

Whitepaper

## Achieving Production Excellence: Solutions for Success



### **Achieving Real-Time Production Excellence**

The problem is achieving real-time production performance management.

The solution for this issue sounds very simple; just create a system that allows you access to exactly what you need when you need it, in order to have a clear idea of what is currently available and required. If you need to know how much gas you have left in your car to determine whether you will make it to your destination, it would be far easier to be able to look at only the information that you would need (in this case a fuel gauge) instead of having to call the service station attendant and the car manufacturer in order to collect and compile all of the data into the valuable information required.

Furthermore, what if you don't get through to the right people and have to wait until the right person sends you the right data? Well, that means you are either going to run out of gas or you are going to wait until you get the data you need before you continue. And what if the information is wrong because the attendant is looking at the wrong gas bill or the car manufacturer was looking at a different model? This simple human error could mean you not going anywhere or you could have gone further.

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## Two Thirds of the Way There

There are three key levels within every production facility's business process management paradigm; the **measurement level**, the **production and events level** and the **accounting level**.

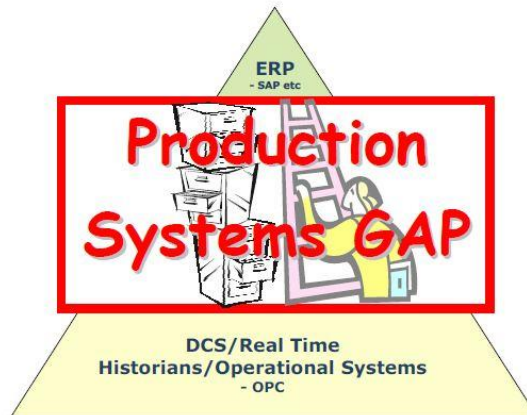


Figure 1 - The Production Systems Gap

At the **measurement level**, solutions that integrate all real-time data (OSI PI, IP21, PhD, etc) from DCSs, historians, production units, etc., have been available for the last 20 years. The assets at this level can communicate with one another and by way of a single application. Today, no one would consider writing their own real-time database.

At the **accounting level**, a similar change happened about 15 years ago to address the problems surrounding multiple, often home-grown, applications that managed a variety of corporate functions. Payroll, corporate planning, accounts payable and other applications needed to “talk” to each other in order to optimize and improve upon the complexities of managing business. SAP®, Oracle®, PeopleSoft®, etc., have provided integrated applications to manage most of these functions in a single application. Today, no one would ever consider writing their own enterprise applications.

### The Weak Link

Between the enterprise applications level and real-time systems level is an application functionality gap that is plugged with numerous ad-hoc applications. This is the **production and events level**. This level suffers from the same malady as the other two levels before their respective integrated solutions were introduced. This means that without an integrated solution, operations processes at this level are not optimized and therefore these processes are operating far below the level of efficiency and performance that could easily be reached. In short, there is no handy gas gauge.

## The Business Feedback Loop

When discussing information within a plant, we often see an emphasis on ‘visualization’ or ‘presentation’ of that information. However the actual business is a loop, with the business goals setting process production targets for the operational business processes to follow by causing actions on the plant assets and material, so that measurements of the state of the assets and material can be reported back in order to determine if the business is meeting its goals.

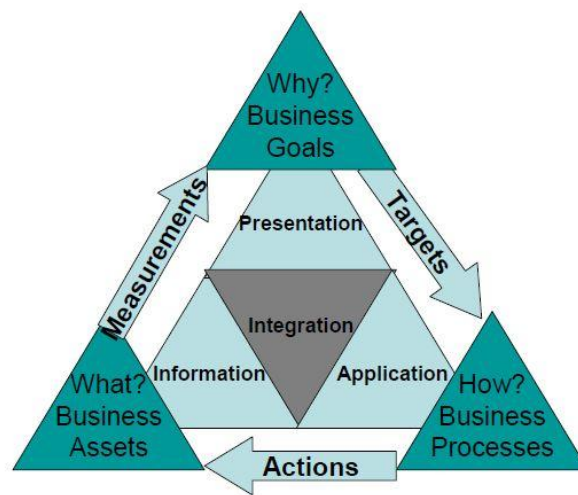


Figure 2 – The Business Feedback Loop

Real-time management demands that this business loop be supported by integrated applications.

**Business goal setting** is supported by **presentation technology** (Operational Insight web portal for example), that provides timely access to these measures to ensure that the business goals are being met. Furthermore, the targets can be quickly changed in response to disturbances or operational changes.

**Business processes** are supported by **applications** that track the targets and determine the appropriate actions on the business assets.

**Business assets** are understood by the **information** about those assets. For example measurements of the material flows or records of the material transactions that are planned or have taken place. Information models, such as the Intelligent Plant Data Model, captures the planned, current and past state of these business assets, and allow the raw information to be transformed to meaningful and accurate measurements.

The **applications**, **presentation** and **information** supporting the business process loop need to be glued together with **integration**, such as using Listeners as web service facades on existing applications, into an integrated whole.

## What Applications are Contained Within this Level and Why Do They Need to be Integrated?

In the production and events level, there are many self-contained applications as well as applications that “overlap” into the measurement and accounting levels. Essentially, these are your production process management, production unit management, plant management and enterprise management applications and processes like KPI's, CMMS, ERPs, LIMS, PIMS, alarm management, process history, production reporting, production planning, condition monitoring, environmental reporting, planning and scheduling, and real-time asset data. If all of this information could be integrated within this level, and if each level could then be integrated with one another, and if each application could then offer its data in combination with other applications to provide the right information to the right person in real time, imagine what this would do for your process.

### Example: The Business Flow

Let's start with an ERP system creating long-term production plans. From these, we use the planning LP to create periodic (usually monthly) production plans. However, these production plans cannot be delivered directly to the operational systems because they simply refer to production totals over a period of time. Operations are seeking specific instructions as to what to produce, with what, where and when.

First of all we need to create schedules for receiving (where are the raw materials stored), operations (what units are required), blending (how do we schedule the blends) and shipping (how do we schedule the material liftings). A scheduling system ranges from a spreadsheet to a sophisticated event-driven LP such as Haverly's HSched. Irrespective of the technology, it needs to be driven by the planned productions: does the schedule keep us on track to meet the production goals?

Unfortunately the 'output' of these scheduling systems does not produce the specific instructions needed for operations. These usually take the form of Microsoft® Word® or Excel® documents delivered at the morning operations meeting containing specific details of feed tanks, specific targets, likely maintenance issues related to operation etc. Note that these instructions do not just take the form of setpoints for controllers: they specify when a mode of operation should start, the overall quantity of a blend, the swing tanks that should be used, etc. Clearly these instructions need to reflect the results of the scheduling process. Therefore there is a process needed to transform the results of the scheduling system into these specific operating instructions.

