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Requirements for smart system implementation in management of manufacturing processes

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Abstract
Main object of the papers to compile and organize the different attributes technologies and facilitating factors consistent with intelligent manufacturing that are currently accessible in the scope of knowledge. This set, of attributes technologies, and supporting factors is intended to help in the comparison and distinction of other initiatives such as Industry Four, cyber manufacturing processes, smart factories development, and improved manufacturing, which are often used interchangeably with industrial automation.
Additionally, these papers recognize the concept of "semantic similarity" in order to prepare the ground towards a potential intelligent production epistemology, as several of the mentioned products exhibit varying degrees of overlap; as a result, some attributes and technologies are combined and clustered. This paper concludes with a detailed list of these attributes, innovations, and enablers that are often correlated with smart manufacturing.
As a summary, a set of five distinguishing characteristics, 12 developments, and 3 facilitating factors are identified as being important for the framework of smart manufacturing. The paper then reviews the developed structure by comparing its attributes and technology clusters to Industry Four and cyber-physical device design concepts.
The purpose of this paper is to supply a strong foundation for a large and multidisciplinary discourse among members of the scientific and technological communities regarding the distinguishing aspects, technologies, and enablers of industrial automation.

Keywords: Intelligent production, smart manufacturing, industry four, smart control, facilitating factors, compatibility

Introduction
The term of smart manufacturing (SM) introduced in the US but widely used worldwide, has achieved considerable traction in past years in industry and science. Numerous production processes are recast as smart manufacturing systems (SMSs).
SM is a series of production procedures that regulate manufacturing operations through the use of networked information and communication technologies (ICTs). Productions were described as a procedure or a series of processes that convert raw materials to finished products. Moreover, the conventional view of production encompasses a great deal more [1].
Manufacturing currently understands data-driven market operations at several levels, which has resulted in the growth of numerous manufacturing paradigms, one of which is SM.
Future SM systems would have unmatched self-assembly capabilities, enabling them to create diverse and personalized goods for new and established markets.
SM analyzes the data to continually enhance and sustain results. Numerous methods for SM have been suggested. One is a precision control method that focuses on four aspects: mechanics awareness, operating processes, intelligent surveillance, and machine shape measurement as well as the error source estimate for an SM system [2].
Despite the increasingly growing literature, implementations, and usage in academia and industry of the word intelligent manufacturing, there remains a lack of agreement as to what constitutes a "smart" production system.
In other ways, SM (Standard or Mass Production), Industry Four, smart systems, digital manufacturing, smart plant, and process management are often used terms to refer to the same stuff [3].

In general, our inquiry remains focused: 'What are the components of production systems that are intelligent?' Various features such as "self-control," "robotics" and "empower management" have been identified in the SM Systems literature as being some systems that may be of vital importance to the manufacturing world.
Through a study of the literature, this paper examines the suggested attributes, technologies, and enablers and attempts to group the homogeneous objects into clusters.

Attributes technologies of SM
The comprehensive definitions indicate that some of these attributes, innovations, and supporting factors are used interchangeably and may be combined to produce a more oriented result. When specific attributes, technologies, and facilitators (As shown in table 1) are important, accumulating is essential to create a more detailed and focused list [4].
Clusters are made up of a group of related features or strategies, or a mixture of both. Furthermore, clusters containing both technology and characteristics should be considered, but essentially only technology or characteristic clusters should be considered. This is due to the heavy interdependence between different objects and vocabulary overlaps. While this is inconvenient and complicates matters, it represents the subject's inherent complexity and the importance of initiating efforts toward a common interpretation and phraseology [5].
Collectives of enabling factors that deal with organizational or human guidelines cannot share characteristics and technologies, and clusters of enabling factors do not share similar attributes and technologies.

Table 1: List of Enabling Technologies Associated SM

No.	Factor of Enablement
1	Law and regulations
2	Learning and education that are innovative
3	STEP AP 242
4	Employees of knowledge
5	CMSD
6	MT Connect
7	Integrating Organizations
CMSD:	Core Manufacturing Simulation Data.

Clusters of Attribute
Some objects may have been classified as belonging to another cluster; however, they are classified as belonging to a particular cluster due to the discussion below.

