, that innovation and change are rife.

Social networks: these sites allow people to build personal web pages and then connect with friends to share content and communication. The biggest social networks are MySpace, Facebook and Bebo.

Blogs: perhaps the best known form of social media, blogs are online journals, with entries appearing with the most recent first.

Wikis: these websites allow people to add content to or edit the information on them, acting as a communal document or database. The best-known wiki is Wikipedia4, the online encyclopaedia which has over 2 million English language articles.

1 http://en.wikipedia.org/wiki/Social_media

Podcasts: audio and video files that are available by subscription, through services like AppleiTunes.

Forums: areas for online discussion, often around specific topics and interests. Forums came about before the term "social media" and are a powerful and popular element of online communities.

Content communities: communities which organise and share particular kinds of content. The most popular content communities tend to form around photos (Flickr), bookmarked links (del.icio.us) and videos (YouTube).

Microblogging: social networking combined with bite-sized blogging, where small amounts of content ('updates') are distributed online and through the mobile phone network. Twitter is the clear leader in this field.

1.3. What is marketing via social media

For a lot of organizations—including business, nonprofits, and governmental agencies—use of social media very often begins in Marketing, public communications, or a similar office or department with a direct connection to customers and stakeholders. This makes sense given that a typical driver for getting involved with social media is a slew of negative comments, a need for "virality," or a boost to overall awareness in the marketplace and especially in the minds of those customers increasingly out of reach of interruptive ("traditional") media. In a word, many organizations are looking for "engagement," and they see social media as the way to get it.
The advent of Web 2.0 and the Social Web is clearly a game-changer, on numerous fronts. Given the rush to implement, and the opening focus on marketing specifically versus the business more holistically, many "social media projects" end up being treated more like traditional marketing campaigns than the truly revolutionary ways in which a savvy business can now connect with and prosper through collaborative association with its customers. As a result, the very objective - engagement, redefined in a larger social context - is missed as too many "social media campaigns" run their course and then fizzle out.
The collaborative technologies that now define contemporary marketplaces—technologies commonly called "social media," the "Social Web," or "Web 2.0"—offer a viable approach to driving changes in deeper business processes across a wide range of applications. There is something here for most organizations, something that extends very much beyond marketing and communications.
Beginning with the emergence of Web 2.0 technologies—the set of tools that make it easy for people to create and publish content, to share ideas, to vote on them, and to recommend things to others—the well-established norms of business marketing have been undergoing a forced change. No longer satisfied with advertising and promotional information as a sole source for learning about new products and services, consumers have taken to the Social Web in an effort to share among themselves their own direct experiences with brands, products, and services to provide a more "real" view of their research experience. At the same time, consumers are leveraging the experiences of others, before they actually make a purchase themselves. The impact on marketing has been significant, to say the least.
Whether consumer-facing, B2B, for profit or nonprofit, people are turning to people like themselves for the information they need to make smart choices. These new sources of information are looked to by consumers for guidance alongside traditional media; advertising and traditional communications are still very much a part of the overall marketing mix. The result is a new vetting that is impacting—sometimes positively, sometimes negatively—the efforts of businesses and organizations to grow their markets.

1.4. Expectations from social media marketing

According to a research survey elaborated by "Insight Strategy Group[2]" showed that, even though marketers often tout social media as a channel that allows them to reach consumers with messages seamlessly tailored to their interests and social interactions, nearly two-thirds (64%) of people say they "hate" when a company targets them through their social networking profile, and 58% agree that social media marketing is invasive. At the same time, findings from this study showed a majority of those surveyed (55%) believe social networking sites are the best way to give a company feedback and that posting about a product or service on a social site can have a strong impact on a brand. In short, people like being able to provide feedback to marketers via social media - but they don't necessarily want to be followed by them.
The series of privacy controversies Facebook has run into over the years, culminating in its consent decree with the Federal Trade Commission in November, underscore public concerns with how personal data is shared on the

2 As it is referred in the article "Study Consumers View Social Marketing as Invasive", by mark Wash, in MediaPost News, 23/01/2012. Available on line on http://www.mediapost.com/publications/article/166313/study-consumers-view-social-marketing-as-invasive.html

world's largest social network. Among other things, the settlement allows users to opt into changes with how their information is shared with advertisers and others.
The future of social media seems to be flourishing. Beyond just social media, customers are deeply engaged with products and services across the entire digital space. They are using multiple outlets to ask questions, give feedback and share and connect with others, and dictating when and where they interact with products and services. And as a result they've come to expect a response from businesses at all times and from everywhere.
We've entered into a new era that businesses interact with the customers. It's no longer enough that a strong marketing initiative will turn consumers into customers. If brands want to stay relevant in the digital era, they have no choice but to adapt. Social media is more than media – it's a cultural shift.[3]
The future of social media will offer many exciting, new opportunities for businesses to connect with their customers. That's why today's businesses must rethink their future strategies and shift most of their marketing efforts towards engaging new social media technologies (see § 2.4). None business is going to strike out by opening the lines of communication with its customers and marketing to them in a personal, caring way that makes them feel valued. Positive brand experiences creates customers, and experience not only matters to customers – it drives results to the bottom line.