Once the results are delivered to operations, operations will follow the instructions as closely as possible. How close are they? Are they achieving the most important goals? These questions are answered by the management systems that collect and report on the unit, inventory and movement activity in the plant. This requires collecting all of the information in a coherent manner so it can be compared.

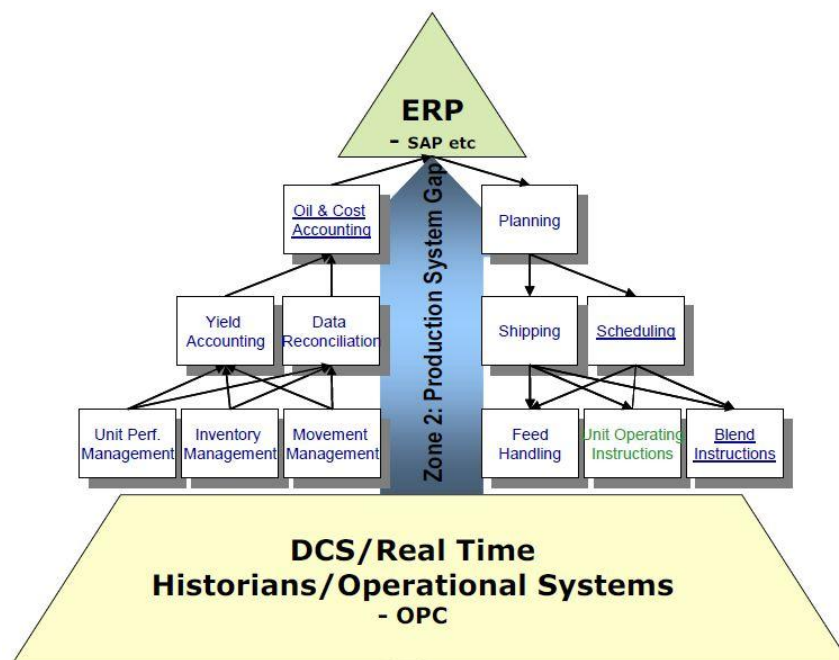


Figure 3 - Business Feedback Loop within the Production System Gap

It is insufficient just to report the unit, inventory and movement results. To ensure production excellence we need to confirm that we are following the instructions. Therefore we need to be constantly asking the following questions: did the material movement start at the expected time or was it delayed; are we moving material into the expected tank; did the blend produce the quantity expected in the destination specified, as well as meeting operational targets such as end points, flow rates etc? This is termed the 'target setting process'.

The next stage in production monitoring is to validate the information (via data reconciliation) and the scheduled yields (via yield accounting). Both of these applications need information drawn from throughout the production process: inventories, receipts, shipments, flow measurements, laboratory results such as densities, corrected volumes and masses, movement sources and destinations, and much more. In other words these two applications are the confluence of the majority of plant data, and form the foundation of all plant volumetric and financial reporting. As a result it is best not to delegate this job to a spreadsheet.

Often we see these tasks performed infrequently. This means the results cannot be used to influence the efficiency of the plant. If these processes can be performed on demand (sometimes called “in real-time” but not to be confused with real-time databases) we can react to problems before they get out of hand. This is the non-conformance process in which the schedule is constantly compared with the actual, providing immediate feedback on problems, instead of waiting until the next operational meeting to find out the schedule could not be followed because of feedstock, maintenance, incorrect scheduled yields or some other problem.

Having obtained a reliable set of production information, we are now in a position to accurately account for the production process over the accounting period: what is the energy consumption; have the production rates over the period met the planned goals; what is the gross unit operating margin; what is the gross refinery or plant margin; etc? Not only can these be calculated but users have confidence in the numbers because they are using the same information for the other production processes.

Just like the other processes, we can compare the planned goals with the actual that was achieved. These are the plant performance indices or KPIs. If the business processes (and as a corollary the data management processes) are well-oiled this becomes no more than just a ‘plan versus actual’ report.

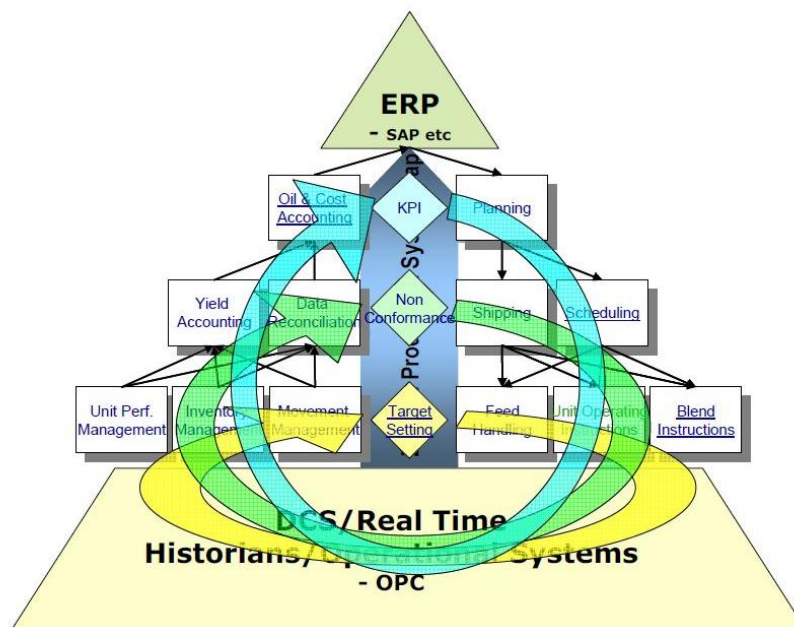


Figure 4 - Feedback Loops Within Production Management

## The Search For Integration Nirvana

The design of an integrated architecture to support this business process loop is challenged by the management of applications:

### Application Proliferation

The challenge is each operating site typically has 50-150 independent applications supporting this business loop. Not all of these are the well-known production applications: laboratory system (LIMS), document management (EDMS), maintenance management (MMS). However it does not mean the others are any less critical for running the business. Each of these applications duplicates data from other systems, causing integrity problems as well as the cost of support and training to maintain these systems.

### Strangled by Spreadsheets

Not all of these are formal applications; it may be the ubiquitous spreadsheet constructed to solve a particular reporting or analysis problem, gradually creeping into becoming an essential application. Often these are all shared on the central file server. If you are not convinced, count the number of spreadsheets that are stored there!

### Application Scope Creep

Clearly applications should meet the requirements of the business processes. However, in an attempt to make their products more attractive, more and more features are incorporated into a product. If these features are used, they can lead to a fragmentation of the business processes and silos of information. For example, an application such as a Maintenance Management System may have the ability to manage related documents. If such a feature were activated in the application, then it may lead to a silo of documents.

