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ERP-PCS Connection in the Cosmetics Industry: Opportunities to Increase Energy Efficiency

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Abstract: This paper emphasizes the prolific effects of Enterprise Resource Planning (ERP) implementation in a large cosmetics company by means of increased technological discipline, and reduced consumption of materials, packaging and energy, while establishing an efficient organization of production, in direct terms of productive staff and capacity utilization. The authors also present in this article their own plans for a promising Enterprise Resource Planning Process Control Systems (ERP-PCS) connection. PCS systems log valuable information on technology and business processes (utilization of raw materials, wrappings, accomplished production, *etc.*), founded on data monitoring of the production automation equipment: electronic flow meters, electronic scales, sensors and transducers, digital countdown and supplementary specific devices. This connection, together with ERP systems' dedicated modules, could determine real time data retrieval on materials, packaging, energy consumption and outputs, thus providing valuable information to the company managers for resourceful decision making processes.

Keywords: Energy Efficiency; Reduce Consumption; Erp; Pcs; Bluetooth

JEL CODES: L53, E21, O31

1. Introduction

Enterprise Resource Planning (ERP) integrated computer systems are designed to model the entire business flow of a company (Comes, Marian, Ghisoiu, & Bircea, 2007), (Res, 2011), and through dedicated modules, they cover its whole economic activity. In an attempt to fully automate the input/output operations to and from an ERP system in order to maximize its performance, it comes into connection with specific software dedicated terminals, such as barcode readers, Personal Digital Assistant (PDA) s, but there is also a need for a more direct communication to important data offered by PCS: electronic dispensers, flow meters, weighing machines, counters, temperature sensors, pressure sensors, *etc.*
Based on information dematerialization, through its transition to digital formats and the large-scale use of EDI (Electronic Document Interchange), ERP systems provide full support for the business management

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needed for specific workmanship. Furthermore, if the modules that manage purchases or sales activities are terminals that generate digital data (taken via the ERP data port), then for production activities, ERP systems generally stop at the border with the production process. To be precise, data from the system are not used directly in the production process but are embodied in specific documents made available to operators from the production area. As a consequence, these human operators will provide input data for ERP as regards the production's progress and outcome, which consists of verifying PCS data then entering it into ERP's forms. We do not try to itemize the reliability and consistency of data provided by human operators, but only remark that data are already "filtered" before becoming actual entries in the system. Along with our proposals of new efficient technologies, equipment and Bluetooth connectivity, we present in this paper various important studies in the field related to hardware and software technologies involved in a projected ERP-PCS connection. Its implementation could lead to a more industrious functioning but also to promising energy savings. Overall, these studies are related to:

- Equipment and technologies related to tracking technological processes, production, consumption of materials and losses, with genuine energy savings in different forms (electric, steam, compressed air, hydraulic, *etc.*). They are also related to several PCS sub-domains, its state of the art and some appealing points of view;
- PCS-ERP conveyed technologies, whose employment might be essential for hardware electrical energy efficiency (communication technologies, distributed systems such as grids, clouds, *etc.*).

These technologies can provide multiple benefits but may also require significant investments from the company. In the current economic downturn and fierce competition for endurance, large firms are more cautious in making large investments and especially long term ones

2. **Literature review**

Current business and manufacturing requirements involve flexibility, efficiency and reduced costs, but also include concerns for the environment and safety, and necessitate integrated advances from high-level management to plant processes (Kwon, Ryu , Sohn, & Chung, I, 2009, pp. 1-8) . Unfortunately, issues have been unconnectedly dealt with, hardly considering the existing relations, with higher costs and time consumption, based on separate databases and software systems.
Infrastructure systems from production, energy and services sectors rely on automatic control systems for secure and efficient operation. They constantly gather huge numbers of measurements (Brundle & Naedele, 2008, pp. 24-29) about the goods and services that we take for granted (electric power, potable water, sewage disposal, fuel, processed food, pharmaceuticals, *etc.*) and then take urgent actions through actuators, valves, pumps, or signal an alarm to human operators. Such control processes are principally achieved in three steps (Hughes, 2006) :

- Monitor a parameter;
- Compare the parameter to a certain value;
- Launch a control action in order to get the parameter nearest to the value.