2. APPLICATIONS of MARKETING via SOCIAL MEDIA

2.1. How businesses use the social media marketing

According to "ComScore", social networking users grew at 25 percent from June 2007 to June 2008 and the number increased from 0.46 to 0.58 billion. Social Networking is the most popular online activity worldwide. In October 2011, 1.2 billion users around the world visited social networking sites, accounting for 82 percent of the world's population. Nearly 1 in every 5 minutes spent online around the world is now spent on social networking sites, making Social Networking the most popular content category in engagement worldwide. Microblogging has emerged as a disruptive new force in social networking. Microblogging, a way of communicating through short-form content, has emerged as a leading social networking platform over the past few years, led by Twitter. In October 2011, Twitter reached 1 in 10 worldwide Internet users, reflecting its emergence as a leading global social network.
Mobile devices are fueling the social addiction. As mobile devices provide users with the means to connect on-the-go and interact in real-time, they show promise in taking social networking even further. Nearly one third of the U.S. mobile population age 13 and older accessed social networking sites at least once in October 2011. Across five leading markets in Europe, nearly a quarter of the mobile population reported doing so as well. With smartphones driving even more frequent social networking use through apps and the emergence of tablets, we expect mobile social networking to be the wave of the future.[4]
How about the business marketing via social media? According to the "Fortune 500 largest corporations" for the year 2010, a large number of the best global corporations use the social media for their marketing strategy.
The "Value of Social Media Report", published by Econsultancy in association with Online Marketing Summit, is based on an online survey of more than 400 companies and agencies, which took place in December 2009 and January 2010. The research looks at the extent of social media marketing being carried out by organizations, the tactics being used and the business objectives they are trying to impact through related activity. Social media marketing includes the use of social networking sites and on-site activity including blogging, wikis, user-generated content, ratings and reviews.
Facebook is the Web property mostly commonly used in social media, with 85% of companies using this site as part of their marketing strategy. This is followed by Twitter (77%), LinkedIn (58%) and YouTube (49%). Over two -thirds of company respondents (67%) say that the amount of money spent on social media has increased since last year, while 30% say it has stayed the same. 81% of companies expect social media budgets to increase over the next year, while 18% expect it to stay the same.
The study also examines how companies are measuring the value of social media, and the challenges involved in doing so. The report finds that companies are using social media in order to help meet a number of key business objectives, including monetization of this channel through generation of sales and leads. As well as helping to meet harder financial goals, companies are also using social media marketing to achieve softer objectives such as improved brand awareness and reputation.
Apart from the widespread measurement of increased Web site traffic generated by social media, companies are typically struggling to measure the success of their social media marketing in meeting a range of harder and softer business objectives.

3 Alex Hisaka, The Future of Social Media and Business. Posted April 26, 2012 at http://socialmediatoday.com/node/496960
4 Source: ComSore, Measuring the digital world http://blog.comscore.com/2012/01/its_a_social_world.html

Perhaps the most encouraging finding of the above survey is the fact that the marketing community seems at peace with the tension between investing in social media and measuring its effectiveness. Clearly, responents across the spectrum understand that the value of the social media isn't primarily in monetization and the hard metrics of "probable" ROI. They see social as an avenue to enhanced brand reputation and greater engagement with their customers. The majority of companies have difficulty measuring the return on investment (ROI) from social media. Almost two -thirds of respondents (61%) say their organizations are "poor" (34%) or "very poor" (27%) at measuring ROI.

Another report "2011 Social Media Marketing Industry Report: How marketers are using social media to grow their businesses" implemented by the "Social Media Examiner", concludes the below major findings[5]:

- Marketers place high value on social media: A significant 90% of marketers indicate that social media is important for their business.
- Measurement and integration are top areas marketers want to master: One third of all social media marketers want to know how to monitor and measure the return on investment (ROI) of social media and integrate their social media activities.
- Social media marketing takes a lot of time: The majority of marketers (58%) are using social media for 6 hours or more each week, and more than a third (34%) invest 11 or more hours weekly.
- Video marketing on the rise: A significant 77% of marketers plan on increasing their use of YouTube and video marketing, making it the top area marketers will invest in for 2011.
- Marketers seek to learn more about Facebook and blogging: 70% of marketers want to learn more about Facebook and 69% want to learn more about blogging.
- The top benefits of social media marketing: The number-one advantage of social media marketing (by a long shot) is generating more business exposure, as indicated by 88% of marketers. Increased traffic (72%) and improved search rankings (62%) were also major advantages.
- The top social media tools: Facebook, Twitter, LinkedIn and blogs were the top four social media tools used by marketers, in that order. Facebook has eclipsed Twitter to take the top spot since 2010.
- Social media outsourcing underutilized: Only 28% of businesses are outsourcing some portion of their social media marketing.

The report also gives some useful information about how business use the social media marketing, the time commitment for marketing via social media and which are the benefits that they gain by using them in their marketing campaign.

Commonly used social media tools: By a long shot, Facebook, Twitter, LinkedIn and blogs were the top four social media tools used by marketers, with Facebook leading the pack. All of the other social media tools paled in comparison to these top four. It should be noted that in 2010, Twitter was in first place with 88% and Facebook was close behind with 87%. Since 2010, Twitter lost 4%, LinkedIn lost 7% and Facebook gained 5%. In our 2009 study, only 77% of businesses were using Facebook. The self-employed (80%) and owners of small businesses (78%) were more likely to use LinkedIn. Larger businesses were more likely to use YouTube or other video and less likely to use blogs (plus 68%). A close examination of which tools more experienced social media marketers are using compared to those just getting underway provides further insight (fig.1).

Time commitment for social media marketing: A significant 58% of marketers are using social media for 6 hours or more each week and 34% for 11 or more hours weekly. It's interesting to note that 15% of marketers spend more than 20 hours each week on social media (fig.2) Those with more years of social media experince spend more time each week conducting social media activities. For example, 63% of people with 3 or more years of experience spend more than 10 hours a week doing social media activities. Only 41% of those with 1 to 3 years experience spend that much time.

5 This study surveyed over 3300 marketers with the goal of understanding how marketers are using social media to grow and promote their businesses (http://www.socialmediaexaminer.com/social-media-marketing-industry-report-2011)

There's a direct relationship between how long marketers have been using social media and their weekly time commitment. For people just beginning with social media, 59% spend 1 to 5 hours per week. However, for folks who have been doing this for a few months or longer, most spend 6 hours or more per week on social media activities. A significant 47% of marketers who have more than 3 years experience spend at least 16 hours per week focused on social media activities (fig.3).