A well-developed plan for the functionality and scope of these applications is critical for a well-tuned business. We want to reduce the application portfolio by making sure the selected applications truly meet the functional requirements, reducing the need for ad hoc application spreadsheets, yet we do not want to purchase superfluous functionality via bloated applications.

In order to help users develop a coherent application strategy, various standards groups have suggested production application recommendations that span various areas of performance, operations, material, asset and quality management:

- ISA-95 is based on the Purdue Reference Model (CIM Levels)
- MESA Organization has MESA11
- OMG MES
- Solomon Associates Application Model

Each 'groups' according to business functions, often based on information flow diagrams:

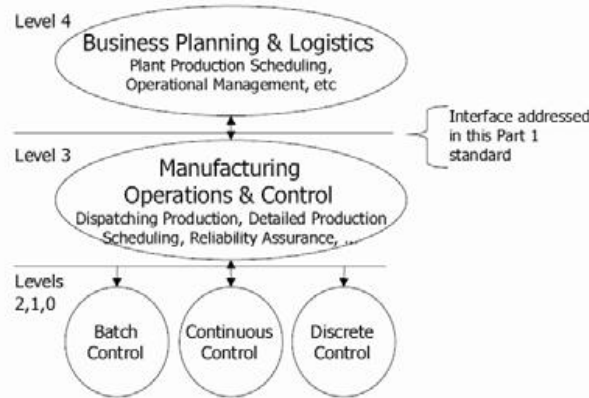


Figure 5 - Purdue Reference Model CIM Levels

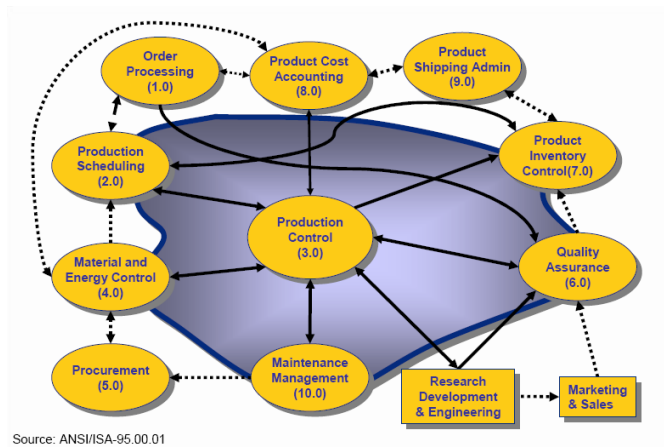


Figure 6 - ISA-95 Functional Model



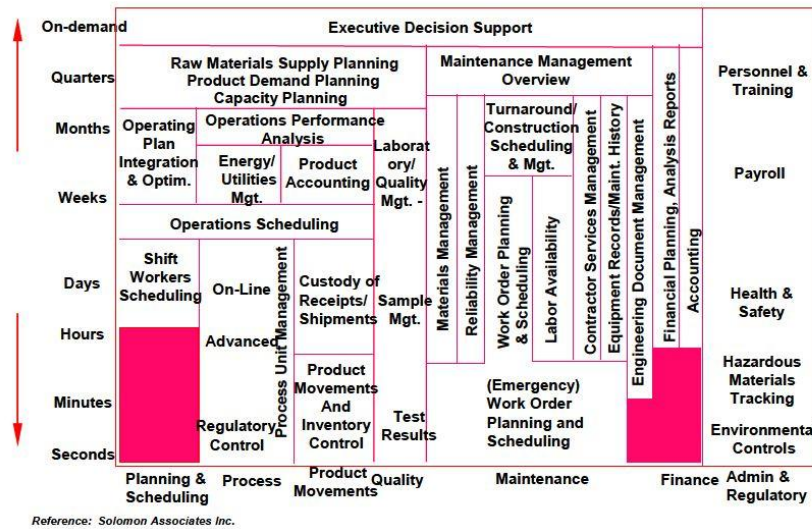


Figure 7 - Solomon Application Model



Figure 8 - MESA Application Honeycomb

If we follow this approach when creating the overall application architecture, it is likely each functional group gets mapped to a separate application system. This leads to multiple applications, each with its own database and set of interfaces to other systems. In fact, even the implementation methodologies tend to divide rather than unite. Take for example a typical functional design document. One of the key elements of that design will be the context diagram of the new application with the interfaces to the other systems. Unfortunately this context diagram is often taken literally, and becomes the application architecture.

### Functional Reference Modelling

To explore the applications required to support a business requires us first to define the business. What is the core business? Is it performance, material, asset, quality and operations management functions? To some extent it is, but even more fundamental to a business is what these functions are acting upon: people, material, equipment, quality, documents, finance etc. This is the 'materiel' of the business. Every aspect of the business is related to managing the materiel, or 'what', of the business.

**Materiel:** The handling of the different assets that are used throughout the processes. Materiel is an encompassing definition to include the raw material (crude oil, ore, etc) as well as documents, intellectual property, customer etc. In fact anything that is required to execute the business.

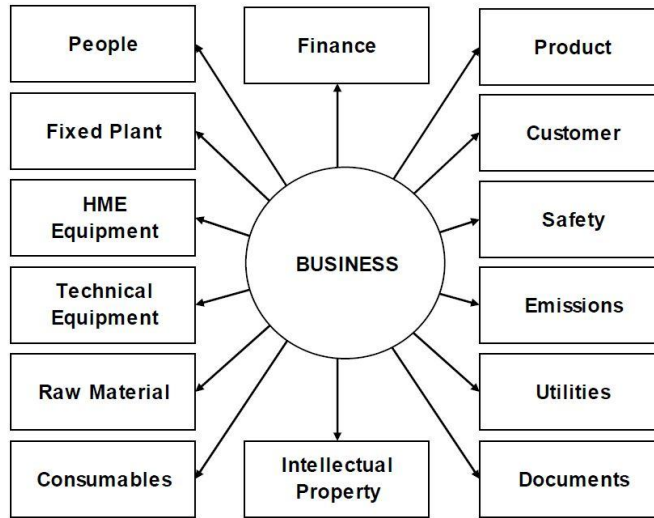


Figure 9 - Materiel Dimensions of a Business

Most materiel is managed the same regardless of its location within the business. However the product of the business is managed differently as it is processed through the value/supply chain: incoming raw material, components, products and shipments. This gives rise to a second, 'where' dimension of the core business:

**Spatial:** The different stages within the supply chain as material is sourced, processed, and shipped to the customer. This represents the location within which the materiel is being used.

The final dimension required to characterize any business is that of time: 'when'.

