Sustainability through process automation

How automation can and should be used to build a better world

Sustainability is a term that now permeates, with all its nuances, our workplaces, homes, schools and many other organized groups, as a true pop star, bringing a sense of responsibility and a utopian, or not, search for a global society, conscious of its actions and interdependence.

A term so common today, but which was despised some years ago, being relegated to the worst times of Brazilian television, for it to keep something in its program grid, focused on sustainable development.

The evolution of the sustainability concept, particularly, draws attention and is needed to guide and motivate those who either directly or indirectly are involved in self-sustainable projects, or are opinion leaders.

But, after all, how is sustainability defined? A quick search in the dictionary does not help much.

Quality of sustainable - That can be sustained -Support to avoid unbalance or change of position

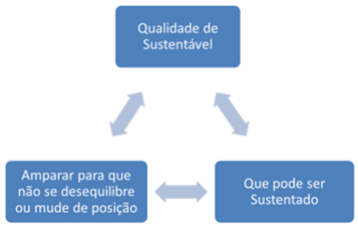

Fig.1: Standard definition of sustainability

This may lead us to reflect on the most basic concepts such as the maintenance of environmental balance or for social responsibility, among other ideas. All these and many other topics are partially right. We'll look at how these various issues culminated in

the concept of sustainable development and how the automation and control play a key role in implementing and maintaining of the sustainability.

Fig.2: The effects of unsustainability

A Global Effort

These disparate ideas and studies began to gain momentum and political force in the late 60's, with the creation of the Club of Rome. The group, formed by key people in various sectors and countries, began sponsoring studies and advanced research related to profitable and sustainable economic growth.

The first result of this initiative was the publication of the report commissioned in 1972 to MIT researchers called - "The Limits to Growth" - which dealt with crucial points for the development of humanity as energy, pollution, sanitation, health, environment, technology and population growth. Through mathematical modeling, these studies revealed that by 2100, the Earth will not support the uncontrolled population growth due to impacts on these points.

With the impact of the publication, was organized by UN, that same year, the first international conference about the organization of the human relationship with the environment. It is worth noting that the scientific community had already detected future problems due to the air pollution caused by industries worldwide.

From this mutual understanding between developed and underdeveloped nations in relation to industrial activities, the actions that followed were supported by organizations such as UNESCO, which created in 1975 the International Program on Environmental Education (IIEP) focused on training educators to follow the principles of continuous environmental education, adapted to regional differences and aimed at fulfilling the interests of the Nations. This would become the first practical action after the agreement reached at the Stockholm Conference.

In 1980 the International Union for Conservation of Nature published the report "The Global Strategy for Conservation," where the concept of "sustainable development" appeared for the first time.

Up to this point it seemed that everything was well, but in 1987, the Brundtland report (or "Our Common Future) pointed out the incompatibility between the models of sustainable development and the current means of production and consumption. Then through a series of new measures it was finally possible to formalize the concept of sustainable development as "the development that meets present needs without compromising the ability of future generations to meet their own needs.

Among the various measures indicated below, only a few are already a reality in our daily lives:

- Limitation of population growth

- Guarantee of basic resources (water, food, energy) in the long term;
- Preservation of biodiversity and ecosystems;
- Reduction of energy consumption and the development of technologies using renewable energy sources;
- Increase the industrial production in non-industrialized countries based on environmentally adapted technologies;
- Control of unplanned urbanization and integration between countryside and smaller towns;
- Meet the basic needs (health, education, and housing);
- Adoption of the sustainable development strategy by development organizations (agencies and international financial institutions);
- Protection of supranational ecosystems such as the Antarctica, oceans, etc., by the international community;
- Outlawing wars;
- Implementation of a sustainable development program by the United Nations (UN).

Based on these corrected guidelines, the concept of sustainable development should be adopted by business leaders as a new way of producing without degrading the environment. Once assimilated, this culture should then be disseminated among the organizations, extensible to all levels, in order to identify the impact of its production on the environment, resulting in the execution of a project that combines production and environmental preservation with the use of new technologies.

Some other measures for the implementation of a minimally adequate program for sustainable development are:

- Use of new construction materials;
- Restructuring of residential and industrial areas;
- Use and consumption of alternative energy sources such as solar, wind and geothermal;
- Recycling of reusable materials;
- Rational consumption of water and food;
- Reduced use of chemical products harmful to health in food production.

With clearer and more coherent goals, the conferences began having greater impact and coverage on their agendas, a fact confirmed in 1992 at the UN Conference on Environment and Development, the birthplace of Agenda 21, which approved the Convention on Climate Change, the Convention on Biological Diversity (Rio Declaration - ECO-92), as well as the Statement of Principles for the Sustainable Management of Forests.