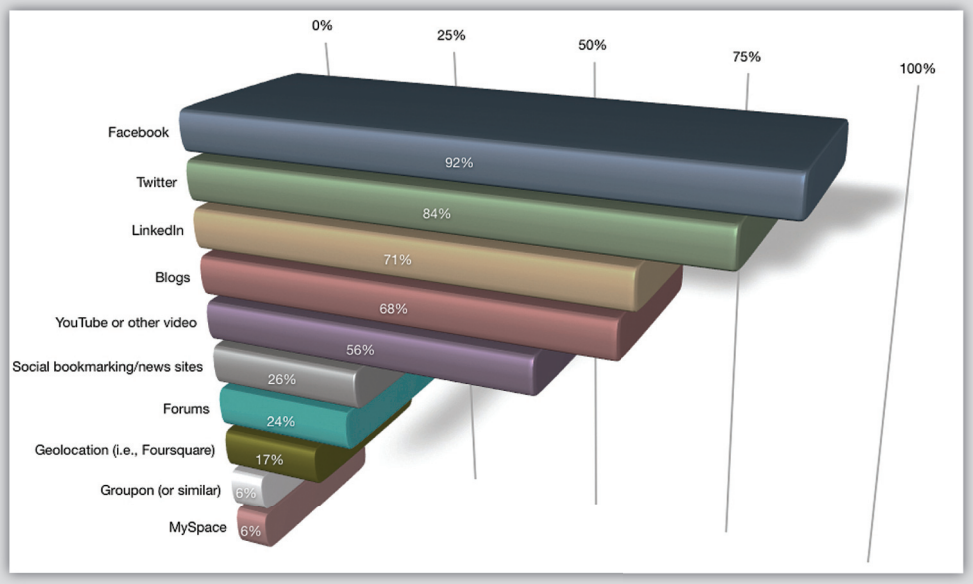


Figure 1: Commonly used social media.
Source: Social media Marketing Industry Report, www.socialmediaexaminer.com

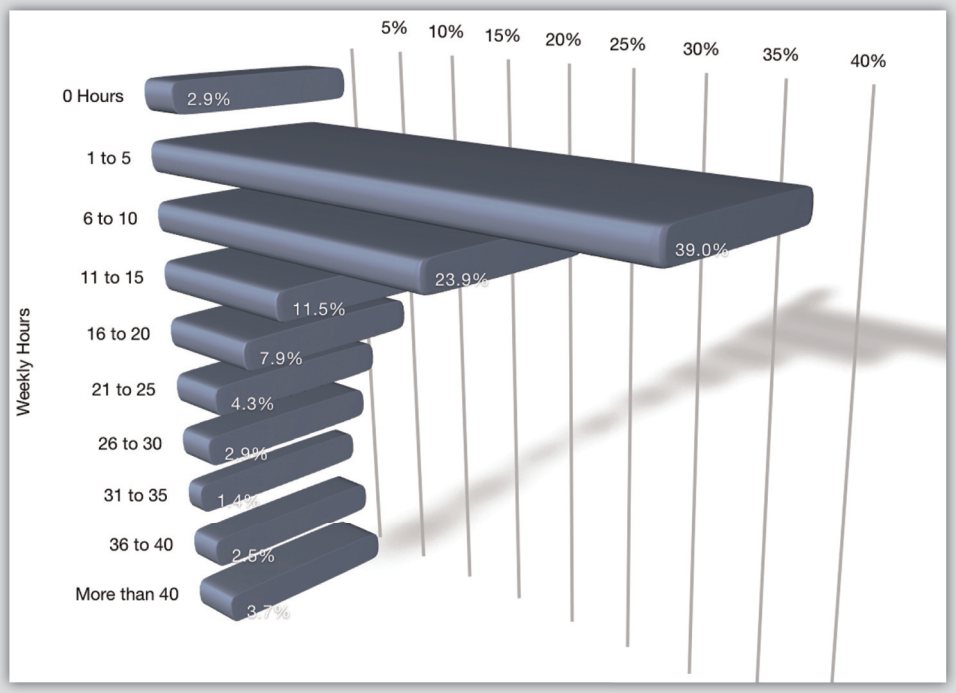


Figure 2: Time commitment for social media marketing.
Source: Social media Marketing Industry Report, www.socialmediaexaminer.com

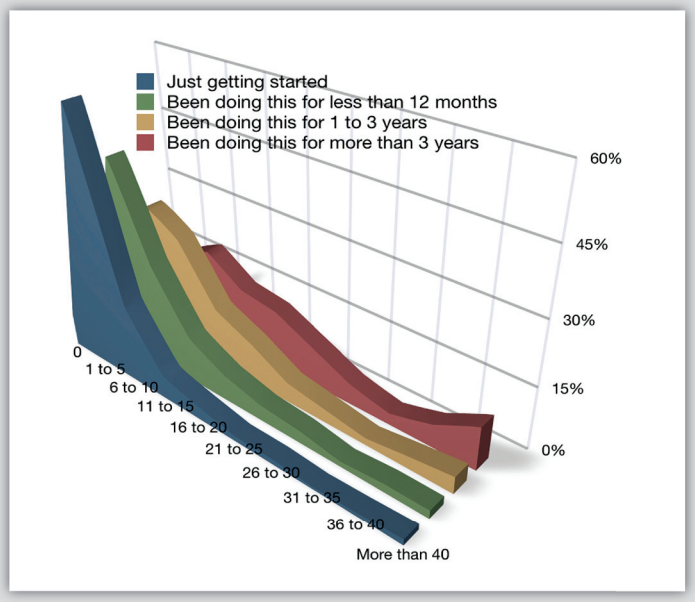


Figure 3: Time commitment for social media marketing according the experience of user.
Source: Social media Marketing Industry Report, www.socialmediaexaminer.com

The time commitment also varies according with business type. The chart in fig.4 shows how different-sized businesses invest their time with social media activities.