**Temporal:** The evolution of the functions over time. This represents the cycle of plan-schedule-instruct-check-act-account. Plan, Schedule and Instruct can be considered as functions dealing with what will happen in the future, whilst Check, Act, and Account deal with the past and how it should change future plans.

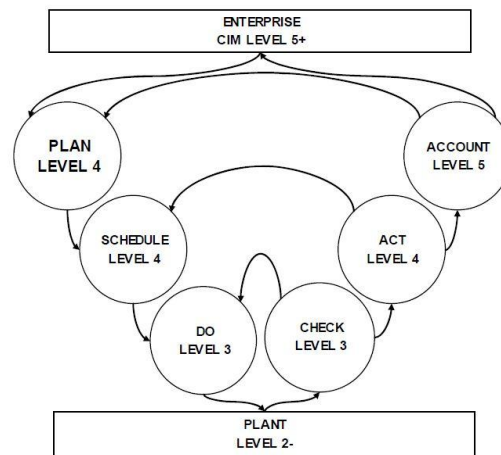


Figure 10 - Temporal Dimension of a Business

How does this help us create a map of the core business? We can use these dimensions to create a Functional Reference Model chart. The axes of this chart are as follows:

The x-axis is that of the material. For convenience we also represent the spatial dimension, or value/supply chain, along this axis. The chart below shows how we might group the material into support material, core competency, and value/supply chain. Note that we can have other assets represented along the material dimension, but these are typical of those that are of concern to a business.

The y-axis is the temporal axis. Unlike many models, we represent the future, present and past as a continuum along the y-axis. Thus the future is at the top of the chart, whilst the past at the bottom.

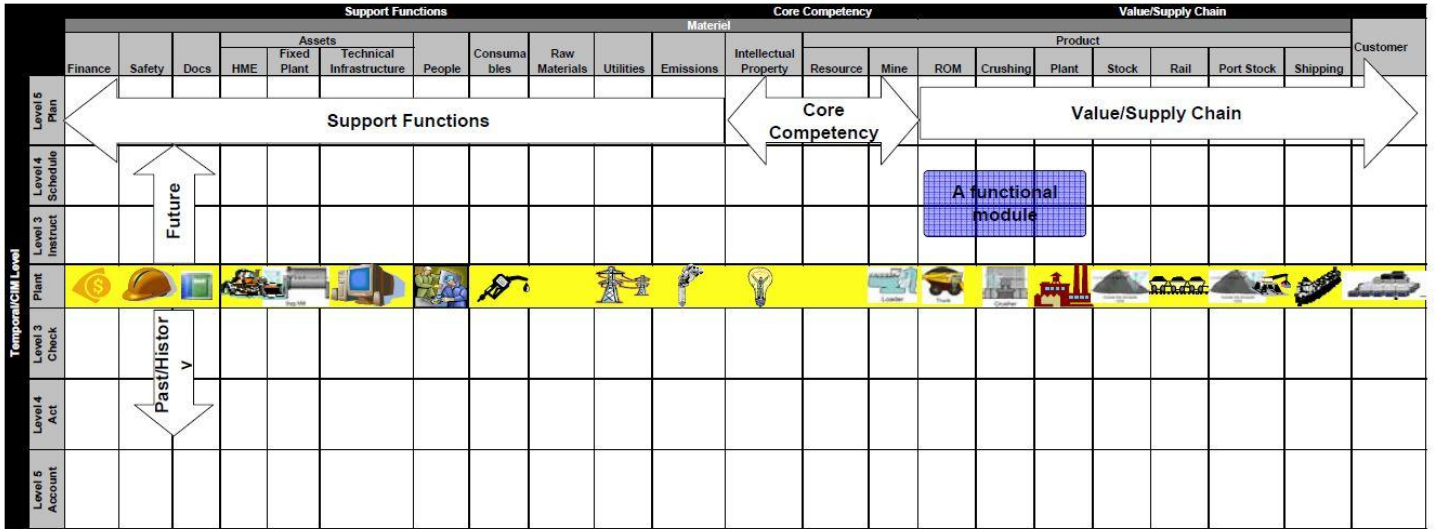


Figure 11 - Functional Reference Model Framework

How does this help? With the Functional Reference Model we can systematically review all of the functions included within the scope of a business to create a map defining all of the function groups that need to be addressed in the MES 'space'.

For example, in Figure 11: Functional Reference Model we identify an arbitrary functional module. We can immediately see that this model is responsible for scheduling and operating instructions associated with the material from the ROM (run-of-mine, or raw material), through crushing, on to the processing plant. Even without further description we have bounded the scope of this functional module.

Thus with the FRM we can ensure:

**Completeness:** Capture all of the functions, to ensure complete coverage. Without completeness it is possible to identify all of the well known, well established applications, but miss many of the subsidiary, yet still critical, functions currently implemented in one of the numerous spreadsheet applications. For example, the function of shift handover report is a detail often missed in functional decomposition.

**Check/Consistency:** Cross-correlate with existing standard and internal reference models.

The functional groups, and hence FRM can be defined at multiple levels of detail:

**Level 1:** The major functional category. It should include all application functions within technical systems scope for this stage of the operation.

**Level 2:** The next level of categorization of functional elements or components. This will likely relate to application modules such as dispatch.

**Level 3:** Component or element that is a grouping of related functionality. It should be described in generic business terms avoiding specific technologies or vendor jargon.

## FRM and Standard Applications

Since all of these standards attempt to define a functional reference model for the manufacturing and process industries, it is important to develop a common terminology. The existing standards ISA-965, MESA 11, OMG/MES and Solomon have been mapped to the FRM in order to provide a common framework with which to compare these standards.

### ANSI/ISA-95

ANSI/ISA-95 is a standard aimed at defining the integration between the many systems supporting the manufacturing or production process. The model centres on an object model. However, its process model is derived from the Purdue Reference Model.

