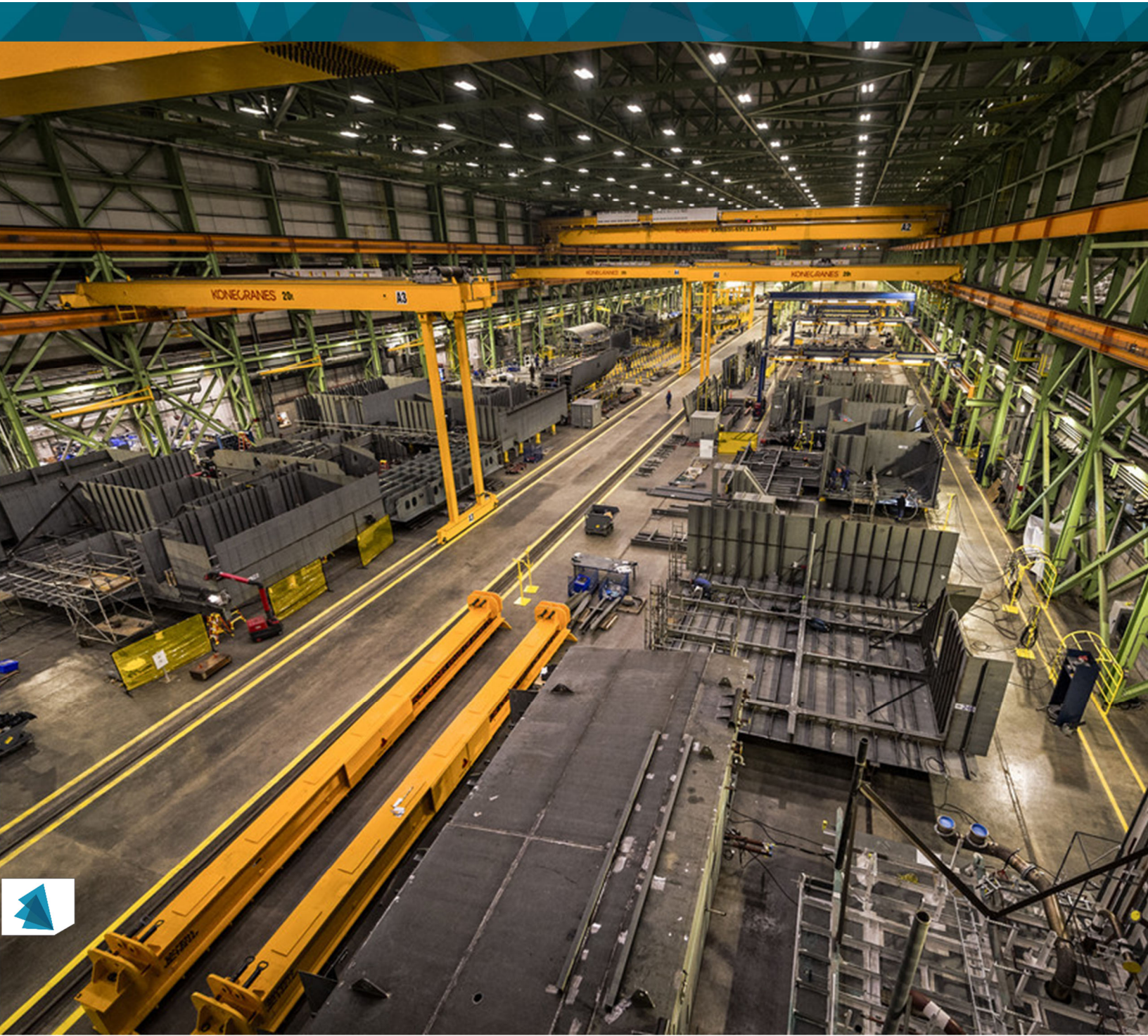# WHY ERP AND MES RELY ON EACH OTHER

Enterprise Resource Planning (ERP) and Manufacturing Execution Systems (MES) have mutual data dependencies: ERP feeds MES with receiving, purchase orders, or sales orders, and Procurement Bills of Materials (P-BoMs). MES feeds ERP with accurate, timely information such as production levels, inventory, work-in-process status, part and serial number usage, scrap material information, all for tracking purposes. The return of ERP-MES investments can significantly increase competitive advantage in delivering on-time quality products that are compliant with customer orders.