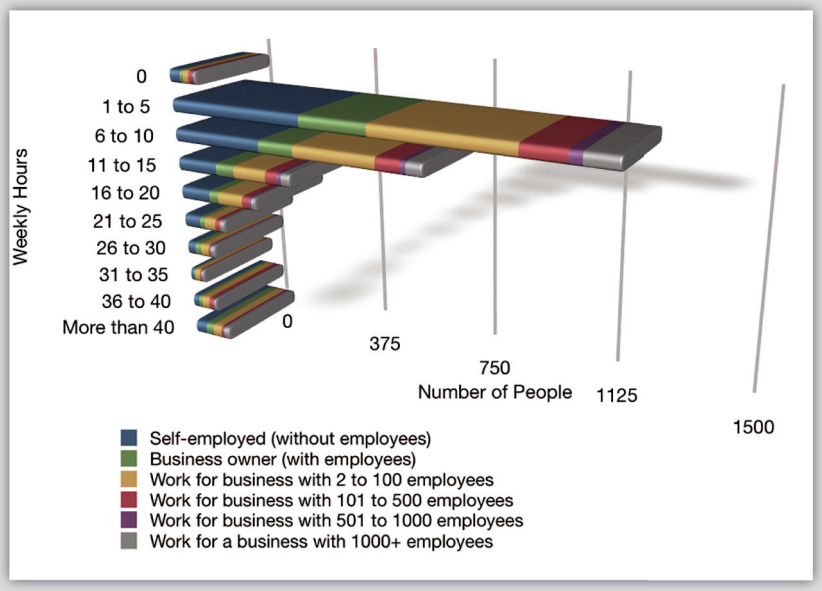


Figure 4: Time commitment for social media marketing according to the business type.
Source: Social media Marketing Industry Report, www.socialmediaexaminer.com

There's a direct relationship between age and time spent on social media. The younger the marketer, the more time he or she spends on social media. People aged 20 to 29 years spend more time than other age groups using social media marketing (with 41% spending 11+ hours weekly), followed by 30- to 39-year-olds (37% spending 11+ hours per week). This is an increase over our 2010 study.

Business benefits of social media marketing: The number-one benefit of social media marketing is standing out in an increasingly noisy world. A significant 88% of all marketers indicated that their social media efforts have generated more exposure for their businesses. Improving traffic and subscribers was the second major benefit, with 72% reporting positive results. Nearly two-thirds of marketers indicated a rise in search engine rankings was a benefit of social media marketing. As search engine rankings improve, so will business exposure and lead generation efforts, and overall marketing expenses will decrease. Slightly more than half of marketers found social media generated qualified leads (fig.5)

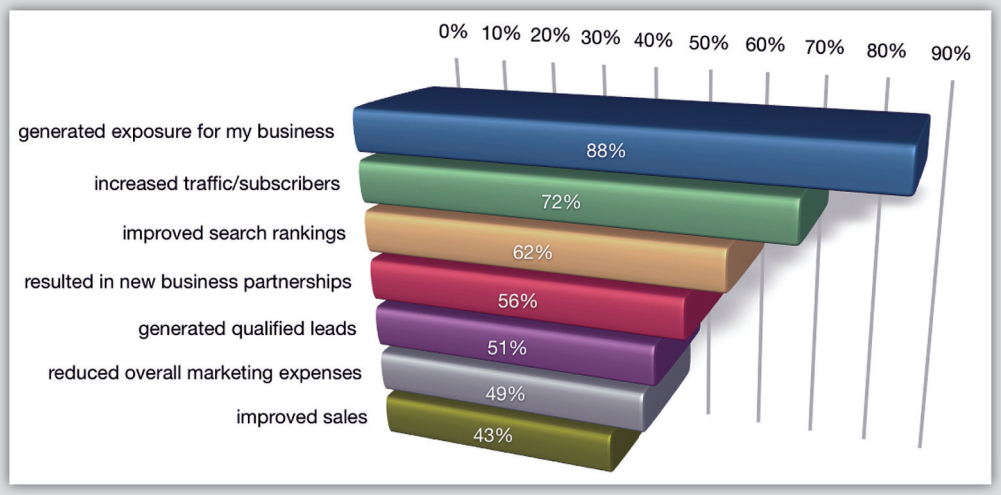


Figure 5: Benefits from social media marketing, business point of view
Source: Social media Marketing Industry Report, www.socialmediaexaminer.com

Reduced overall marketing expenses: The main financial cost of social media marketing is the time it takes to gain success. However, a significant percentage of participants strongly agreed that overall marketing costs dropped when social media marketing was implemented. The self-employed (59%) and small business owners with 2 or more employees (58%) were more likely than others to see reductions in marketing costs when using social media marketing (fig.6,7).

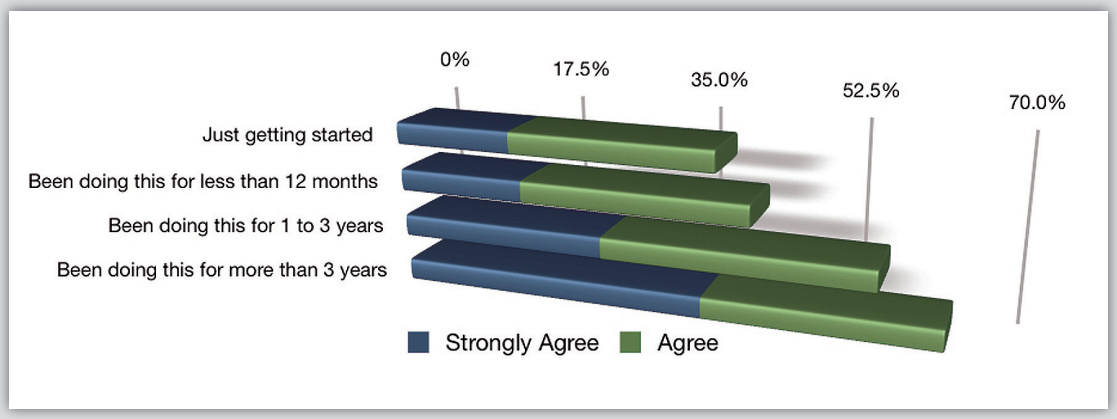


Figure 6: Reduction of marketing expenses according to the time using social media.
Source: Social media Marketing Industry Report, www.socialmediaexaminer.com

