International
DATALYZER
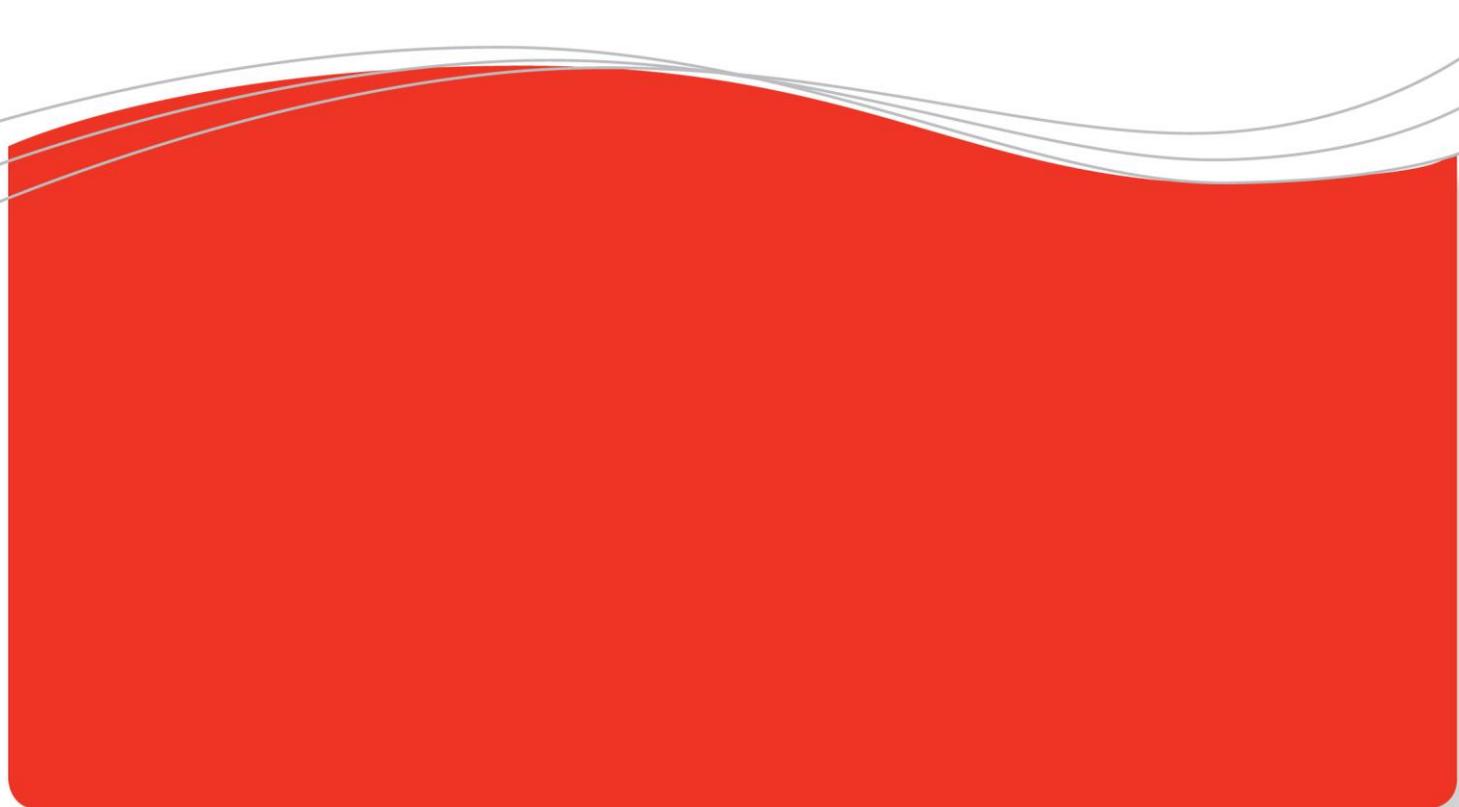Partners in Continuous Improvement

How does an SPC software solution fit in Industry 4.0?

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1 Introduction

You have been selected by your boss to head up a project to select a new software program for your company. You have experience using a manual system and believe that your background is adequate for selecting the right computerized system. You start researching various programs and immediately create a short list of companies that peak your interest. A few of them offer a free trial. You submit a request for a trial and the vendor responds. What happens next? Have you prepared a checklist of items your company needs in the new program? What are your expectations? Knowing the answers to these questions, will help you to make a recommendation to your management.