| Temporal Level   | Support Functions                     |        |           |                            |             |                          |                      |                                    |               |           | Core Competency                           |                       |          |      | Value/Supply Chain |          |          |       |       |                        |                                   |                  |                         |              |               |
|------------------|---------------------------------------|--------|-----------|----------------------------|-------------|--------------------------|----------------------|------------------------------------|---------------|-----------|-------------------------------------------|-----------------------|----------|------|--------------------|----------|----------|-------|-------|------------------------|-----------------------------------|------------------|-------------------------|--------------|---------------|
|                  | Finance                               | Safety | Documents | Assets                     |             | Technical Infrastructure | People               | Consumables                        | Material      |           |                                           | Intellectual Property | Product  |      |                    | Customer |          |       |       |                        |                                   |                  |                         |              |               |
|                  |                                       |        |           | HME                        | Fixed Plant |                          |                      |                                    | Raw Materials | Utilities | Emissions                                 |                       | Resource | Mine | ROM                |          | Crushing | Plant | Stock | Rail                   | Port Stock                        | Shipping         |                         |              |               |
| Level 5 Plan     |                                       |        |           |                            |             |                          |                      |                                    |               |           |                                           |                       |          |      |                    |          |          |       |       |                        |                                   |                  |                         |              |               |
| Level 4 Schedule |                                       |        |           | 10: Maintenance Management |             |                          |                      |                                    |               |           | 2: Production Planning                    |                       |          |      |                    |          |          |       |       |                        | 9: Inbound shipping and inventory |                  | 12: Marketing and sales |              |               |
| Level 3 Instruct |                                       |        |           |                            |             |                          | 13: Labor Management | 4: Material and energy control     |               |           | 3: Process Support Engineering            |                       |          |      |                    |          |          |       |       | 5: Operations planning |                                   |                  |                         |              |               |
| Plant            | [Icons: Dollar, Hard Hat, Smartphone] |        |           | [Icons: Tractor, Forklift] |             |                          | [Icon: Worker]       | [Icons: Conveyor, Gear, Lightbulb] |               |           | [Icon: Lightbulb]                         |                       |          |      |                    |          |          |       |       | [Icon: Mountain]       | [Icon: Factory]                   | [Icon: Mountain] | [Icon: Train]           | [Icon: Ship] | [Icon: Truck] |
| Level 3 Check    |                                       |        |           |                            |             |                          |                      |                                    |               |           | 11: Research, development and engineering |                       |          |      |                    |          |          |       |       |                        | 7: Product inventory control      |                  | 8: Quality assurance    |              |               |
| Level 4 Act      |                                       |        |           |                            |             |                          |                      |                                    |               |           | 6: Production Cost Accounting             |                       |          |      |                    |          |          |       |       |                        |                                   |                  |                         |              |               |
| Level 5 Account  |                                       |        |           |                            |             |                          |                      |                                    |               |           |                                           |                       |          |      |                    |          |          |       |       |                        |                                   |                  |                         |              |               |

Figure 12 - ISA-95 Functional Reference Model

As would be expected, ISA-95 concentrates on the Level 3 and Level 4 ‘temporal’ aspects of the business. It is interesting to note the aspects of the business that ISA-95 does not cover: documents, technical infrastructure, safety, and resources.

### MESA 11

MESA 11, developed by MESA International, proposes a ‘honeycomb’ of major application areas. These have a loose relationship to the Purdue Reference Model.



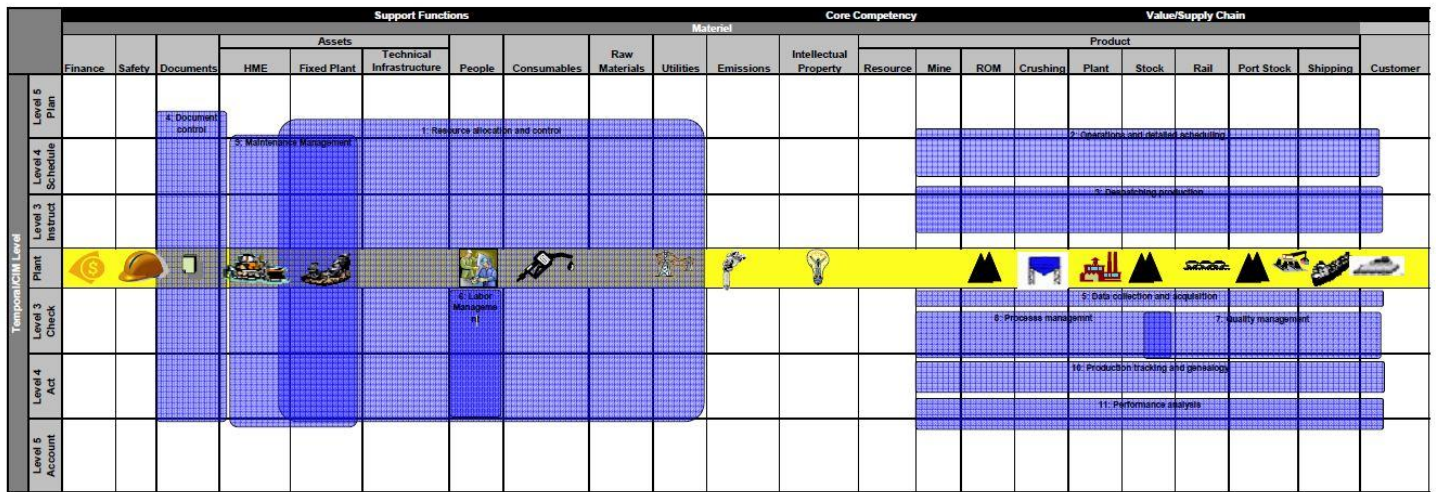


Figure 13 - MESA-11 Functional Reference Model

Since it is derived from the Purdue Reference Model it does, as expected, concentrate on CIM Levels 3 and 4. Like ISA-95, it is notable for not dealing with some important material, safety, emissions, intellectual property and resources.

**OMG/MES**

OMG/MES developed by the Object Management Group started an initiative to define the datamodel (object structure) based on the MESA11 definitions. OMG/MES definitions are therefore derived from MESA 11 but provide more detailed granularity.