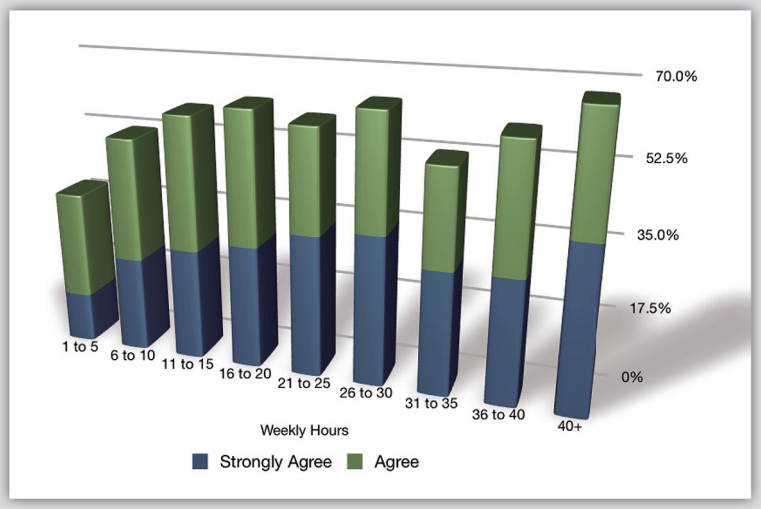
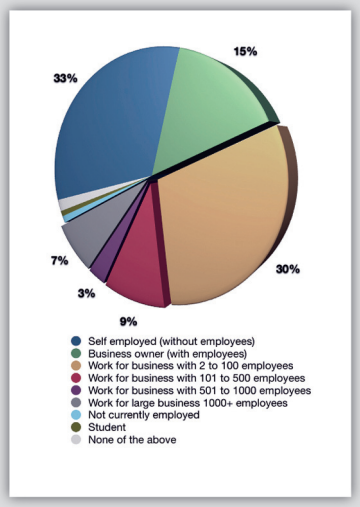


Figure 7: Reduction of marketing expenses according to the weekly time spending for this procedure.
Source: Social media Marketing Industry Report, www.socialmediaexaminer.com

2.2. Type of firms / organizations that marketing via social media

There are no data or any documentation about the general profile and the type of firms that primary marketing via social media, about their type, size, or other characteristics.
Some data may have throughout the profile of the firms that take part in the various surveys concerning social media marketing, such as the above mentioned survey "2011 Social Media Marketing Industry Report: How marketers are using social media to grow their businesses" elaborated by Michael A. Stelzner – Social Media Examiner. Research team leveraged social media and email to find participants for the survey. They started with a post on Twitter in January 2011. The message was retweeted hundreds of times by other marketers. In addition, many people posted links to the survey on Facebook, LinkedIn and other social media sites. They asked survey participants to help spread the word about our study. Finally, a list of 50,000 marketers was emailed and asked to take the survey. Finally, they closed the survey with 3342 participants.
The largest group who took the survey was self-employed (33%) followed by people working for a company with up to 100 employees (30%). 19% of people taking the survey worked for businesses with 100 or more employees (fig.8). Most survey participants (74%) were between the ages of 30 and 59. The median age was 40 to 49 (fig.9). Females edged out males, representing 60% of all participants.



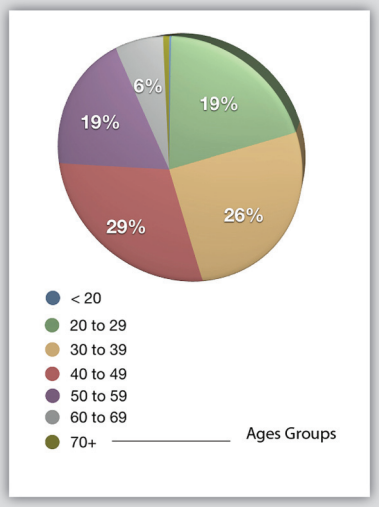


Figure 8-9: Social Media marketing Industry Survey participants. Profile of participants and age of participants.
Source: Social media Marketing Industry Report, www.socialmediaexaminer.com

Social media marketing can work to benefit many different types and sizes of companies. Here is a look at what types of general businesses that social media marketing can help with:

Small and Large Online Business: There are thousands of businesses and more online that use various sizes of marketing strategies. Both small and large businesses need recognition in order to be successful. Especially small businesses thrive on personal attention and connection, and these days, the most common way to do that is to hit social media. That's why small businesses are finding great benefit in using social media sites. By using social media sites, small business owners can stand out in a noisy marketplace, find increased exposure for free, and discover new business partnerships.

Local Business Websites: Local businesses may tend to stick with their locality but this doesn't mean that they cannot use social media marketing. There are networks created for any given locality and the business can be publicized on these.

Non-Profit Organizations: Non-profit organizations sell different products and services and also require marketing plans. Social media can help these organizations also because the networks build up popularity and reputations. For any type of non-profit organization, these networks can be utilized as long as the networks are the correct type for the organization.

Freelancers: The internet has brought on a new opportunity for freelancers but the field is fairly saturated with competition in the majority of the work areas. Social media marketing allows a person to put their name out there to sell their products and services. By building up a large network of friends and contacts, a person can be a very successful freelancer in their field of choice granted that they are good at what they do.

More and more businesses are involved with the social media for their marketing and promotion. But there are some industries that seem to take advantage of social media better than others. For some, social media is just a natural outgrowth of an already established marketing strategy; for others, they've done an exceptional job harnessing the power of social media.[6] Whatever the reason, these industries are finding that social media is an incredibly beneficial tool:

Entertainment: Users love to discuss fashion, endearing moments, and surprising awards, all while watching TV with a "second screen" to connect with other fans. It's clear that TV watching has taken on a whole new meaning, and the entertainment industry is reaping the rewards.

