

## May 2013 - The development of a dashboard monitoring productivity and sustainability

A step towards controlling a Manufacturing System is to monitor it. Thus, the consortium of the FoFdration project have decided to implement a Dashboard system to aid the management decision in the framework of a sustainable production.

The fourth year of the FoFdration project aims to enhance the “Smart Factory” architecture by implementing the Dashboard System employing Smart Enterprise Content Management. The instant view of the production performance would aid the decisions of the today’s industry by enabling the managers to analyse performances on distinct levels of their business. Such distinct levels are:

- Strategic and management level
- Company and operational level
- Factory Level
- Shop floor level
- Machine level

The main target of the dashboard is to forecast the manufacturing performance of different production scenarios and indicate their specific advantages and disadvantages. It will be therefore also able to evaluate the sustainability of the current production line as well as of any alternative scenario. Knowledge-based indicators derived from logged production data will be considered together with assets in order to predict the performance of each production aspect. This will be achieved with the implementation of a dashboard prototype for integrated manufacturing management, including sustainability needs.

The new Key Performance Indicators (KPIs) as defined by other parts of the project will be able to be visualized, in order to provide decision makers with the utmost visibility of the production process. The following figure reveals the architecture of the system and the relations between its components. The information flow is shown by arrows and it goes all the way up to the dashboard (Figure 1).

According to the strategy of the project, the triple-bottom-definition of sustainability, which takes into account social-, economic- and environmental factors, the partners have taken specific actions so far. In continuation to these actions, the structure of the dashboard offers a variety of tools, such as:

- Visualization of Performance
- Management of the content from the MIP
- Decision Support for supplier selection

In the following section a short review of each tool will be given.

### Visualization of Performance

The dashboard, as shown below in Figure 2, will be able to visualize (key- or simple-) performance indicators with the help of charts and tabular forms. The performance indicators will regard various productivity and sustainability aspects, such as:

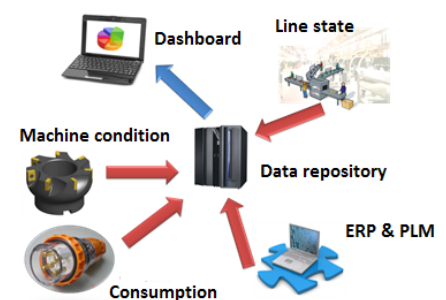


Figure 1: FoFdration architecture & production data visualisation through the dashboard

- Cost
- Quality
- Production time
- Energy Consumption

As already mentioned, the evaluation of production scenarios will be possible in terms of the above criteria. In Figure 3, this is depicted. This will allow choosing the scenario best fitting to the criteria set by the user. The Multi-Criteria Evaluation and decision making methodology is shown in Figure 4.

An additional feature will be the trend analysis for any performance indicator come across in the framework of the FoFdation Project. This will be performed with implementing mathematical tools and integrating them into the dashboard.