The control systems (Cárdenas, et al., 2011, pp. 355-366) are considered nowadays to be computer-based systems that monitor and control physical processes, and are regularly made of a range of networked agents, including sensors, actuators, control processing units (like programmable logic controllers PLCs), and communication devices. It is important to mention that the actions linked to process control have always existed (Hughes, 2006):

- First, in the form of a "natural process control"—any operation that regulates some internal physical characteristic that is important to a living organism (body temperature, blood pressure, heart rate, *etc.*);
- Then in the form of an "artificial process control"—actions that regulate some external environmental parameters to maintain life (maintain the environment's temperature);
- Then came into use the term APC "automatic process control" (without human intervention) due to automatic procedures for more efficient production and processing of materials, manufacturing of products or processing of material.

Automation is an essential part in process control implementation, due to its involvement of complex assignments that could be exposed to human faults (Nicol, Sanders, Singh, & Seri, 2008, pp. 30-36). At the same time, a further supervision of these systems is needed, in case of possible malfunctions. Some scholars (Jui-Chin, Feng-Yuan, & Chun-An, 2008, pp. 3-7) use the general term APC to name the engineering process control (EPC), which is the principle for the application of feedback control.
It is commonly utilized for continuous mass manufacturing procedures, which rely on automatic production lines. Anchored in this process, human operators or automated machines are instructed to continuously regulate the controlled variables. Based on the involved applications, the modern control systems can be classified in (Cárdenas, et al., 2011, pp. 355-366) :

- PCS (Process Control Systems)
- SCADA (Supervisory Control and Data Acquisition) Systems perform central functions in critical infrastructures *(i.e.* electric power, oil and natural gas distribution, water and waste-water treatment, and transportation), and are integrated with health-care devices, weapons systems, *etc.*
- DCS (Distributed Control Systems)
- CPS (Cyber-Physical Systems) refers to embedded sensor and actuator networks.

These systems evolved from using isolated and purpose-built protocols, interfaces and networks, and operator interfaces, to complex RTU (remote terminal units) and PLC (programmable logic controllers) with embedded operating systems, network ports and web interface for configuration, thus resembling somehow enterprise IT computer systems. Due to economic efficiency and timely business access, COTS (commercial off-the-shelf) technologies are used to connect the control systems to corporate systems, mainly through a DMZ (demilitarized zone) to avoid direct access from the corporate network and possible security problems. Process control systems generally include three main factors or terms (Hughes, 2006) :

- Manipulated variables (e.g. valve and damper position, motor and conveyor speed, *etc.*).
- Controlled variables—conditions that should be kept at certain preferred value (e.g. temperature, moisture content, weight, speed, level, pressure, pH, density, *etc.*). Every controlled variable is connected to a manipulated variable that should be adjusted in order to maintain the preferred value of the controlled variable, despite the disturbances. As a rule, this is done manually by control system operators, or by automatic process control systems.
- Disturbances - affect the process and have a tendency to push the controlled variables away from the preferred value or “set point” (e.g. changes in ambient temperature, in the supply of feed material, *etc.*).

Together with the process control, we have to mention SPC (statistical process control) procedures used to screen process behavior. SPC represents a sub-area of SQC (statistical quality control), and is made of methods for understanding, monitoring, and improving process performance over time (Woodall, 2000, pp. 341-350). One of the main purposes of its featured tool (control charting) in order to prevent overreaction and under reaction to the process is to distinguish between two types of variation (Woodall, 2000, pp. 341-350):

- "Common cause" variation—caused by the inherent nature of the process and could not be changed without changing the process itself.
- "Assignable (or special) causes" of variation—represents abnormal shocks or further disruptions to the process, the causes of which can and should be removed.

Researchers (Jui-Chin, Feng-Yuan, & Chun-An, 2008, pp. 4-6) mention certain control processes adopted by production managers to deal with the systems’ disturbances, such as SPC (statistical process control) and EPC, which could determine a better stability with efficient compensation for the process shifts. They applied control techniques including SPC, EPC, feedback control and adaptive control to model the multiple-input multiple-output (MIMO) process and support high quality management for real production environment.