Contextuality
Context knowledge is a critical attribute of SM system, and it can be thought of as a set of the following characteristics [6]:

- **Identity:** A self-contained SM device should have a unique identifier. Given that SM systems always work in a digital climate, we can assert that they could be them possess *digital presence*, supplying them with a unique identifier in the digital community.
- **Location:** It is used to refer to the system's or subsystem's physical place.
- **Status:** This term refers to the current status of the operations occurring within the SM system. *Self-awareness* of the asset also implies that the SM system must be conscious of its current state.
- **Time:** The SM system should be capable of defining its time priorities, and it may also be required to take into account local time. *Self-awareness* of the asset also implies that the SM system must be conscious of its current state.
- The characteristics of the context perception cluster are depicted in figure (1).

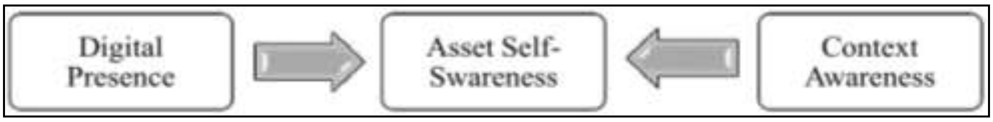

Fig 1: The graphical description of context perception cluster with associated properties

Modularity
The term Modularity is referring to a property of a device that allows for the decomposition of a unit into elements which can be assembled to form a variety of combinations. Composability refers to a system's capacity to be constructed from its subsystems.
Because each of these properties considers that a sub-unit is built and because modularity permits the construction of new units, composability can be regarded as a subset of modularity [7].

Heterogeneity
Heterogeneity takes into account the variety and dissimilarity of elements and constituents. However, since it does not take into account the combination of modules, such as modularity, it should be proposed a distinct trait [8].

Compositionality
This term is referring to a property that pertains to the comprehension of an entire structure based on the concept of its constituents and their combination. Since the device or component definitions are neither modular nor heterogeneous, compositionality should be regarded as a distinct characteristic [9].

Compatibility
The attribute of compatibility is the property that enables system units to exchange and share information. Through *networkability*, systems may cooperate on a variety of process-related tasks, and in order to do so, they must allow

one another to share and transfer information [10].
Likewise, *shared* systems enable other systems also on the network to reach the information and data contained in one system.
As a result, compatibility encompasses the network ability and shared properties of systems.
Data appropriateness refers to the availability, accessibility, and understandability of information when it is required; this may be an attribute of information that is shared; therefore, the information would be useless.
Integrability is the property that allows separate units to be integrated, but when connected with each other's data, two units may also be integrated. This integrability feature is therefore integrated into compatibility.
As a result, this integrability attribute is incorporated into compatibility. *Decentralization* is the property that enables SM to be run by several related units and thus can be regarded as a component of compatibility [8].
Integrability, on the other hand, differs from modularity in that modularity physically integrates the systems to construct a new structure, while integrability is concerned with information sharing between different systems and is thus a subset of compatibility. It's important to address the distinctions between compatibility and cloud-based.
Data computing is similar to a database in that data can be stored and accessed by any of the cloud's systems. Compatibility, on the other hand, enables devices to access data and knowledge that have not been exchanged, such as in the cloud. Figure (2) shows all of the attributes found in the compatibility cluster functionally [10].