2 Requirements: Integration

Over the last 40 years, we have seen all kind of questionnaires in the software selection process varying from a few questions to checklists with hundreds of detailed questions. What selection process will work for you depends on the requirements and the scope of the project.

If your requirements are limited and you are simply looking for a stand-alone SPC software solution to manually enter data or maybe use some gages, then we often see that the traditional approach will work.

Establish a list of requirements including training and support. Invite suppliers present in your area and based on demonstrations and quotations select a supplier to run a trial.

But in a lot of cases, the SPC software solution will not be a stand-alone solution anymore and will have much more impact. Your SPC software solution will be a key component of the future ICT architecture within your company.

If that is the case, you need to go much further when establishing your list of requirements. Typically, the key in establish requirements is integration. SPC software solutions must be integrated in 4 ways in a company:

1. Integration in the organization - Shop floor, supporting departments, management
2. Integration in the flow - (APQP) FMEA, MSA, SPC, CAPA
3. Integration in the data architecture - Gages, sensors, OPC, big data, data warehouse
4. Integration with other functionality - Machines, Testing, MES and ERP etc.

Integration in the organization (shop floor, supporting departments, management)

Real time SPC software will be used on the shop floor. In case of issues, the supporting departments (engineers, maintenance) need to be involved. Management needs to drive the continuous improvements process, so the system should provide all necessary information at the right time to management. If we include division management or companywide management, it might be required that a centralized dashboard instantly show the KPI's.

On each level, information requirements need to be established. It is also important that the system will provide the information efficiently. For example, you can make a report in Excel or a statistical analysis tool, but it will take a lot of time to get the information from various sources and in the right format. Data collected at the shop floor should be instantly available across the whole company.

Integration in the flow (APQP) FMEA, MSA, SPC, CAPA

The advanced product quality planning process (APQP) is used in more and more industries.

The APQP process starts with a drawing and or a JT model. In the FMEA process, that information needs to be imported. The information needs to be transferred to the Control Plan and to the CMM machine. The control plan information needs to be imported into the SPC software. Feedback from production to the FMEA process is required in case of problems so if the total flow is supported by one system, a lot of time can be saved.

The description above is for discrete manufacturing products but a similar approach can be described for other types of industries.

For example, in the food industry it is not called FMEA but HACCP and measurements are not done with a CMM but for example with a HPLC device, but the principles of quality planning are the same and so is the discussion to make sure the full flow including feedback is supported.

Integration in the data architecture

Data in an SPC system can come from multiple sources:

- Manual data (measurements and defective counts)
- Gages (Calipers, scales, etc.)
- Files and databases (Excel, txt, csv, XML, JSON, SQL databases)
- PLC's and sensors
- ERP, MES systems (webservices, API etc.)

Data can also be exported in many ways:

- To a Datawarehouse
- To an ERP system
- To a MES system
- To a machine controller

More and more companies are looking for a big data solution. Big data is very powerful, but it is important to distinguish between common causes of variation and special causes of variation otherwise you don't know what you are looking at. SPC software makes it possible to provide that specific information and so it is recommended to integrate SPC software into a big data approach.

Because data sources are still not standardized, you need to look for a flexible solution which can adapt to all these situations and indeed, any new ones.

What is required is again specific for each company.

An example:

Requirement: You would like to collect 100% of the information from different PLCs in your company.

If you collect data from a lot of PLC sources, with a high frequency (seconds), you cannot provide that data to the operators on the shop floor, because they will not have time to process thousands of measurements in a short time frame. Given this, it is important you convert the data to meaningful information.

So, the data architecture requires you store 100% of the data, the operators require aggregated information from that data, but the engineer will need to look at the detailed data again, in case of problems.

In the following graph you see an example how this can be realized with a supplier of real time data integration.