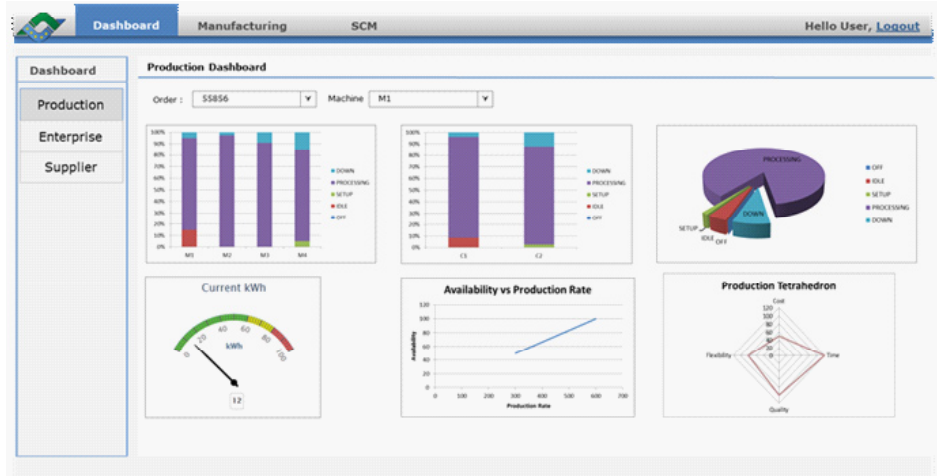


Figure 2: Sample screen of the Visualisation tool

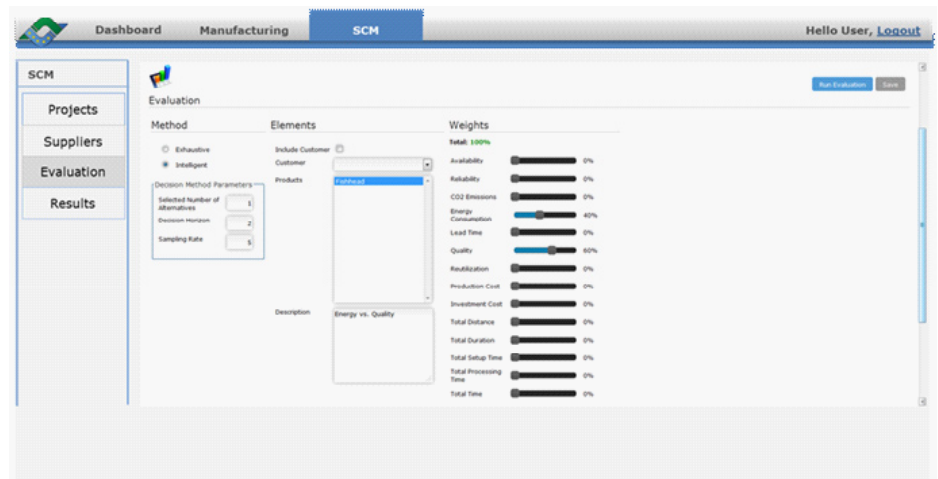


Figure 3: Sample screen of the Evaluation Tool

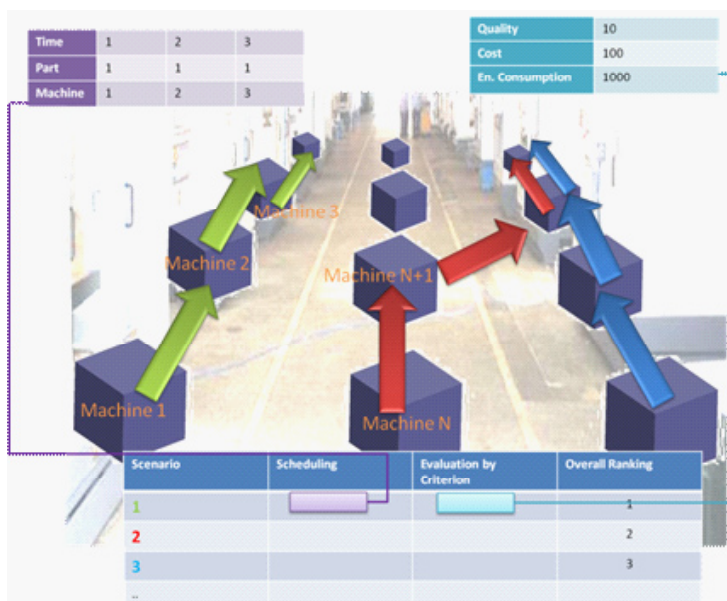
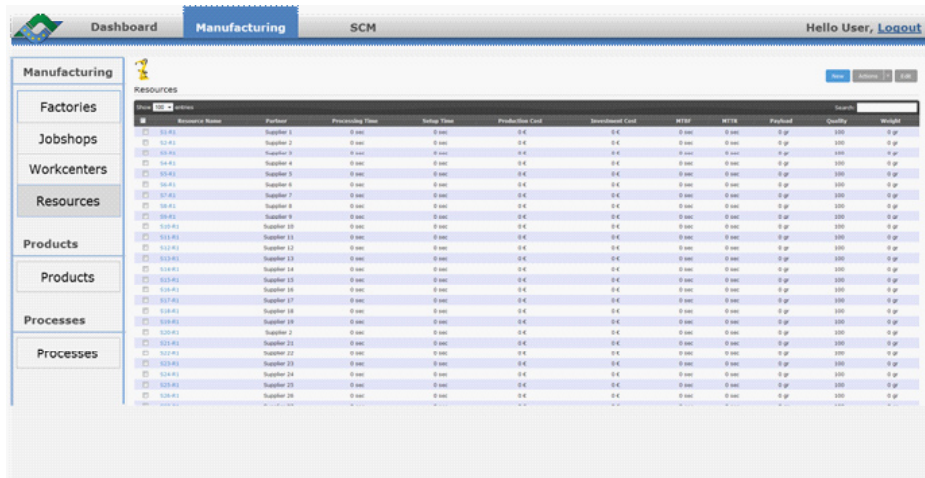


Figure 4: Multi-criteria Evaluation

## Management of the content from the MIP

Smart Content Management is going to be accomplished through a specific format that will facilitate manufacturing information pipeline (MIP), as shown in Figure 5. As shown in Figure 1, a central repository with indexing capabilities will be used to store and retrieve data concerning suppliers, orders, machines, products, etc. All information will be accessible from Dashboard. This will be demonstrated in a Use Case regarding a wire-EDM machine.