With the "siege" closing in upon the nations, next came the 1997 Kyoto Protocol requiring more stringent commitments to reduce gas emission and the greenhouse effect, which had a major impact in nations such as the United States and China.

To compensate for and make the efforts more transparent and valuable, the Dow Jones Sustainability World Index was created in 1999, being the first indicator of financial performance of leading companies in global sustainability. Their derivations now include companies in the stock exchange of the United States and Europe. Following the same methodology, in 2005 the Corporate Sustainability Index (ISE) was created, as the first initiative in Latin America (Bovespa), one that represented an efficient way for the economic sector to encourage sustainability initiatives in Brazilian companies.

And more recently, in 2009, the Copenhagen Conference enhanced the Kyoto Protocol, which expires in 2012.

The term "sustainability" now has a wider connotation and spreads rapidly, now incorporated to the politically correct vocabulary of business, mass media, civil society organizations, nearly to become a global unanimity. However, the solution of the causes for unsustainability seems to move at a much slower pace, even with the more dire predictions about the future. This apparent slowness occurs even with the encouragement of debates, whose proposed solutions may conflict with the various parties involved.

Otherwise, within the social perspective, we face our own challenges. Just to give you an idea, according to recent surveys in Brazil, from harvesting to community consumption, 20% of all food produced in the country is wasted (IBGE statistical agency). That would be enough to supply all of the Brazilian poor. Moreover, they are generated 125 000 ton of organic waste and recyclable materials a day. Not to mention the waste of 50% of treated water throughout the country. Likewise 9.5% of the annual energy production is also wasted.

These are impressive numbers. The Brazilian Association of Maintenance indicates that maintenance costs in the country reach the milestone of 4.2% of GDP, and 4% of gross sales of companies are spent on maintenance actions.

These data are more than sufficient for this complicated scenario, full of challenges, where the engineering of automation can provide the necessary support to these and many other demands of society, always looking for the "optimal" balance point of this equation whose three main variables are the ecological, social and economic requirements.

The figure below shows deviations of results, when one of the main variables of this "equation" is put aside. The results obtained are very different from what sustainability means:

Fig.3:The difficult equation of Sustainability

Automation goes green in industrial networks

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The technological support of global organizations in the standardization of equipment resources is one example. Today, entire equipment and automation solutions leave the factory with the green seal of sustainability, not only because they consume less energy but also because they have been designed with a standard application profile that allows the plant to turn itself off in unused areas. An example of this concept is the ProfiEnergy, the newest Profibus International application profile.

It covers not only the basic procedures, such as control loop fine tuning, but also other aspects to improve processes such as asset management systems, manufacturing execution systems (MES) and Business Intelligence whose objectives are clearly outlined: increasing production capacity without investing in expansions and/or new plants, bringing the operational availability to its peak, avoiding unplanned downtime, wastefulness with final product variability and failures in control production (due to lack of real-time information for decision makers).

With industrial networks and intelligent equipment, the basis of industrial automation now has data that previously would be topics for science fiction movies. Non-Control information is increasingly available and ready to meet these specialized systems.

Automation systems based on intelligent protocols

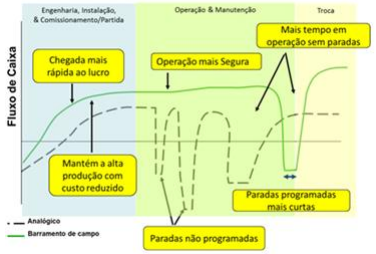
Conventional automation systems – non-control information, control information

Yesterday - Today

Fig.4: "Non-Control" information for operational improvement

These systems are expected to turn collected data into real-time information important to business.

In the case of asset management, the figure below is typical:



Analog - Fieldbus / Cash Flow

Engineering, Installation & Commissioning/Start-up – Operation&Maintenance – Exchange

Faster arrival to profit – Maintains the high production with cost effective – Safer operation – Non-scheduled stops – Longer operation without stopping – Shorter programmed stops

Fig.5: Profitability through better monitored and analyzed plants.

In the figure, the comparison between fieldbus systems and conventional analog systems shows how to maintain high profitability without worrying about the non-scheduled stops and how the operational stability of the plant provides a longer and profitable life for the equipment, instrumentation and control systems.

