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# INDUSTRY 4.0, M2M, IOT&S – ALL EQUAL?

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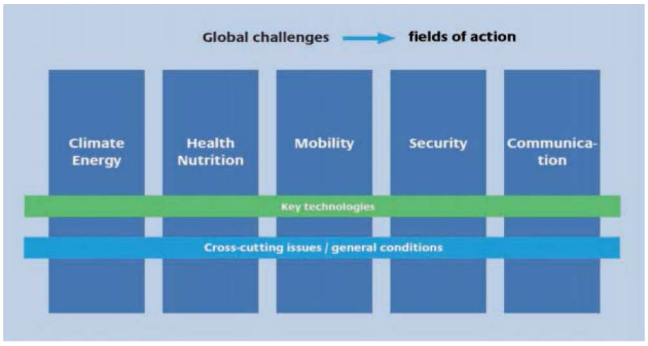
**Abstract:** *Similarity between Industry 4.0, M2M, IOT&S. Advantages and disadvantages obtained using this three important methods. Decreasing costs while components are getting smaller and smaller in a world with better networking. Influence of business management applications integrated in smart factory logistic. The most important impacts in merging virtual and real production world, with the improvement of best processes having the same goal: creating value by open innovation.*

**Key words:** 4th Industial Revolution, Smart Products, Benefits

## Introduction

Emerging the economic and financial crisis, the global race for knowledge is quicker day by day and the competition for new technologies is intense due to the global challenges. All this can be foreseen through the dissemination of the researcher's innovations from all life fields, including health, nutrition, security, etc.

**Figure 1: Important points of global changes**




Source: BMBF (2013)

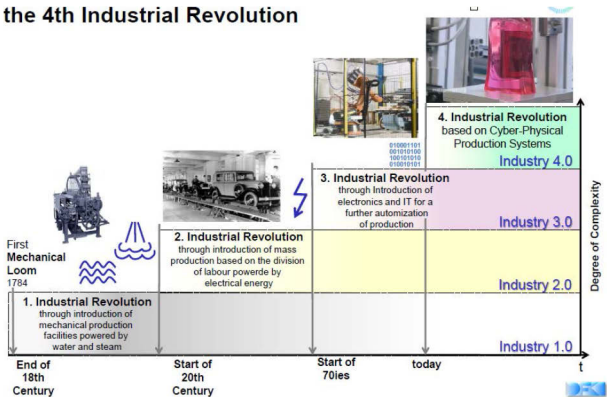
The future next to us is facing the huge impact of industrial revolution on our lives. Intelligent products are telling machines what to do, the processes are managing their aims by themselves, cyber-physical production systems are integrating technology that enable a good communication between machines and products through Internet of Things. "Smart Products" and "embedded systems" will be one day able to tell decentralized all the steps that products need to become reality in the world of production respecting the needed flexibility and productivity. Linke(2012)

## From Industry 1.0 to Industry 4.0

The first steps in industrialization were taken by the creation of mechanical equipment at the end of the18th century. This moment was marked by the *First Industrial Revolution*, which was followed by the *second on*e beginning with the 20th century together with the implementation of electrically-powered mass production of goods. The *third revolution* was started during the 1970's using electronic information and devices which led to increase automation of manufacturing processes, and the first steps in eliminating the manual labor were already made. The industrial manufacturing processes did support a lot of changes for several decades, but the last 30 years where marked by the IT revolution, with its radical transformation and implications in our life. This impact is almost the same with the former impact of the first Industrial Revolution. Autonomous

microcomputers, are provided through smart networks, using cloud computing following the protocol IPv62 from 2012 with implications in networking resources, people, databases inventing the Internet of Things and Services that rolls to the new and visionary Industry 4.0.