Marketing: It's no secret that marketers are flocking to social media in order to connect businesses with new customers and maintain existing customer relationships. In 2010, 85% of marketing departments surveyed indicated that using social media generated exposure for their business, and 48% indicated that by using social media marketing, they were able to reduce their overall marketing expenses. It's clear they are seeing results and plan to build on this in the future: 81% of marketers have plans to increase their social media presence in the future.

Retail: According to CBS News, 45% of retailers are active on social media. Often, brands are able to get feedback and nip customer complaints in the bud, leading to increased consumer loyalty and positive word of mouth.

Consumer Technology: Especially for the most known firms, users openly share their love for products on social media, and bloggers especially contribute to the fervor that surrounds every new announcement.

Old media: Old media is increasingly flocking to (and thriving on) social media. Foreign correspondents who used to read local papers and visit the foreign press club are now hitting Twitter for the latest leads. But social media is good for journalists in more than just news gathering: newspapers, TV stations, and other news outlets are enjoying increased interaction with readers and viewers, a practice that now goes way beyond letters to the editor and has expanded into real time Twitter conversations and Facebook comments.

6 According to On Line College – 11 Industries That Benefit the Most from Social Media, on http://www.onlinecollege.org/2012/03/26/11-industries-that-benefit-the-most-from-social-media

Fashion: Old media is simply too slow for the fashion industry, which has found new life on social media. This industry has found communication that moves as quickly as fashion does. Brands are able to personally connect with their target markets, and learn about reactions in real time. Moving to social media has allowed fashion to enjoy genuine interaction and an increased sense of customer loyalty.

Travel and Tourism: The highly competitive travel industry has been highly advantaged by the social media. Travel agencies, websites, and tourism boards have hosted travel competitions, winning Facebook Likes and Twitter mentions that help propel them to the forefront of customers' social media spheres. Last-minute travel deals are shared with renewed fervor, and travelers can share immediate feedback, helping to attract new customers. Further, travel companies are able to act quickly on customer complaints, offering a new level of customer service that can help build and maintain a good reputation for the company.

Restaurants and food industry: Restaurants, and the food and beverage industry overall, have found great value in social media. So many small restaurants struggle to maintain a functional website, but many have adopted social media channels to share, promote, and get feedback on their restaurants. As customers check in, post photos, and share reviews, they're bringing attention to the latest and greatest eats in their local area. Restaurants can build a positive (or negative) reputation in lightning speed, where new restaurants used to have to wait several months to build a presence.

There are other business and organizations that can benefit from using social media marketing. It is not necessarily based on the product or the service although the social media site that is used should be suitable for it. Often, it is the type of exposure that a person wants for their business that would prompt them to use this type of promotional strategy.

2.3. Small business' marketing via social media: success stories

A little Toronto start up called Rypple applies social thinking in a different way- for internal employee management. Its social evaluation tool lets everyone in a company rate everyone else and gives people continuous real time feedback. It taps social and peer pressure to make job evaluation more effective at driving future performance. The product was largely developed in a beta installation at Facebook itself, whose internal organization strives to be flat and unbureaucratic.
Rypple, which has raised $13 million in funding, is a web-based social performance management platform that helps managers and employees improve performance. Essentially, Rypple replaces the traditional performance review with a more social and collaborative approach. The software allows managers to track projects, guide their team and give kudos to deserving staff for others to see within its online application.
The software employs various game mechanics, like badges, which can be custom-built to reflect a company's own values. And employees can rack up "skills earned," in a method reminiscent of building up a character in a virtual world or MMORPG, for example. Rypple also recently launched a new mobile application that allows managers to give real-time feedback to staff, provide coaching, track goals and publicly recognize colleagues. Founded in 2008, Rypple counts Facebook, Gilt Groupe, and Spotify as users.

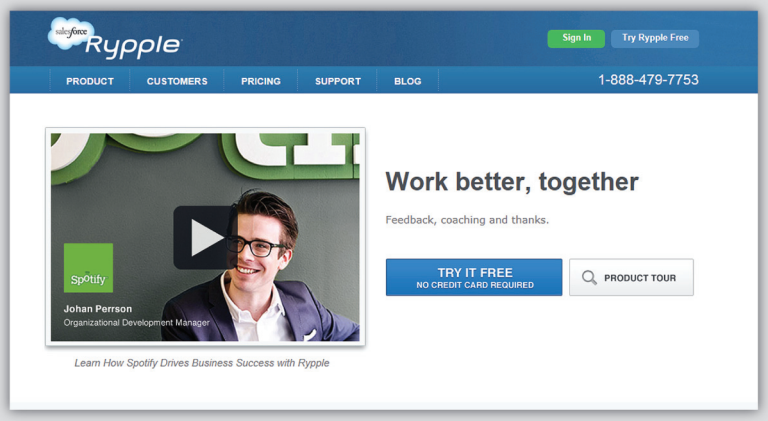


Figure 10: Rypple application.
Source: www.rypple.com

AJ Bombers is a burger restaurant located in Milwaukee, Wisconsin that ramped up in a very tough economy in large part by a high level of creativity around the social media space. They have invested the time to build a personality across a number of platforms like Twitter, Facebook, Foursquare, and YouTube. The business understands it needs to drive people to the actual location and have done so with social media.
The road to success for AJ Bombers was considerably shorter, although there were plenty of reasons to think the business would fail quickly: It was launched in the middle of the worst recession in generations and was located at an address that had seen at least five businesses fail in recent years. AJ Bombers' one-year path from grand opening to the pages of the "Wall Street Journal[7]" speaks volumes about the way social media is changing business. AJ Bombers' successful use of social media demonstrates the power of the medium. The restaurant's constant attention toward building awareness and energizing fans has included:

- Active engagement on Twitter and Facebook. On Twitter, AJ Bombers has tweeted more than 10,000 times to its 3,000 followers. On Facebook, the restaurant updates its status several times a month and engages with over than 8,000 fans /"likes" (fig.11)

Figure 11: Restaurant AJ Bombers' Facebook page with 8.975 likes.