Asset management software

Controller

Positioner

Auto-tuning

Air to supply and output pressure – Leaking Diaphragm

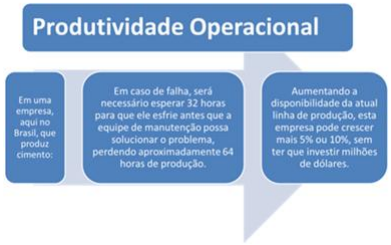
Number of strokes - Time to open – Time to close – Hysteresis - Gain

Fig.6: Self-diagnostics in asset management systems

Tag	Descrição	Ação Recomendada	Posição
DT303	Este instrumento não pode ser lido....	Verifique se o endereço e as conexões estão corretos....	Endereço : 10
FY303	O percurso total percorrido pela válvula excedeu o limite	Executar os procedimentos de manutenção preventiva da válvula	Endereço : 15
FY303	Módulo de saída não detectado	Verificar a instalação do módulo de saída	Endereço : 15
FY303	Sensor de pressão não instalado	Instalar um sensor de pressão para obter um auto-diagnóstico mais preciso	Endereço : 15
FY303_2	Sensor de pressão não instalado	Instalar um sensor de pressão para obter um auto-diagnóstico mais preciso	Endereço : 8
FY303_3	Temperatura da eletrônica muito alta		Endereço : 13
FY303_3	Sensor de pressão não instalado	Instalar um sensor de pressão para obter um auto-diagnóstico mais preciso	Endereço : 13
FY303_3	Instrumento não inicializado (Auto-Calibração não executada)		Endereço : 13
FY303_3	Módulo de saída não detectado	Verificar a instalação do módulo de saída	Endereço : 13
FY303_3	Partida fria (Deve ocorrer depois que o FACTORY_RESET = 1 foi executado.)		Endereço : 13

Fig.7: AssetView: a guide to maintenance

If implemented well, this concept can provide solutions like this:



Operating Productivity

In a cement-producing Brazilian company.

In case of failure, the maintenance personnel must wait 32 hours until the furnace cools before solving the problem, losing about 64 production hours.

In a survey by ARC the use of asset management software can generate savings of around 20% of the budget for maintenance. The chart below shows the profile of the money saved:

Fig.8: Up to 20% savings with the adoption of Asset Management. Source: ARC Report.

Business Solutions for Manufacturing

Previously known as Manufacturing Execution System (MES) it is now officially the Manufacturing Enterprise Solutions (MES) for being much more than a system for production control. Issues such as product quality, inventory, maintenance, data management and life cycle management cannot be analyzed separately from the manufacturing control.

The chart below shows that this advanced solution of information technology has more economic factors than factors adjusted to regulatory standards.

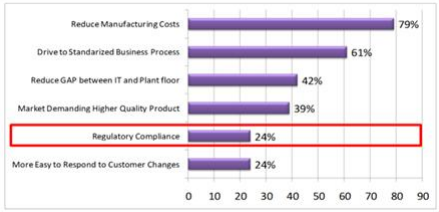


Fig.9: Illustration of Governmental Regulatory pressures on the adoption of best production practices. Source: Aberdeen Group

ISA95 Model

This model enables the creation of standard interfaces, documents and key performance indices (KPIs) through integrated layers from (the) factory floor to enterprise systems like the ERP. The change of focus in each level of these solutions promotes the visualization of customizations and adaptations, as each plant sector needs

Business Planning & Logistics

Production Operations

Batch – Continuous – Discrete

Level 0 – Production

Level 1 – Sensors

Level 2 – Monitoring

Level 3 – Monitoring

Level 4 - Synchronization

Fig.10:Scope of MES systems

The change of focus at each level promotes the implementation of tasks and analysis of information much more accurately and quickly. Thus, the same data from the field undergoes different treatments at each level in order to show only what is extremely useful for that position. Then, the operator would be concerned about the flow of a particular product, the plant manager concerned about the performance of a particular plant sector, the product manager, with the availability and quality of a particular end product, and the administrative management, with the production indices of each unit.

This solution has the advantage of being independent from supervisory systems in addition to the OPC connectivity, providing endless database connections.

Fig.11: Maintenance focused on what is most interesting for each automation level

Conclusion

Sustainability goes far beyond Advertising and Publicity. It's a simple concept to understand, but it brings an entire historical context of conflicting interests and the pursuit of understanding between the involved parties. In this search, much has been learned and much will be learned. The speed of adoption of sustainable solutions is well below the desired, as it requires political will to force changes; business will to create significant improvements in their means of production in addition to the determined pressure by society as a whole. Society, by the same token, must adopt the awareness of sustainability and avoid uncontrolled consumerism.

You cannot, however, belittle the achievements gained so far, as it is a very difficult concept to keep in the absence of tools and policies. In this context, automation plays an important role. Through further research and the adoption of smarter methods and production tools this situation tends to improve very much, with little investment.

Finally, we are all responsible to reinvent our future in a self-sustaining way, focusing on the common well-being of our planet.

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