**Figure 2: Steps of Industrial Revolution evolution**




Source: Hoppe (2013)

Some of the most important characteristics of Industry 4.0 are:

- A good interaction between all the actors and resources involved in manufacturing and warehousing systems; smart factories are embedded into inter-company value networks; end to end engineering accompanies manufacturing processes and products;
- Production is more and more attractive, sustainable and profitable in urban environments;
- Smart products are easy to be indentified in any location and time of their way to became real and will know all the details of their own manufacturing process, in the same time controling all live stages; business management applications is integrated in smart factory logistic, deployment and maintenance;
- The design, configuration and manufacturing phases, will include individual customer and product specific features with last minute changes that will led to profitability for small quantities of goods; easy controling, regulating and configuring resource networks;
- Employees will be able to focus on creative value-added activities because of the flexible working conditions;

The implementation of Industry 4.0 did already start, involving an evolutionary process and a lot of benefits.(Wahlster, 2012) Saving energy today is an important task. Production facilities, like integrating capability to power down inactive parts during production breaks, weekends and shifts with Industry 4.0 is important for saving energy. Statistics said that 12 percent of total energy consumption of an assembly line occurs during breaks in production. The machine remains powered up even if the line is working five days a week in three shift pattern. Now, implementing Industry 4.0 the potential on energy saving is growing, because during longer breaks a kind of standby mode (Wake-On-LAN) is used. "The increasing extractors will use speed-controlled motors that can be adjusted to meet requirements instead of motors that cannot be controlled in this way. In the case of the laser sources, completely new systems are the only way of delivering improvements. Taken together, these measures enable a reduction of 12 percent of total energy consumption to be achieved (from 45,000kWh/w to approx. 40,000kWh/w), together with a 90 percent cut in energy consumption during breaks in production. These energy efficiency considerations should be taken into account right fromthe earliest stages when designing CPS." The final goal is achieving a 20-25% energy and resources savings.

The most important impacts of the Industry 4.0:

"• Merger of the virtual and real production world, the products themselves control their manufacturing, distribution and billing;

• The human being itself as operator of future assembly lines would not even be physically present at the factory, falling development costs, operations, sales and billing;

• One-off production at prices charged for mass production become possible, improved, new processes to create value; Radical increase of the product diversity and rising development speed, increased innovation ability - idea of „open innovation".

**Figure 4: Power saving today and tomorrow**


Source : Wahlster (2012)

Almost 80% of the companies are already evaluate machine data, sensor data and service data.

**Researching for the next industrial revolution M2M**

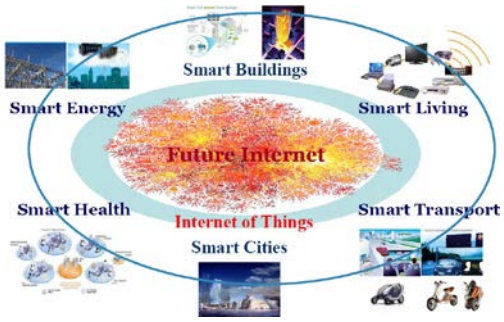
Research goes on…another part of this is for example the RES-COM project, **machine-to-machine communication M2M**, and implementing of new IT platforms sponsored by the German Federal Ministry of Education and Research. Linke(2013)

In our days, the handling of limited resources is a social challenge. Energy, water, air will be software-driven by IT systems. Resources will be connected through highly interconnected and integrated sensor-actuator-systems. Industrial products and ordinary objects will be capable to communicate their status and the stage of production or maintenance connecting integrated memory and communication capabilities, sensors, actuators, and digital product memories. "This new generation of products can use machine-to-machine communication (M2M) to mutually exchange information, initiate actions, and interactively control each other via the Internet. Interruptions of the production cycle, or material bottlenecks are detected and corrected in a timely manner by decentralized sensors. In the RES-COM project, prototype scenarios for resource efficiency are being implemented by means of highly networked and integrated sensor-actuator systems, from embedded systems to cyber-physical systems An example for the benefits of RES-COM is the transparency and optimization of the operating infrastructure in terms of an "Energy-Supply-Chain", the use of materials to support the vision of "no waste" production, as well as for intelligent process management, perhaps by adopting a technology like the automatic start-stop mechanism used in automobiles for the field of urban production. Active product memories capture and analyze the resource use in a decentralized manner and communicate among themselves for the autonomous optimization of the underlying process. RES-COM addresses these requirements through a network of local, distributed, autonomous systems with key structures that support the vision of a future "Internet of Resource Efficiency." Rescom(2012)