The control chart records data and checks for process stability, determining the two concepts (Woodall, 2000, pp. 341-350): process "in statistical control" (when the probability distribution representing the quality characteristic is constant over time) or "out of control." Other modern monitoring tools significantly supported by statistical software and data collection systems, include CUSUM (cumulative Sum) charts and EWMA (Exponentially Weighted Moving Average) charts. Increasingly in recent years, the idea of SPC-EPC integration gained more support (Jui-Chin, Feng-Yuan, & Chun-An, 2008, pp. 4-7) for a better adjustment in the process inputs so as to improve the systems' performance. Karcanias and Stupples present their studies (Karcanias & Stupples, 2010, pp. 1-10) on operations and design integration that closely rely on new common standards, thus fracturing the traditional restrictions between technical and managerial disciplines, operational and design issues, and between software and data supporting individual activities. Their approach to the enterprise is through a holistic standpoint, proposing a loop between "top-down" and "bottom-up" approaches, which implies the propagation of high level decisions down to the lowest level and consecutively prompt identifications and reactions to changes at the lowest level. In order to secure the PCS infrastructure (Nelson, 2013), there are organizations *(i.e.* the US National Institute of Standards and Technology) that provided recommendations for PCS configuration, like network access control policies to be obligatory on an entire network. Nicole et al. (Nicol, Sanders, Singh, & Seri, 2008, pp. 30-36) proposed an Access Policy Tool (APT) to express and check a specific class of best practice recommendations, thus offering opportunities for PCS operators to determine whether their systems pursue best practice recommendations.

The APT included complex algorithms to analyze very large systems leading to exploration of many research paths, utilized in the framework of ample visions for critical infrastructure protection. Supplementary surveys referred to transposing English-language recommendations for global policy in a machine-checkable form that PCS administrators could formulate and understand. Further studies (Xiuming, et al., 2012, pp. 68-77) publicized delays (control loop latency) in traditional sampling methods from process control systems, where sensors sample the process data and send it periodically to the appropriate controllers through a field bus. With the purpose of correcting or minimizing the control loop latency, higher than necessary sampling frequencies have been usually implemented, determining avoidable energy losses.

Researchers (Xiuming, et al., 2012, pp. 68-77) proposed a sampling interval control algorithm with non-periodic sampling tasks that have equal maximum and minimum distance constraints, with obvious advantages for wireless control in industrial automation. At European Union levels, an important intergovernmental framework, COST[2], through its actions (such as IC0804) initiated important researches for realistic energy-efficient solutions in several domains of activity, including the sharing of IT distributed resources.

These could play an important part in lowering the energy consumption founded on complementary approaches, like hardware adaptation and innovative algorithms in the distributed systems' layers (middleware, network, applications). Since the distributed systems, such as grids and clouds, have lately experienced a significant expansion, scientists (Da Costa, et al., 2009, pp. 1 - 8) (Da Costa, et al., 2010, pp. 95-104) proposed in recent years integrated frameworks for energy savings, comprising tools and mechanisms to measure, log and present energy consumption data to the users for efficient decision making. Furthermore, Clouds and PaaS (Platform as a Service) providers (Da Costa & Pierson, Characterizing Applications from Power Consumption: A Case Study for HPC Benchmarks, 2011) can also save up to an important part their energy consumption while not influencing the applications too much. In order to accurately model or simulate the power consumption of distributed systems (Glimsdal, 2011), it is essential to evaluate correctly the network appliance energy consumption.

Studies showed that an efficient framework for electrical energy savings in distributed systems should have (Da Costa, et al., 2010) (Kwon, Ryu , Sohn, & Chung, I, 2009, pp. 1-8): an infrastructure that is energy aware through connections distributed autonomic energy sensors, an adaptive resource management system with workload prediction modules, and a trust evaluation component.

3. Results and Discussion

[2] COST, http://www.cost.eu (viewed August10, 2015)

Companies from the cosmetics sectors present a considerable challenge. Production lines include complex chemical reactions, complex incorporated design processes, and products with dissimilar compositions. All these necessitate a rigorous professional control in its main areas, such as supplying, production, packaging, but also amid environmental preoccupations. In the cosmetics industry, there is a sizeable difference between the terms “natural” and “green” (Nelson, 2013) :

- “Natural” usually refers to the source of the raw materials;
- “Green” refers to the conversion process of starting materials into refined ingredients.