For some companies it is mandatory that the SPC software is capable to integrate with this kind of solution to achieve the long-term goals.
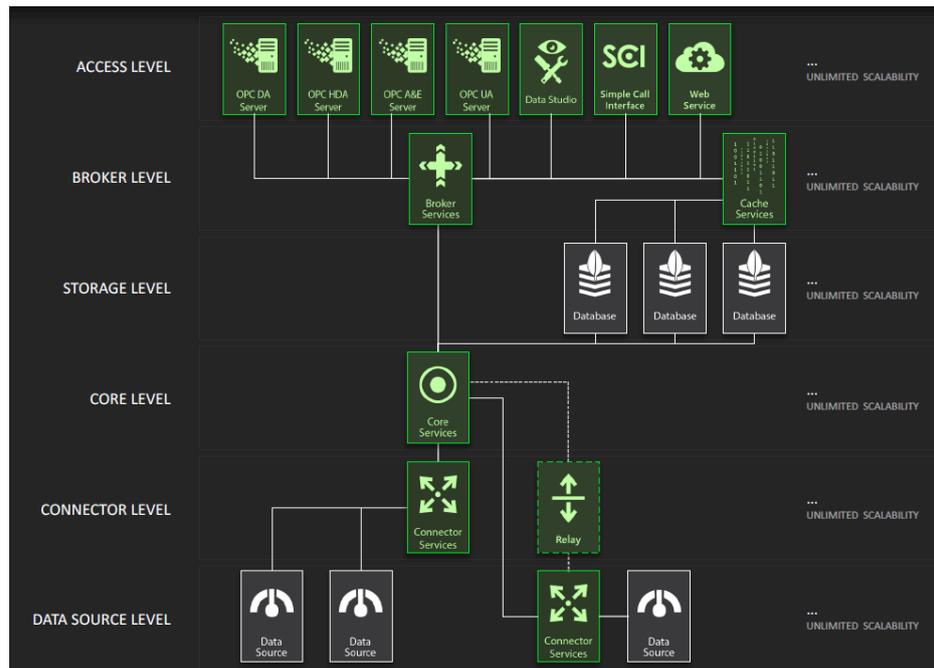
Figure 1: Integration of DataLyzer SPC software with Inmation system

.**Integration with specific functionality**

People prefer SPC requirements integrated in the daily process. When entering information about production in an MES or ERP system, operators don't like to switch to another program to enter the quality data. So SPC functionality becomes available in more and more applications.

- Machine suppliers are integrating SPC functionality
- Measurement suppliers are offering SPC functionality
- MES systems are offering SPC functionality
- Gage suppliers are offering SPC functionality
- SPC functionality is offered by six sigma tools
- Lab software offers SPC functionality

Although all solutions might be good, using different SPC software solutions has some disadvantages as follows:

- It is difficult or time consuming to roll up all SPC information to the management level and present meaningful dashboards or KPIs
- All SPC systems have different ways of setting up the system (SPC rules, managing control limits, calculation of capability indices) which means that the shop floor needs to understand all SPC information and how to apply this differently in different tools.

Standardizing SPC and getting optimal results is a challenge. Achieving optimal results with multiple SPC systems on the shop floor is hard.

It is recommended to use just one, central SPC solution which can interface with all specific situations in your plant or enterprise. Because of this requirement, some companies prefer to develop their own solution because they require maximum flexibility and maximum integration.

Although making instead of buying provides flexibility, it also involves specialized knowledge and will always be very costly. To avoid making that decision, DataLyzer offers all functionality as a programming kit (API, DLL). Then you have the best of both worlds. Wherever required, you can develop your own solution and integrate SPC in the production or test process. In a lot of cases, the standard functionality will suffice saving you a lot of development cost and speeding up the implementation.

The integration discussion above is a key element in the Industry 4.0 approach and it is fair to say that SPC (and OEE) must be part of the Industry 4.0 approach, to make sure you get reliable processes.

3 Requirement: Industry specifics

We have discussed how integration plays an important role in the selection of a SPC software solution. The requirements described above are the most important because if they are not present, it will be costly to implement them, and it might cause delays in implementation.

But in addition to integration, you will also need to look at company or industry specific requirements. These specific requirements need to be in the core of the software. Adding that functionality if it is not already present might be time consuming and expensive.

Some examples:

- Legal weight methods for food industry
- CFR 21 part 11 requirements in pharmaceutical or medical device industry
- TS16949 requirements (SPC, MSA and FMEA) in automotive industry
- DPMO defect analysis in PCB or EMS industry
- Mould and form registration in glass manufacturing or injection moulding
- Defect mapping in automotive or aerospace industry
- All languages used in the company to support the shop floor
- AQL requirements in some industries.

Often, emphasis is on specific SPC requirements like for example, is a moving range chart supported. Every good SPC software program should support all these required functionalities and otherwise they are not very hard to implement.

Finally, you should be sure to establish if the SPC supplier is present in all regions where you are active and also if the supplier is capable of supporting you with training and SPC consultancy in the longer term.

If you establish the requirements established above, the companies remaining on your short list need to convince you in a demo and - if the price is acceptable - prove in a trial that what is demonstrated is working in practice.