Simply put, ERP knows "why" (strategic decisions), while MES knows "how to" (operational decisions).

Within Hexagon PPM and NESTIX, we have provided MES for more than 40 years. We have been involved in MES that has ranged from analyzing the requirements and the potential return on investment to defining the specifications to training the operators in how to use the system. Hexagon (mainly through automotive and aerospace) is actively involved in the ISA 95 and therefore the ISO standard IEC62264 as well. With the acquisition of NESTIX by Hexagon these resources became also available to NESTIX. Upon review, it was discovered that the NESTIX experience was identical to the ISA 95 standard (evolved to the latest technology standards like XML and web-based protocols).

So, what is the ISA 95 standard, and in particular, the Part 3?

Based on the ISA 95 Part 3 standard, the picture below depicts the inputs and outputs of an MES solution, whereas traditionally the product definition comes from Engineering since they contain the geometrical as technical attributions required for the MES. The remaining inputs and outputs go to the ERP solutions in order to synchronize capacity as well as commercial impacts.
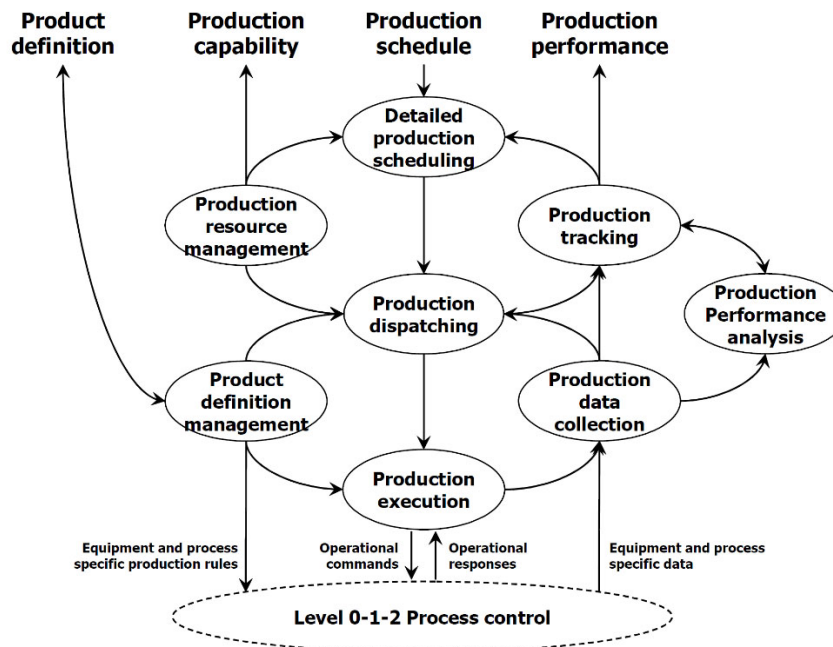

Figure 1: ISA Part 3: focuses upon the activities within the Manufacturing Operations, i.e., within level 3. This part specifies a generic activity models that applies for different types of Manufacturing Operations such as production, maintenance, inventory and quality. The activity model for Production Operations is shown in figure 1 (ISA 95 part 3, draft 16), each activity is represented as one oval.

In many of these MES projects, one of the triggering elements has been the installation of a new ERP system or the replacement of an existing one. It was therefore natural to wonder if every ERP actually needs an MES system. Based on experience, the answer is absolutely yes.

Only with a continuous and efficient exchange of timely and accurate information can the supply chain operate effectively as a whole.

There are many reasons that every ERP must be supported by an MES, but let's focus on a few:

1. **ERP is not designed to reach the shop floor.** Even with all the features related to production execution in an ERP, no machine that produces a piece per cycle will probably ever communicate to the ERP that it completed the cycle. Shop floor production systems and ERP systems operate on different interpretations of "real time" - one typical of the strategic management of the business, the other associated with the punctual execution of the process. The systems must communicate and act as a seamless whole to allow the manufacturing industry to meet the dynamic demands coming from customers, regulators, suppliers, and even internal staff. ERP systems are not designed to be truly "real time" applications; they lack "speed" and responsiveness, and they tend to be static or have significant latency. In contrast, MES systems are fast and allow real-time decisions. On the shop floor, it may not be necessary to analyze static data of the recent past, but instead to focus on current information on what is happening in the present and perhaps on an evolving trend related to the information in question.