It is important to create and apply a multi-stage plan to improve the company’s general performance, its business and its environmental results through means of automation. We believe, based on our experience (Microsoft Dynamics NAV implementation in a large cosmetics company, developing and production administration) that the means of organizing, taking over old modules from previous systems, and mirroring the manufacturing process are particular issues for each company. Because the respective company has just implemented in the recent years a top ERP solution with after high costs and great work, the executive might be reluctant in renovating the main information systems with distributed systems, grids and clouds, although it is evidently a new, cheaper and more energy efficient solution (Da Costa, et al., 2010). It is essential to point out that the implementation led to a 5% increase in the company profit after the first year of operation, meaning that today, after few years from the implementation, and the introduction of functionalities and new products on the assembly lines, the Microsoft Dynamics NAV ™ fully meets the company’s business requirements.
We propose a new approach based on existing systems, with several investments related to:

- Equipment and technologies related to monitor technological processes, production, consumption of materials and losses, with genuine energy savings in different forms (electric, steam, compressed air, hydraulic, *etc.*);
- PCS-ERP conveyed technologies, for hardware electrical energy efficiency (communication technologies).

After a successful ERP implementation, we are trying to introduce certain optimizations in several areas. This is going to be accomplished through an elaborate process, based on a few steps (Glimsdal, 2011) :

- Widen ideas for reducing energy consumption, increasing process/tool efficiency;
- Calculate energy savings from identified measures;
- Calculate implementation cost of identified measures;
- Project selections for additional examination/development.

3.1 Chemical industry (including cosmetics) novel PCS equipment

Chemical industry specificity is given by the use of lines (technologic networks) with raw materials and finished products mostly on the move. These production lines feature:

- Electronic dispensers for supplying various chemical reactors or packaging machines, depending on the technologic prescribed amount that is monitored by PCS;
- Electronic flow meters that have the same role as dispensers only used for gas and liquid components—non-invasive measurement using the clamp-on method for precise bi-directional, highly dynamic flow measurement;
- Electronic weighing machines to determine the input/output quantity related to the technological flow.
- Electronic counters for counting the resulting finished products or the quantities supplied by packaging machines,
- Various other equipment (machines) for measuring and controlling process parameters (such as temperature sensors, pressure sensors, *etc.*).

It should be noted that PCS strictly verifies whether the working parameters are according to the technologic requirements. At the same time, ERP systems are designed to record and monitor the expenditures and revenues (not only in the sphere of production), or to monitor the performance of company’s economic and business parameters. The connection of two computerized systems, one with highly analytical and technical records (PCS) and the other with both analytical and synthetic economic records of economic events (ERP), allows monitoring the physical quantities throughout the financial efforts made for their realization.

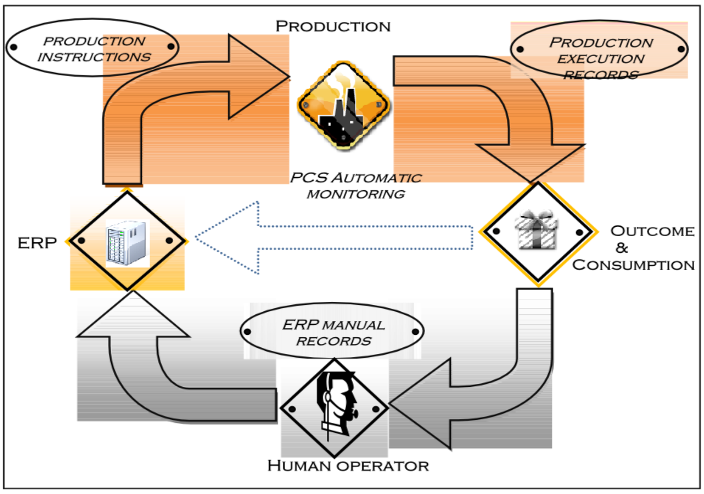

Figure 1. Enterprise Resource Planning (ERP) manual data input *vs.* Process Control Systems (PCS) automatic monitoring

These systems act as process recorders for production information, for administrating the manufacturing launch, its progress, and its results; however, its automatic procedures are interrupted by the need to manually enter certain data. For example, in this exact situation there is the production report for management accounting, for the evidence of production results, but also an inventory statement through consumption recording (raw stock, materials, wrappers, energy, *etc.*).
We consider that the most favorable data flux is attained when the production launch information is comprised of effective commands for the production equipment and the associated consumption should be supplied in a digital format, directly into the information system, instead of passing through an operator’s keyboard (see Figure 1). This plan could be achieved via the automation of the manufacturing process in connection with PCS computerized monitoring.
Some of the tools involved the automation encompass industrial robots, machine tools with numerical control (NC), computerized machining centers (in the case of assembly industry), or electronic metering, electronic flow meters, electronic scales, *etc.* (in the case of process industry). All these receive digital commands whose effect is to fulfill a task, with a twofold result:

- Technical—by performing a physical action (e.g. dosing).
- Economic—by recording the amount of raw materials, materials, fuel, energy used in the process or by weighing/recording the products.