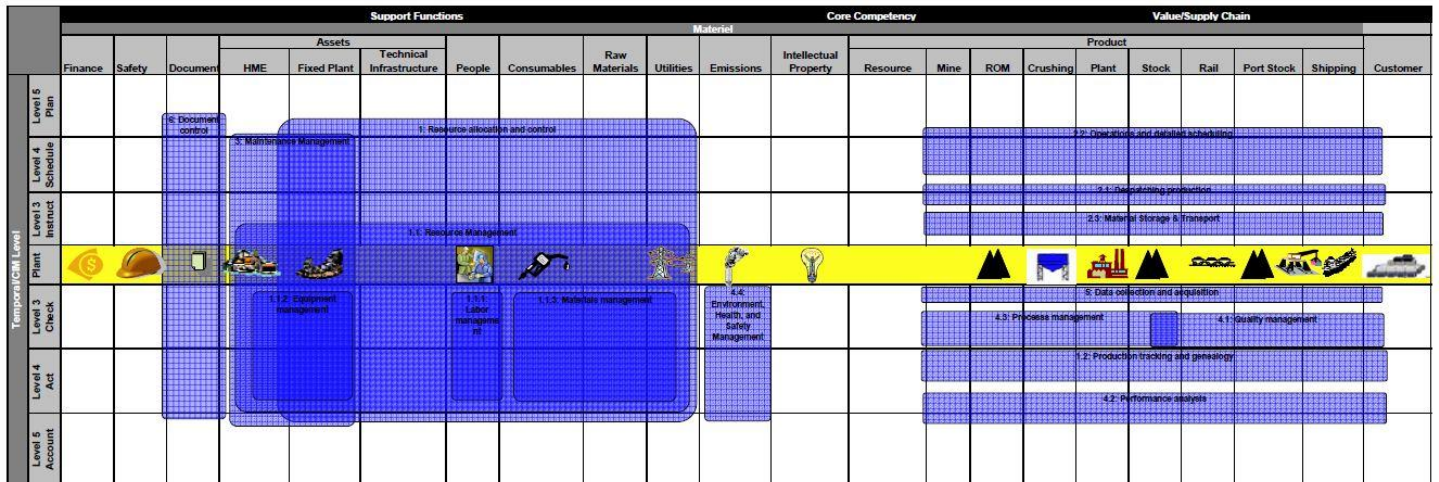


Figure 14 - OMG/MES Functional Reference Model

Since it is related to the MESA11 it does, as expected, concentrate on CIM Levels 3 and 4. Like ISA-95, it is notable for not dealing with some important material, safety, emissions, intellectual property and resources, although emissions monitoring does appear.

**Solomon**

Solomon Associates created a reference model designed primarily for the hydrocarbon process industry, but with some similar ties to mining and material processing.

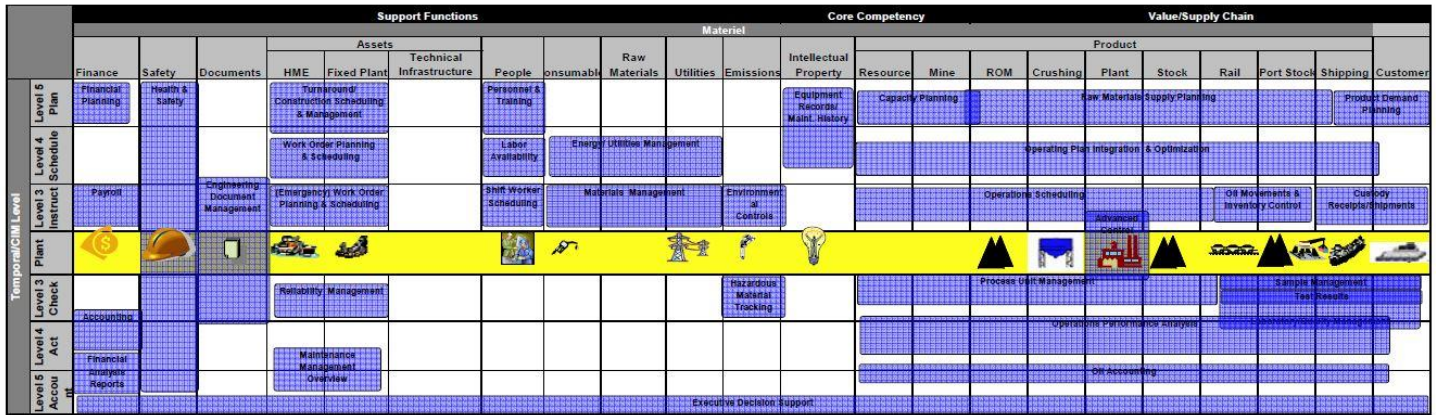


Figure 15 - Solomon Functional Reference Model

Solomon’s model has the most complete coverage of the FRM’s material and temporal dimensions. Unfortunately Solomon does not go into further detail of each of the functional modules.

### FRM and Standard Data Models

Recently we have seen data model standards emerging, each focused on a particular domain. It is useful to map these standards against the FRM to explore their coverage and compatibility.

| Name          | Description                                                                                                                                                                                                                                       | Domains                                                                      |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| ISO10303      | Step, PISep, Epistle, many parts, basis of other standards, file transfer only                                                                                                                                                                    | Equipment data                                                               |
| ISO15926      | <a href="http://www.tc184-sc4.org/wg3ndocs/wg3n1328/lifecycle_integration_schema.html">http://www.tc184-sc4.org/wg3ndocs/wg3n1328/lifecycle_integration_schema.html</a>                                                                           | Equipment data                                                               |
| Mimosa        | OSA-EAI, OSA-CBM, <a href="http://www.mimosa.org">www.mimosa.org</a>                                                                                                                                                                              | Equipment data                                                               |
| OPC           | <a href="http://www.opcfoundation.org">www.opcfoundation.org</a>                                                                                                                                                                                  | Process Data, Embedded systems                                               |
| ISA – SP95    | <a href="http://www.pera.net/Standards/S95_Presentations/MESA_S95_files/frame.htm">http://www.pera.net/Standards/S95_Presentations/MESA_S95_files/frame.htm</a> and <a href="http://www.s95.nl/S95_02_en.htm">http://www.s95.nl/S95_02_en.htm</a> | Production planning and Equipment data                                       |
| B2MML         | <a href="http://www.wbf.org/">http://www.wbf.org/</a>                                                                                                                                                                                             | Production planning                                                          |
| API690        | <a href="http://www.pera.net/Standards/API_Standards_presentation/API%20TF%20690%2001-20.pdf">http://www.pera.net/Standards/API_Standards_presentation/API%20TF%20690%2001-20.pdf</a>                                                             | Equipment data                                                               |
| API-689       | ISO14224 – see above                                                                                                                                                                                                                              | Operations and maintenance data                                              |
| API-610       | See above                                                                                                                                                                                                                                         | Procurement, engineering, construction                                       |
| OASIS         | XML only transfer of PSLX see <a href="http://www.oasisopen.org/committees/tc_home.php?wg_abbrev=pps">http://www.oasisopen.org/committees/tc_home.php?wg_abbrev=pps</a>                                                                           | Production planning                                                          |
| OMG MfgDTF    | Object Management Group – Manufacturing Domain Task force <a href="http://www.omg.org/docs/mfg/01-06-06.pdf">http://www.omg.org/docs/mfg/01-06-06.pdf</a>                                                                                         | Manufacturing software components interoperability via CORBA (out-of- scope) |
| ISO/TC184/SC5 | JWG 8 (Manufacturing Process and Management Information - administered by ISO/TC 184/SC 4                                                                                                                                                         |                                                                              |

| Name    | Description                                                                                                                                                                                                                                      | Domains                           |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| ProdXML | PRODML is an industry initiative to provide open, non-proprietary, standard interfaces between software tools used to monitor, manage and optimize hydrocarbon production: <a href="http://www.prodxml.org">http://www.prodxml.org</a>           |                                   |
| WITSML  | WITSML was initially developed by the WITSML project, an oil industry initiative sponsored by BP and Statoil, and later by Shell, as a new standard for drilling information transfer. <a href="http://www.witsml.org">http://www.witsml.org</a> | Drilling and well log information |
| PIDX    | Part of the API with the goal to streamline information exchange: <a href="http://committees.api.org/business/pidx/description.html">http://committees.api.org/business/pidx/description.html</a>                                                | Procurement                       |

Table 1 - Data Model Standards

## FRM and Solution Functionality

How do we define application functionality? This is a question frequently asked of the program manager for a new application. The truth is that the Request-for-Information is often a fishing expedition for vendors to supply their specifications, which are then used as a shopping list for the functionality included in the Request-for-Quotation. This is often the source of applications with redundant functionality which increases the purchase cost and results in more complex implementation.