Implementing assets information management, is now done using cloud technology. For example in Endress+Hauser company, from their thousands of individual components, only one of these intelligent components relays a message requesting maintenance or reporting a malfunction, the responsible technicians often require information that is stored in various and different IT systems operated by different stakeholders. This information includes manuals, maintenance histories, malfunction reasons, and currently available software updates or firmware. With the help of asset information management, all this information can be merged transparently for the maintenance technician in a fraction of a second – irrespective of which database it is stored in. This not only saves time and money, it also increases plant availability". Linke (2013)

Important portfolio is made by integrating devices in control systems delivering values via digital communication. Part of the most important benefits are reducing costs, risk free of transfer throughout customized trainings, combining practice and theory. A lot of standardization committees and user organizations ensure a good connection with the new trends. Digital communication is now based on two-wire architectures which fulfill all requirements of the new system. In the future, however, employees will receive a message on their smart phone asking them whether they are available to work and when.

**Figure 7: Smart World**




Source : Dignan (2013)

**Internet of Things -key points**

It was the initiative that simultaneously forecast and foster a fundamental paradigm shift in the design of production processes with information embedded in individual work pieces that are linked to a cloud platform. Schonegger(2013)

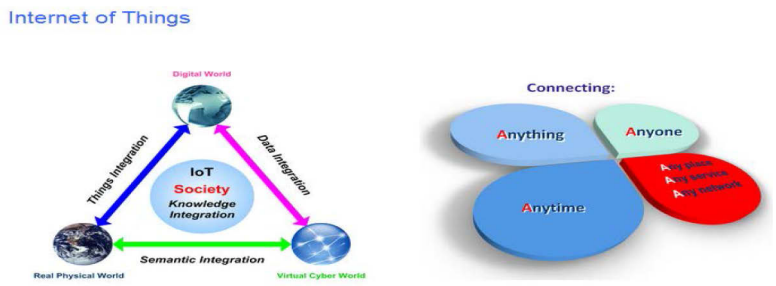
Internet of Things, is a game changer for many industries and sits in the intersection of cloud computing, big data and mobility. Compliance, regulation and standards matter regulated industries that face numerous compliance rules. Creativity is the key to create an ecosystem where developers can take advantage of interoperability to network and analyze various sensors and data points.The technology is moving to almost all domains. Now that networking equipment and "wireless carriage have dramatically decreased in cost, wireless coverage, speed, and capacity have also increased, we can now embed connectivity into the "things" we use in our day-to-day lives. That translates to new business intelligence (BI), operational efficiencies, and revenue-generating opportunities". This means sooner as we can imagine, THINGS, will be able to communicate their location, allowing for real-time parcel tracking. Machines can be set to follow existing parameters, or to feed data through to humans, or to learn to go where the attention is needed. Although the experts disagree on the exact number of "things" that will be connected to the internet, one fact is clear: it's going to be massive. Dignan (2013).

What makes an object smart? Almost any manufactured good now includes an embedded processor, together with user interfaces, that can command and control functionalies of the object, having also the ability to communicate with you through touchpad or switches. After a device becomes smart through the integration of embedded processing, the next logical step is remote communication with the smart device to help make life easier. For example, if I am running late at the office, can I turn on my house lights for security reasons using my laptop or mobile phone?