This mixture of records (such as dosing, weighing, counting, *etc.*) provided by production automatic devices from is complex, due to increased equipment specificity for manufacturing automation. For this reason, in an ERP brochure there could not be usually found any connecting modules to the production automation software. With the aim of accomplishing this inter-connectivity, a niche has been developed for IT solutions in PCS - ERP interfacing, or PCS - other software solutions.
One of the "new kids on the block" of green processes that we propose to address the requirements for more sustainable products is biocatalytic processing (Nelson, 2013), a major advance due to the reduction of energy needed for production whilst reduces solvents and other garbage. Some of its main features are as follows (Kwon, Ryu , Sohn, & Chung, I, 2009) :

- Use of enzymes and closely-controlled conditions to make esters without the energy-intensive high temperatures and strong acids;
- Removal of the organic solvents (substances that dissolve reactants);
- Reduces more than 10 liters of waste per kilogram of product in comparison to processes using solvents;
- Higher purity products;
- Higher initial cost than traditional chemical reactions.

Process heating is fundamental to virtually every production process, because it provides the heat required to create materials and merchandise. In many activities, heat is given by only a few techniques: fuel-fired, steam, hot air, hot oil, hot water, and electric heating. It is conveyed unswervingly from the source, or circuitously by the oven walls, or through jets and fans. All these, together with the new equipment (such as super heaters, combustion air pre heaters, blow-down heat exchangers) and the type of heat recovery, establish the process system's energy effectiveness, therefore putting forward opportunities to save considerable amounts of energy in various forms. Our proposal is an investment in a modern steam system, needed for several activities:

- Boilers to produce steam for a mixture of processes (pressure control, mechanical drives, separation of components) and also to produce onsite electricity.
- Process heating, cooling and refrigeration.
- Direct non-process utilization (facility heating).
- Production of hot water for process reactions.

An up to date assortment of multi-component systems used for metering, mixing, and dispensing the constituents should also be an important added-value to the company. The novel separation and mass transfer equipment and technologies include:

- Static mixers, which enable homogenization and dispersion of gases and liquids with no resort to stirring parts;
- Dynamic mixers for diverse process industry applications;
- High-tech products, which are for amalgamation, stripping, distillation, evaporation, separation of phases, liquid-liquid extraction, crystallization, membrane separations.

It is important to overcome one of the restrictive factors in cosmetics' high performance, for example hand or face creams lacking the capability to be absorbed into the skin (a direct consequence of non-effective particle size reduction). Thus, an imperative element in a cosmetics firm is represented by the micronization used to obtain a homogeneous and stable product liquid or cream, with enhanced ingredient diffusion rather than with the legacy stirrers, colloid mills or rotor-stator apparatus. A higher pressure in homogenization trims down the constituent part sizes to nanometers with a standardized distribution, by applying energy through fluid-dynamic upshots: acceleration, turbulence, cavitations, impact. Some of the most important effects of high pressure homogenization can be translated into:

- Emulsions stabilization;
- Efficient dispersion of constituents;
- Elimination of surplus water compounds;
- Perfume distribution;
- Consistent coloring.