The FRM can form a systematic basis for determining the functional requirements. For each combination of the three dimensions temporal, materiel, and spatial, we can define the functionality **required** to manage the business assets.

| Location |              |                   | Functionality                                                                     |
|----------|--------------|-------------------|-----------------------------------------------------------------------------------|
| Temporal | Materiel     | Spatial           | Level 2                                                                           |
| Schedule | Raw material | Inbound storage   | Ensure sufficient inventory available                                             |
|          |              |                   | Determine composition based on schedule                                           |
| Schedule | Raw material | Inbound logistics | Define schedule of material movements to storage, specifying destination location |
|          |              |                   | Schedule contents of process lines to ensure no scheduled contamination.          |

Table 2 - FRM and Functionality

## FRM and Benefits

Application deployment is not free. Not only are there the application purchase and project costs but, more importantly, the cost to the business of adapting to the new business processes and procedures. All this will be part of a well-designed implementation plan. However, what are the real benefits?

We can use the same FRM to align the benefit estimates with the functionality, which in turn aligns the benefit within the FRM temporal-materiel-spatial coordinates. For example:

| Temporal | Materiel     | Spatial           | Level 2                                                                           | Opportunity                                                                                                    | Assumption                                                             | Benefit                                                                                |
|----------|--------------|-------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Schedule | Raw material | Inbound storage   | Ensure sufficient inventory available                                             | Eliminate possibility that scheduled receipt cannot be unloaded due to insufficient storage                    | Assume that x inbound demurrage incident charges can be reduced by 50% | 50% X demurrage incidents X demurrage charge                                           |
|          |              |                   | Determine composition based on schedule                                           | Ensure that the unit schedule has the best prediction of feed tank quality determined from deduced composition | Reduce unit upset duration by 20% on feed tank cutover                 | Number of feed changes X Unit settling time X 20% X Unit feed rate X Reprocessing cost |
| Schedule | Raw material | Inbound logistics | Define schedule of material movements to storage, specifying destination location | Reduce uncertainty regarding movement destination                                                              | Operator workload reduced by 10%                                       | Inbound operations cost X 10%                                                          |
|          |              |                   | Schedule contents of process lines to ensure no scheduled contamination.          | Reduce possibility of black-white oil contamination                                                            | Reduce quantity of line-fill flushed to slop tanks by 50%              | Line-fill X processing cost X 50%                                                      |

Table 3 - FRM and Benefits

## FRM and Production Management Solution

Honeywell's goal is to offer an integrated suite of applications that meets the customer's business requirements. In the companion white paper: 'Achieving production Excellence: Architecture for Success' we describe how Honeywell's integration architecture brings together applications, information, and presentation. Our intention is not to provide the 800-pound gorilla of applications within which we compel users to deploy all aspects of their business. However in the same paper we identify that many functions within an enterprise are not adequately supported by applications, so they have become adhoc and often unsupported solutions. Therefore Honeywell offers application solutions covering most of the scope of the business as demonstrated below, yet at the same time allows third-party applications to be used as well.

The fundamental business loop within the process industries is as follows:

### Production Plan Manager

In order to achieve the business goals, targets (plans) are set for the business processes to follow. Although plans might be derived from sophisticated planning and scheduling applications, it is just as important that these plans and schedules are published so they can be followed. Additionally, once the plan has been executed one will want to verify that the plans were followed. If not, then why not? Was the plan wrong in the first place because the feedstock or unit performance was incorrect? Whatever the reason it will be important to track the plan.

### Production Materials Manager

Targets (plans) then have to be converted to actions on the materiel of the business: feedstocks, processing unit setup, components, blends shipments etc. Frequently this is an ad-hoc process involving spreadsheets and email. Materials Manager takes the plans and converts them into specific instructions that can be delivered to operations for execution. Unlike plans, which tend to set quantity goals over a period of time, or schedules, which identify periods of operation, Materials Manager handles the specific instructions: what tanks to feed to what units; where the products should be run to; which tanks to use for the blending components; when and where to load a product.



Production Manager is Powered by Matrikon, which represents vendor neutrality. This product works with third-party control systems and applications

### Production Accounting Manager

Once actions are taken on the business assets, it is important that one measures what really happened to account for the material. Accounting Manager takes the information collected within the Materials Manager—inventories, material flows, shipments, receipts, material movements etc—and aggregates them over periods of time, over different operational areas, over different categories of material. In a perfect world material in equals material out, but any material accountant will tell you this does not happen. So part of Production Accounting Manager is the ability to reconcile all material flows in order to detect any imbalances and attribute the errors to missing material movements or incorrect measurements. This then improves upon the quality of the raw measurements.

### Production Performance Manager

Are we achieving the business goals? If we are not measuring the actual performance and constantly comparing with the plans and targets, we will be resorting to 'regret' reporting: '*we regret that last month we did not meet the plan*'. Only if the performance is constantly and accurately measured, just like a feedback control loop, can we achieve the tight control of the business required to achieve operational excellence.

One problem often faced is that the information required to perform the plan versus actual comparison is scattered in different systems, using different formats, assigned to differing product codes and conventions. This makes it difficult to perform this performance assessment on a regular basis. However with Honeywell's Production Management all of the information: production plans, production materials, and production accounts are all held in a consistent format allowing easy comparison between plan, actual, accounted, reconciled, scheduled, etc., each of these comparisons providing important feedback such as the ability of the scheduling process to follow the plan. Additionally the complex performance measures such as availability, specific energy consumption, and unit yield become trivial since the real reason for the complexity of these performance measures is accessing the raw data, not the complexity of the calculation.