Some of the most representative categories for IoT-related applications:

1. Interconnected devices with unique IDs interacting with other machines/objects without data mining of people's behaviors having as final goal simplifying people's lives;
2. Leveraging the data that gets collected by smart devices with sensing and connectivity capability and data mining for trends and behaviors that can generate useful marketing information to create additional commerce;
3. Connecting smart devices (nodes) to the web coming together to accommodate the Internet of Things sooner than most people expect will touch every aspect of our lives;
4. Services will be able to interact with smart things/objects using standard interfaces that will provide the necessary link via the Internet processes without direct human intervention.Karimi (2013)

**Figure 9: Internet of Things**



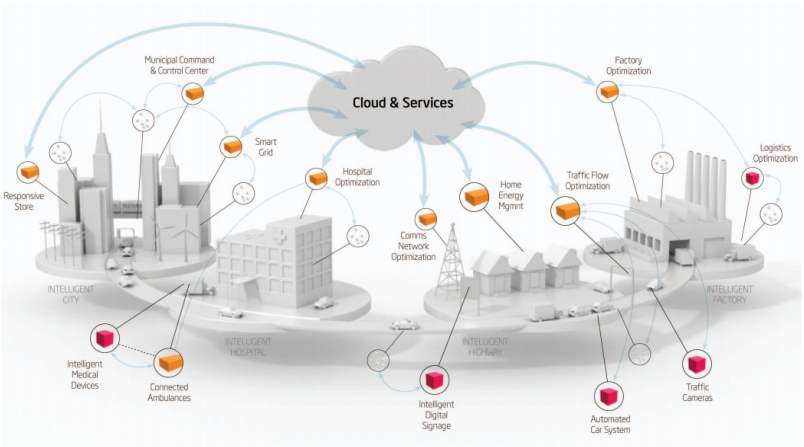

Source :http://www.internet-of-things.no/iot.html

**Conclusions**

Working places will transform themselves and companies will adjust to the new economic and industrial changing structures. Frameworks conditions will be in line with the customer interests. Smart products volume will have high precision and quality. The base of Industrial Revolution are cyber-physical systems combined with Internet of Things and Services will influence our day by day life. Wahlster (2012)

Future Internet and Internet of Things technology will include almost every domain : IoT technologies , IoT-resources, IoT labs. http://www.internet-of-things.no/iot.html Using data to make objects smarter, connecting people through social networks, creating new opportunities and changing the way to perceive networks offers unlimited possibilities, some of them known other still to be discovered. The next "big thing", will be the symbiose between the real world and virtual one. Accumulating data is not enough, there are needed tools to understand it. Development of the Cloud infrastructure, improved hardware technology allows manufacturers to manage their production processes and react to unexpected events immediately. Manipulation of the massive data flow through enhanced visualization and analytic tools would bring enormous value to the companies processes and production. "Internet of things market is predicted to generate between $1.2 trillion and $14.4 trillion in revenue and represent over one trillion connected objects by 2023".

**Figure 10: Opportunities in applying IoT**




Source : http://hutgrip.com/blogs/market-opportunity-for-the-next-big-thing/

The goal is to improve their return on assets (ROA) by optimizing processes and resource consumption, reducing all production downtimes and achieving higher end product quality and consistency. http://hutgrip.com/blogs/market-opportunity-for-the-next-big-thing/ This **social network-style** approach is intended to simplify the tedious process of coordinating shifts and to make data available quickly in systems. As a result, employees can easily add or take credits from their time accounts and the company can keep its production process flexible. Bearing in mind the highly volatile nature of production demand, the ability to deploy employees flexibly is a major advantage. Linke(2013) The **future market of M2M** goes on to offer some new opportunities:

– Generating growth sectors around new jobs and synergies with macroeconomic benefits: improved safety, service and lower costs;

–An energy turnaround is inconceivable without M2M; E-Health and E-call are only two of the possible specific examples of benefits for the consumer;
- M2M has vast potential for industries such as healthcare, utilities, manufacturing and transportation to name a few, but is still nascent in many ways. Dignan (2013)

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