As regarding the homogenization, we propose (see Figure 2) applications and equipment for dynamic high pressure homogenization, such as pneumatic rotary indexing tables (for bottles of perfumes, nail varnish, shampoos, *etc.*)

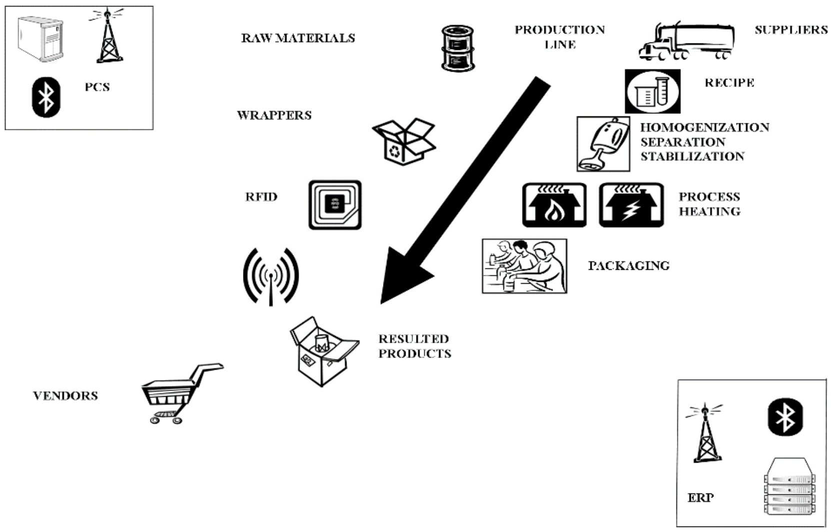

Figure 2. ERP-PCS connection in the process industry: The production line

3.2 Connectivity in the proposed ERP-PCS integration

If, during the delivery activity, the introduction of bar code readers has contributed to the automation of the process and rendered it possible to optimize the process, for the monitoring of the production process, the ERP–PCS inter-connectivity is much more difficult to achieve. For the fact that the UPC (Universal Product Code) bar code has its limitations, we concentrated our studies in on RFID (Radio-Frequency Identification) technology and its applications for small and medium industries. It is about small electronic labels including a small chip capable of carrying certain amounts of data and an antenna. These tags represent the clever bar codes that communicate to a networked system, which thus is able to track every raw material box, every component or product from the production assembly line. Their most important gain is that the RFID tagged product device does not have to be placed near a scanner, and can be scanned from several meters away. The technology might be older (since it was initially used also for cattle tracking), but its importance grew in recent years, having applications in many areas of socio-economic life: tracking consumer products worldwide, retail merchandise, cars tracking, for airline passengers, Alzheimer's patients, pets *etc.* We propose RFID tags for application in tracking of each product from the time it is made until it is bought in a supermarket. RFID technology has several advantages over classic bar-code, labeling methods (Kwon, Ryu , Sohn, & Chung, I, 2009) :

- Untouchability;
- Saves an enormous amount of energy and labor force, with no human hands to label and scan the items one by one;
- High accuracy and speediness of reading rate;
- Efficient management of goods,;
- Convenience and capacity to store data.

There might be also several communications problems regarding the smart tags, such as reader collision (signal overlapping in the case of more readers) and tag collision (many tags are near in a little area), some of which could be solved through readers and counters' integration in integration in Bluetooth Piconets. We are in the process of designing a Bluetooth Scatter net for the ERP-PCS connection in a cosmetics plant Figure 3, thus integrating its production lines measuring equipment with the implemented ERP solution. Bluetooth will play an important role in their communication, and each division will integrate its features in one or more Piconets (as needed). The Piconet represents the basic network, a collection of up to 8 devices (one master, up to seven active slaves, and up to 255 parked slaves), that frequency hop together. They will include electronic sensors nodes (with controllers and Bluetooth unit) and gateways. Sensor nodes (masters) will collect data from a number of sensors (slaves) and will transmit it via Bluetooth to central computers and ERP system. Thanks to the Bluetooth technology, tiny transceiver elements can be positioned in an ample variety of sensor equipment, thus determining their mobility through a rapid and secure data transmission. Its main characteristics, based on state of the art studies (Brundle & Naedele, 2008, pp. 24-29), (Tahir, Hasbullah, & Tahir, 2012, pp. 626-642), will be generally as following:

- The master will administrate and schedule data transmission and channel allocation for slaves, and send packets to slaves in an even-number of slots using a round-robin scheduling technique;
- Slaves (the PCS measuring equipment) will be synchronized with the master, listen to the master, and will respond to the master in subsequent slots (odd);
- Data will be transmitted in the network using the structure of packets, on an unchanged during the transmission of a packet and each new packet will be transmitted with a different frequency to improve reliability;
- Mobility of the measuring devices due to Bluetooth connectivity and low energy consumption.