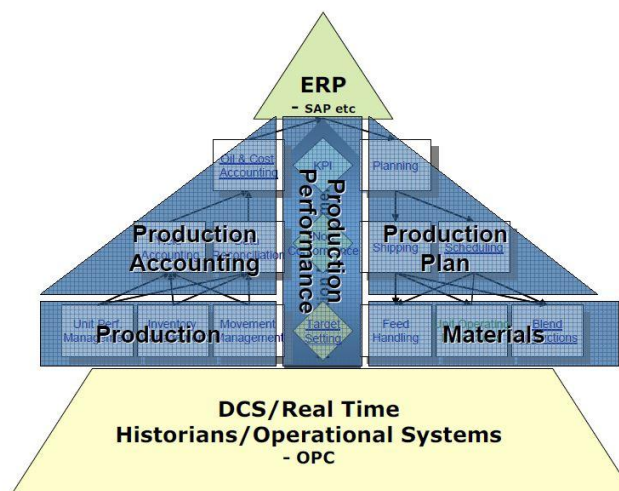


Figure 17 – Honeywell's Advanced Solutions Production Management

## Honeywell's Advanced Solutions: Production Management

The position of Honeywell's Advanced Solutions Production management solution is shown in figure 18. The functionality of each of the elements is then detailed, showing the comprehensive coverage of this solution throughout the business process.

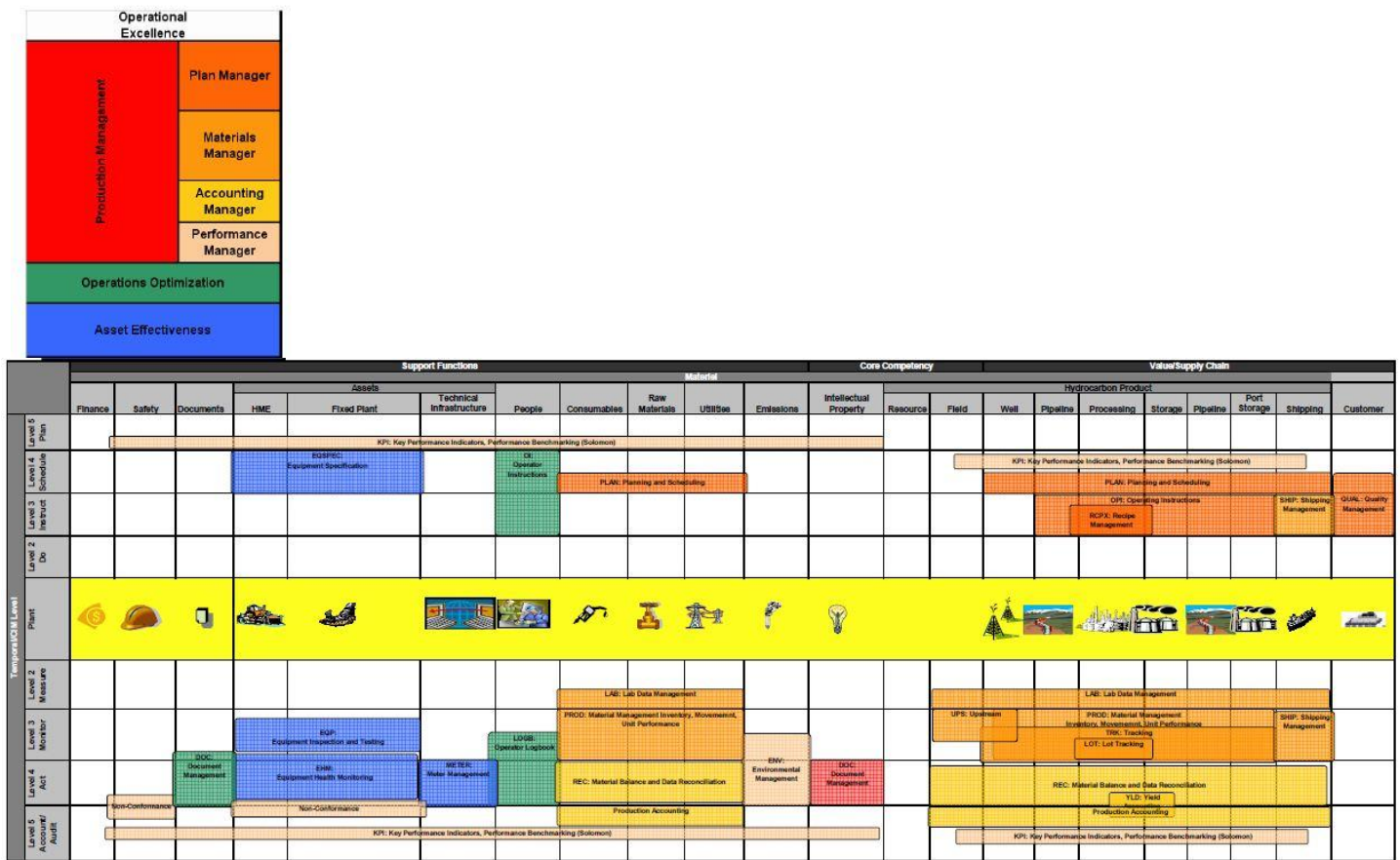


Figure 18 – Honeywell’s Advanced Solutions Production Management Functional Reference Model

**Production Plan Manager**

- **Delivery of Plans and Schedules:** Publish plans and production schedules – long-term, monthly, daily
- **Operations Targets:** Convert schedules to operations targets
- **Production Orders:** Match production to production orders
- **Recipes:** SP88 and more

**Production Materials Manager**

- **Movements:** Continuous movements, truck tickets, lots, batches, batch ownership
- **Inventories:** Volume, mass, energy, strapping tables, volume compensation
- **Shipping:** Ships, trucks, itineraries, schedules, BOM
- **Pipelines:** Pipeline inventories, pipeline batch tracking
- **Material Tracking and Genealogy:** Forwards and backwards genealogy, lot tracking, batch tracking
- **Composition Tracking:** Compositions at any location at any time
- **Ownership Tracking:** Ownership of all inventories and material movements, losses included
- **Sample Schedules:** Sample points, samples, sample plans, laboratory analyses
- **Product Specifications:** Product catalogues, raw materials, intermediates
- **Assays:** Multi fraction crude assays
- **Quality Predictions:** Property blending by mass, volume, non-linear blending tables

### Production Accounting Manager

- **Balancing:** Volume balancing, mass balancing, energy balancing at any organizational level
- **Loss Calculations:** Loss quantities, qualities and ownership
- **Yield Accounting:** Unifies production balances with expected unit yields
- **Royalty Allocations**
- **Statistical Reconciliation:** Reconcile complete facilities
- **Measurement Errors:** Identify measurement problems
- **Data Quality:** Improve raw data quality – calculate unmeasured streams

### Production Performance Manager

- **Performance Metrics:** Calculate comprehensive performance metrics, including Solomon
- **Drilldown hierarchy:** Rapid problem identification
- **Non-Conformance Alerting:** Send alerts, e-mail, escalate problems
- **Complex Calculations:** Create business Key Performance Indicators using data from

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#### For more information:

For more information about Production Management, visit our website

[www.honeywell.com/ps](http://www.honeywell.com/ps) or contact your Honeywell account manager.

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