- Offering new FourSquare mayors a free burger and fries[8], encouraging repeat visitsand checkins among its fan base. The restaurant was recently among 30 small businesses to test new FourSquare analytics technology to track user data and create more engagement.
- A promotion launched with a YouTube video, creating a contest that permitted one lucky winner to earn free burgers for a year.
- A promotion launched with a YouTube video, creating a contest that permitted one lucky winner to earn free burgers for a year.
- Regular tweetups to draw fans to different events, such as a holiday party and Bloody (Mary) Brunch.
- Turning a stolen sandwich board into a local news items thanks to a reward offer and smart use of Twitter.

7 http://online.wsj.com/article/SB10001424052748703787304575076001164243926.html?mod=wsj_share_twitter

8 Users visit the FourSquare Web site (developed by another start-up that integrates social media with marketing, the FourSquare Labs Inc.) to download a free mobile-phone application for a participating merchant. When customers visit the participating establishment, such as a restaurant, they can "check-in" via the mobile application, letting their friends know where they are and racking up possible points with the merchant. The application uses global-positioning technology so that consumers need to be at a business to get credit for checking in—though technically they could just be close by. It also offers consumers the option to notify members of their Twitter and Facebook networks whenever they check in to an establishment (source: Wall Street Journal - http://online.wsj.com/article/SB10001424052748703787304575076001164243926.html?mod=wsj_share_twitter)

2.4. Techniques and tools for social media marketing

Even though it's hard to turn around without hearing a reference to one of major social networks such as Facebook, LinkedIn, YouTube, Twitter, Myspace, there are various other community spaces / sites. An article in "USA Today[9]" in May 2008 estimated there would be nearly 250,000 sites calling themselves social networks within the year 2009, compared to the about 850 recorded in May 2008. While there may not be that many social networks on the Internet today, one fact that's indisputable is that the number of users is growing, and they're gravitating toward several key sites.

Some of the social media techniques that may be useful in social media marketing are:

Social Media Optimization (SMO) and Social SEO (Search Engine Optimization)

Social media optimization (SMO) is a set of methods for generating publicity through social media, online communities and community web sites. Methods of SMO include adding RSS feeds, adding a "Digg this" button, blogging and incorporating third party community functionalities like Flickr photo slides and galleries or YouTube videos. Social media optimization is a form of search engine marketing. Social media optimization is in many ways connected as a technique to viral marketing where word of mouth is created not through friends or family but through the use of networking in so¬cial bookmarking, video and photo sharing websites. In a similar way the engagement with blogs achieves the same by sharing content through the use of RSS in the blogsphere and special blog search engines.

Social Media Analytics and Reporting

Companies that marketing via social media have discovered that social media analytics is crucial, especially for customer feedback and building goodwill. Such social analytics include the listening platforms from companies (such as General Sentiment, Attensity, Expert System and Telligent Systems) that are used by advertising agencies, corporate marketing departments and call centers to scan popular social media networks. The analytics allow marketers to identify sentiment and identify trends in order to accommodate the customer better. There have been significant examples where companies have used such analytics tools to engage customers in response to their feedback.

Social Bookmarking and Tagging

Social bookmarking is the collaborative equivalent of storing favorites or bookmarks within a web browser. Social bookmarking services such as del.icio.us or Furl allow people to store their favorite web sites online and share them with others who have similar interests. Social bookmarking is an excellent way to share the collective intelligence of the Internet and tool that business marketing via social media may exploit.

Tagging is the way of categorizing online content using keywords that describe what can be found at a web site, bookmark, photo or blog post.

Viral marketing campaigns

Viral marketing concerns the planned promotion of a product, brand or service through a process of interesting actual or potential customers to pass along marketing information to friends, family, and colleagues. This word -of-mouth advertising is now accomplished by a creative use of social media and other non-traditional marketing channels. Most usual viral campaign is the viral video (via Youtube, Vimeo etc) refers to video clip content which gains widespread popularity through the process of Internet sharing, typically through email or IM messages, blogs and other media sharing websites. Viral videos are often humorous in nature and may range from televised comedy sketches to unintentionally released amateur video clips.
The future of the social networking seems to be very flourishing for the next years. What is anticipated to change is its existence as a distinct product category and how it is going to change as we move from Web 2.0 to Web 3.0.[10]

9 http://www.usatoday.com
10 "Marketech-Tools and trends in Marketing technology" available on line on http://expertaccess.cincom.com/wp-content/uploads/2009/10/Marketech_Final_wCinacomLogo.pdf

According to "Global Enterprise Web 2.0 Market Forecast: 2007 to 2013[11]," a report issued earlier this year by Forrester Research, large companies are expected to spend $4.6 billion by 2013 on Web 2.0 technologies, with social networking, mashups and Real Simple Syndication capturing the biggest share. It's part of a trend that, over the next decade, will morph into Web users look¬ing not just for Web pages that contain the information they want, but also for Web services that provide constant updates on items that appeal to their individual interests and needs. We'll be moving toward a platform that interconnects people, organizations, services, products, Web sites and more.

It is anticipated for business and marketers to include features that move them toward making existing applications more interconnected and cooperative: A browser that instantly shows the most interesting content for the user, search engines that return fewer, better results – every time and access to contacts' current details all the time.

3. IMPLEMENTATION PROCEDURE

3.1. Steps/Phases for a successful marketing strategy via social media

As it is obvious, there is no need for specific, high cost and high technology infrastructure for a business to implement its marketing strategy via social media. The most crucial theme for a business in order to implement a successful marketing strategy via social media is the constitution of a clear strategy for not been lost in the social media "noisy sea". Moreover, a social media marketing strategy has to keep some specific characteristics in order to avoid customer or users invasion.