Resource Name	Position	Processing Time	Setup Time	Production Cost	Investment Cost	MTBF	MTTR	Yielded	Quality	Waste
S11-R1	Supplier 1	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R2	Supplier 2	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R3	Supplier 3	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R4	Supplier 4	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R5	Supplier 5	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R6	Supplier 6	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R7	Supplier 7	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R8	Supplier 8	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R9	Supplier 9	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R10	Supplier 10	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R11	Supplier 11	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R12	Supplier 12	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R13	Supplier 13	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R14	Supplier 14	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R15	Supplier 15	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R16	Supplier 16	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R17	Supplier 17	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R18	Supplier 18	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R19	Supplier 19	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R20	Supplier 20	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R21	Supplier 21	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R22	Supplier 22	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R23	Supplier 23	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R24	Supplier 24	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R25	Supplier 25	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00
S11-R26	Supplier 26	0.000	0.000	0.0	0.0	0.000	0.000	0.00	100	0.00

Figure 5: Smart Enterprise Content Management with MIP

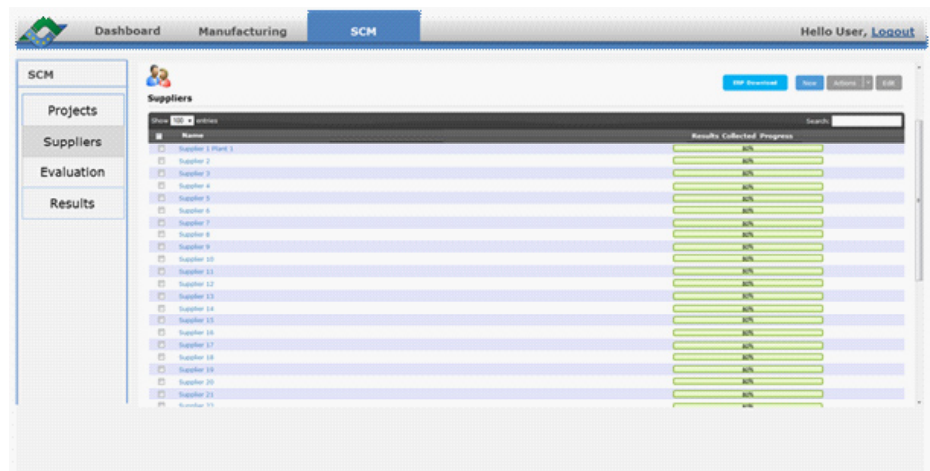
## Decision Support for supplier selection

In accordance with the selecting the optimum scenario, the dashboard will also be able to support selection of suppliers. Below, in Figure 6, one can find an indicative screen-shot for this case.

Taking into account Use Case involving suppliers choice, focus will be given on the three following stages:

- Select a supplier and manage catalogue
  - It provides the ability to share i) standards managing machines capabilities and ii) process description between a Prime and a Supplier.
- Process qualification and simulation phase
  - Both exchanging in a standardized way and managing simulation results (enhanced by FoFdration breakthroughs) between a Prime and a Supplier are possible. Thus, seamless integration of all data relative to simulation is to be performed into a single Information System.
- Run and manage results
  - One optimization cycle will be able to be run based on KPI between the Prime and a Supplier (i.e. for sustainability purposes).

On the whole, the dashboard will be a valuable tool for decision making support. It will be able to visualize both productivity and sustainability data and at the same time communicate with other entities built in the framework of the FoFdration for data input / output (from production monitoring systems or controllers to Life-cycle Management). It will also have the ability to call external or built-in features (i.e. trend analysis, scheduler) to process the production data.



Supplier	Results Collected Progress
Supplier 1 Plant 1	100%
Supplier 2	100%
Supplier 3	100%
Supplier 4	100%
Supplier 5	100%
Supplier 6	100%
Supplier 7	100%
Supplier 8	100%
Supplier 9	100%
Supplier 10	100%
Supplier 11	100%
Supplier 12	100%
Supplier 13	100%
Supplier 14	100%
Supplier 15	100%
Supplier 16	100%
Supplier 17	100%
Supplier 18	100%
Supplier 19	100%
Supplier 20	100%
Supplier 21	100%
Supplier 22	100%
Supplier 23	100%
Supplier 24	100%
Supplier 25	100%
Supplier 26	100%

Figure 6: Sample Screen from the Supplier-Selection Tool

For more information about the FoFdation project visit <http://www.fofdation-project.eu> and the project's social media pages, including Facebook ([#fofdationproject](#)) and Twitter ([@FoFdation](#)).

**Acknowledgements:**

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*For further information please visit:*

*[http://ec.europa.eu/research/industrial\\_technologies/factories-of-the-future\\_en.html](http://ec.europa.eu/research/industrial_technologies/factories-of-the-future_en.html)*