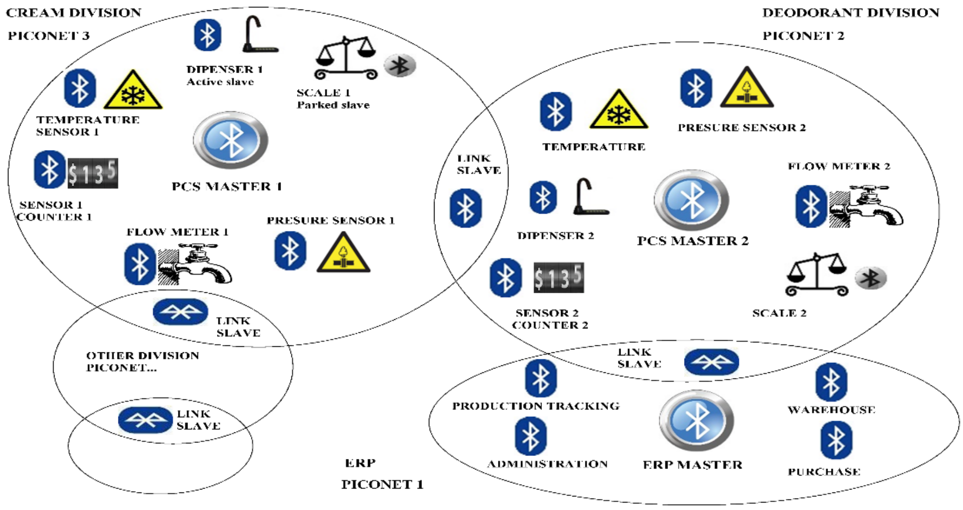

Figure 3. Proposed Scatter net for ERP-PCS connection in a cosmetics plant

The Bluetooth connections could be better solutions compared with an Ethernet platform, due to their important mobility, elasticity, low-energy consumption, scalability in industrial environments, with lower costs and less spent time. In comparison, the legacy Ethernet (Sergio Hernandez, Ochoa, & Ramirez, 2007, pp. 27-32) presents some difficulties:

- "Down time" problems—difficulty to change;
- Technical accuracy problems—in the case that a device or cable section attached to the network fails, this could result in the entire network failing;
- Time consuming—in determining what node or cable section is causing a problem, and the network must be troubleshot by a "process of elimination";
- Complexity—cables need to be installed and reconfigured to add new users.

4. Conclusions

In the present paper, we present our on-going studies on the designing an efficient ERP-PCS connection for a cosmetics plant, in order to gain additional data consistency and reliability. We tried to show that manufacturing and technology all converge under the economic interests. Thus, an efficient production is reflected in the ERP recordings that frantically need accurate and real time production tracking, and also the consumption of raw materials, wrappers, energy, *etc*. Some of the proposed ERP-PCS connections' main benefits could be succinctly presented as follows:

1. An increase in the information processing speed as regards the evolution of the production process by eliminating the input of data by human operators.
2. Maximum accuracy (depending on technical tolerance of the automation equipment) for in recording consumptions for the achieved production. This accuracy will have valuable effects for a judicious supply management.
3. RFID could play an important part in production tracking.
4. Real-time checking for the technical discipline's compliance, not just "post factum" when closes all manufacturing orders. Any deviation from the technological consumer rules will be highlighted from the start, therefore operators could interfere with necessary corrections on the production process parameters.
5. Providing accurate information in real time for economic efficiency calculations
6. Increasing accuracy in the ERP data provided to decision support and business intelligence systems.
7. If scrutinizing the evident advantages in terms of energetic economy brought by this form of connection, we see the following:
    - Bluetooth technology involves a minimum electrical power consumption to perform the data transfer, less than a LAN (with its power supplies, switches, routers, *etc.*),
    - A minimum intervention on the environment by lack of physical connections between transmitter and receiver,
    - The PCS-ERP connection itself will lead to real energy savings, regardless of the form in which it is provided: electric, steam, compressed air, hydraulic, *etc.* This saving will be achieved since ERP systems indicate the unjustifiable energy consumption with no economic outcome (e.g. equipment idling, equipment loaded under the economic breakeven point, *etc.*).

In today's society, where energy efficiency is the predominant indicator that differentiates companies with productive and further activities, the automation and monitoring of the production process can lead to the strategic objectives of the firm and therefore reaching the projected profit.

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