For avoiding these problems and having a successful marketing via social media, business should take into account some tips[12]:

1. Understanding the importance of strategy, not only the tools and the techniques
2. Map out the basic plan to help guide the way to marketing via social media
3. Access their social capacity and what resources aiming to invest in order to built strong relationships
4. Building solid business infrastructure to support the weight of social media (management, technology, responsible employee, customer services). A crucial first decision for a business is the decision to structure a social media marketing by its own recourses or otherwise to outsource this procedure
5. Navigating the social media "sea of noise" using monitoring tools and listen foropportunities to interact
6. Filtering connections for relevance and building business value by connecting the right audience, content, channel and time (fig.12)
7. Understanding the business audience. Business should learn about the needs of the audience and keep testing ways to move from connection to engagement
8. Business should first interact and secondly promote the products and sell. Otherwise marketing will be an invasion for their followers / social media users
9. Built relationships to help float campaigns not the opposite
10. Humanization of the brand is another crucial theme
11. Understanding the ethical scale when marketing via social media

11 Young, O. (2008), "Global Enterprise Web 2.0 Market Forecast: 2007 to 2013", available on line on http://www.forrester.com/go?docid=43850

12 Based on: Smiciclas M. (2011), 19 social media best practices, Social media explorer com. Available on line on http://www.socialmediaexplorer.com/digital-marketing/19-social-media-best-practices-video

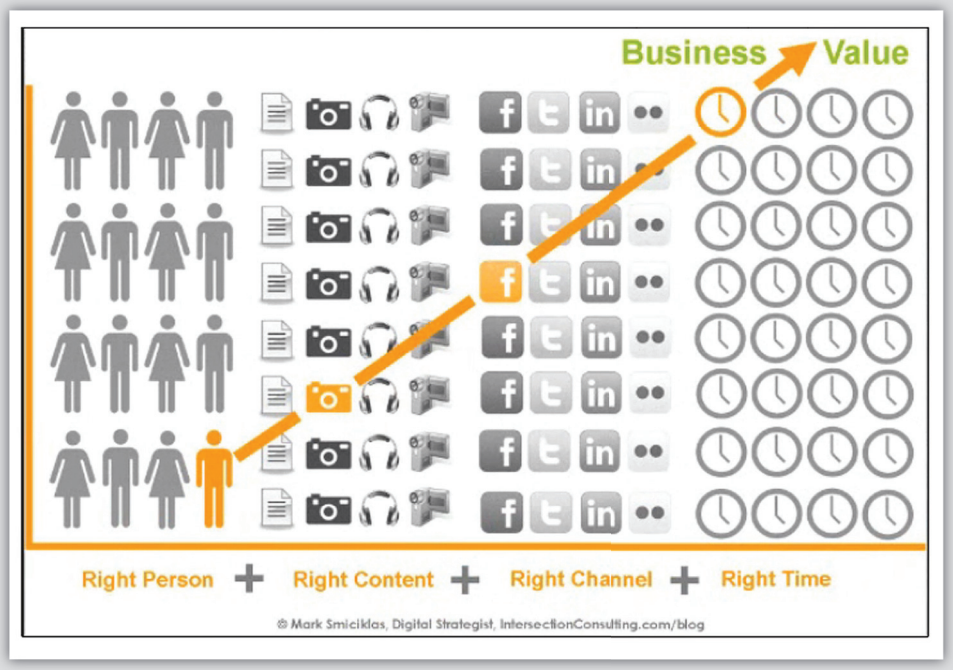


Figure 12: Building business value by connecting the right audience, content, channel and time.
Source: Graphic by Mark Smiciklas, on http://www.socialmediaexplorer.com/digital-marketing/19-social-media-best-practices-video

3.2. Cost of implementation of a marketing strategy based on social media

One of the most frequent questions referred to the implementation of a new business marketing strategy is the cost and the cost effectiveness. Internet marketing in general is the most low cost and recourses for business to implement an overall strategic approach. Especially, local and small business owners are discovering that social media marketing can be a cost-effective and easy-to-use way to build relationships with current and potential customers. While it still lags email and advertising in proven effectiveness, the high level of usage by local and small businesses indicates that business owners feel the benefits outweigh the risks.

The chart below (fig.13) ranks various marketing tactics in a variety of ways. Social media marketing is No2 to email in terms of ease of use, cost-effectiveness, and comfort and knowledge. If we take into account the difficulty of some business owners (especially the most aged) to reach this new approach, we could say that the social media will take the first place in this rank.

Reasons that US SMBs Use Select Marketing Tactics, April 2011

% of respondents

1 Email
2 Social media
3 Direct mail
4 Advertising
5 QR codes
6 Mobile marketing

	1	2	3	4	5	6
Ease of use	60%	53%	40%	39%	34%	32%
It is cost-effective	59%	54%	31%	30%	19%	27%
Comfort and knowledge in this area	40%	39%	35%	38%	24%	18%
Proven effectiveness with response rate, sales, etc.	38%	30%	36%	43%	17%	18%
My competitors are using this channel	20%	30%	22%	28%	29%	25%
None of these	4%	3%	9%	7%	11%	16%

Source: Pitney Bowes, "Small and Medium Business Owners Summary Report," May 20, 2011

www.eMarketer.com

Figure 13: Reasons that US Small and Medium business select marketing tactics.
Source: http://www.emarketer.com/Article.aspx?R=1008425

The real cost of social media marketing campaign is depended of the recourses that a business want or be able to spend for this; if the business can handle everything in-house, or need to outsource some of the work or all of the work.

In general, it's better for a business not to outsource their social media efforts. External consultancies can advice small business for the overall strategy and how to craft content that will be more valuable to customers and show them how to encourage interaction, but they won't be able to match the passion or understanding that the owners have for their business. That can't be outsourced.

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