2. **Things change in production 10 times faster.** Any strategic or market change managed at the ERP level generates a volume of change about 10 times higher on production level. The production management system therefore must be specifically designed and implemented to manage both the amount and the speed of change it creates for production.

3. **Those who work with ERP have different needs from those who work in production.** Different operators with different needs require not only different information, but they also need information presented in a different way. The classic ERP interface tends to organize information for users who perform analysis on which they base decisions. In production, because everything happens faster, the information must be packaged to allow fast - if not immediate - decisions. Often it is not necessary to analyze static data of the recent past, but instead to have information on what is happening in the present and perhaps on an evolving trend related to the information in question. Different types of information and the people who consume it necessitate the use of a diversity of systems.

4. **The supply chain needs to be integrated beyond the strategic or commercial level.** In modern economic scenarios, the competition no longer takes place between Company A and Company B, but between Supply Chain A and Supply Chain B. This means that efficiency should be pursued across the entire supply chain, which cannot be obtained with the single integration of data at the strategic or commercial level. Information integration can only be done through constant alignment of all levels of each link in the chain, from the shop floor up. Only with a continuous and efficient exchange of timely and accurate information can the supply chain operate as a whole effectively on the market.

5. **The ERP knows "why," while the MES knows "how to."** While the former primarily supports strategic decisions, the second supports the operational ones. Who knows *how to* make things always works for those who know *why*, but who knows *why* must rely on people who know *how to* to actually turn their decisions into reality. It is an essential symbiosis required to achieve any idea.

6. **At the shop floor a lot of information required is actually geometric based.** For instance, the profile cutting robot requires the end-cut definitions, something that is never stored in an ERP solution. The location of the profile onto the panel is a geometric problem that again is known and understandable within MES but is totally a mystery for the ERP solution.

Common MES Interfaces

Using the standard ISA 95 as a basis helps in the communication between the multiple parties that are involved in today's IT landscape, whereas Engineering and ERP are the two major solutions besides the MES system.

Using this standard as a guideline, the following benefits can be achieved:

The most obvious benefit is, of course, that a set of common terms and terminology is defined. Employees working at the business level (i.e., SAP, Oracle, IFS, JDE etc.) can start to communicate with the manufacturing and control people. Traditionally, the two groups have used different words for the same thing, or called the same thing different names, resulting in misunderstandings and unnecessary time-delays and errors. Technicians, operators, managers and CEOs can now better understand each other. And people from different companies now have a common set of terminologies to use when speaking with each other. The standard has been developed by a large group of people with different backgrounds working with different aspects of the enterprise-control system integration topic. The collective knowledge of this group is unbeatable and there is no need to "reinvent the wheel." What this group has agreed upon is probably the best solution concerning models and terminology to be successfully used.

Are we speaking the same BOM language?

The main area of discussions comes from the word BOM (Bill of Materials), which is often insufficiently defined. While the Procurement BOM (P-BOM) is something that needs to be communicated between ERP and MES, the Manufacturing BOM (M-BOM) is often coming directly from the engineering tool or is a

combination of the Engineering BOM (E-BOM) with manual modifications within the MES environment (e.g. adding bevel information, weld data, margin, shrinkages, etc.). Once this is clearly established, the boundary between ERP and MES regarding integration become clear again.

Both systems are needed and have their own place.

From experience, both systems are very complementary to each other, whereas often with material requisitions, purchase order deliveries to the warehouse are done within the ERP solution. What happens from the warehouse is managed within the MES solution (we know which parts are cut out of which plates since nesting is embedded for plate and profiles, something that the ERP system does not know, and see comment 1 & 2, which prevents ERP systems to react quickly enough to the changes, for instance the penetration that needs to be marked instead of cut at the last minute). We often see that the schedule information from the workpack can be handled through the ERP solution or through a specific planning tool.

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About Hexagon

Hexagon is a global leader in digital solutions that create Autonomous Connected Ecosystems (ACE). Our industry-specific solutions create smart digital realities that improve productivity and quality across manufacturing, infrastructure, safety and mobility applications.

Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

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