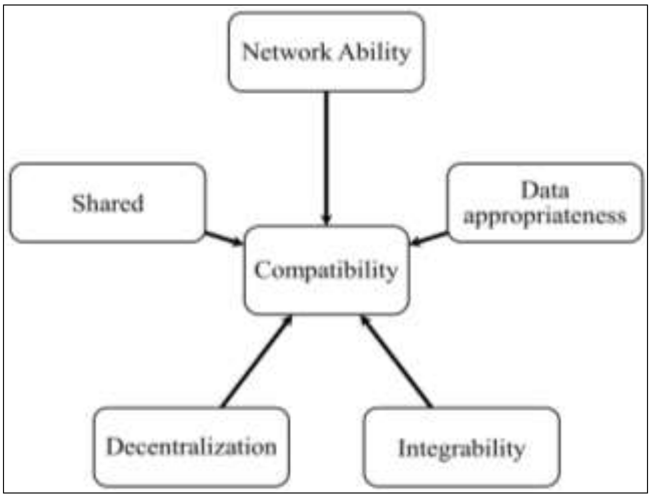

Fig 2: Graphical description of compatibility cluster and associated properties

Clusters of Technology
Smart Control
A critical Attribute of manufacturing processes is their ability to react quickly to events. *Responsiveness* can be described as an SM system's ability to rapidly deliver requested products to customers. *Agility* refers to a system's capacity to react to external impacts in an SM system, this may include market shifts.
Scalability is described as the property of a system that enables it to easily achieve fluctuations in request, resulting in a change in response.
Adaptability refers to a system's capacity to determine its assessment, survival rate, and optimal system output in the face of unknown details [11].

If a system performs well under unpredictable conditions and *adapts* to changes in the external world, it is said to have a high degree of *robustness*.
Reliability is the capacity to carry out tasks as planned, which also makes the outcomes predictable. *Accuracy* refers to the capacity to produce a result that is identical to or very similar to the real result. Since the meanings of all characteristics tend to be identical, they are grouped together.
With the assistance of intelligent technology, a machine is capable of changing its behavior in response to its own experiences, and if it utilizes smart control properties, it may use techniques such as artificial intelligence to control its processes, ensuring its dependability and accuracy.
These attributes and technologies intersect on the ability to respond to changes and may employ artificial smart methods to do so, and thus could be regarded as a subset of smart control.
If a production unit may respond to feedback and carry out its activities in order to accomplishing the aim, and if the unit wishes that the feedback module work, the unit has *autonomy*. It would necessitate the use of intelligent control technology; however, autonomy must be incorporated into intelligent control [12].
A system is called *completely automated* if it is capable of performing all of its tasks; however, the degree of automation varies between systems.
Where the system that is completely automated must also have intelligent regulatory mechanisms, to be totally automated.
The system becomes more automated as the control systems become more advanced. As a consequence, intelligent control should also provide this attribute.
Proactivity is an attribute that enables units to avoid deficiencies by sensing the environment.
Due to the fact that this characteristic requires sensing and regulating the system's processes, it will require a smart control mechanism. As such, it can be considered a subset of smart control.
Proactivity, on the other hand, detects current situations that may require data and thus may be included in the data analytics cluster.
The smart control cluster's various attributes and technologies are depicted in figure (3). The data analytics section discussed how machine learning could be a part of data analytics rather than intelligent control [13].

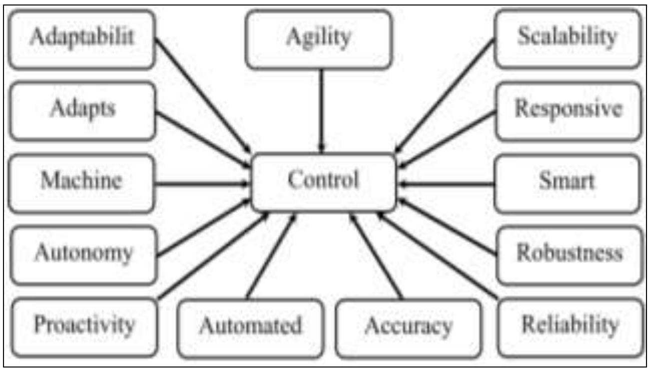

Fig 3: Graphical description of smart control cluster with associated attributes and technologies

Efficient use of Energy
Sustainability is described as goods and processes that are

reusable and have a small environmental impact making them more economically, socially, and environmentally friendly. Energy consumption savings by SM have been frequently addressed and energy savings are one of the primary drivers of SM [15].

Efficient use of energy is a technology that allows for a reduction in the amount of energy used to deliver a product or service.

Numerous studies have been conducted to determine how to reduce energy consumption in production processes. In certain situations, if a device's components can be reused, the amount of energy required decreases. As a result, sustainability can be considered a subset of energy conservation. While authors compared energy efficiency to several technologies, it should be regarded as a requirement for any production system, not just SM system.

Cyber Protection

Cyber-threats must be prevented. Since SM is heavily reliant on digitization and data-driven services, cyber protection is a critical component of the SM framework. While this attribute often includes data, it must be treated separately from compatibility because interoperability is concerned with information cooperating and reliability, whereas cyber protection is concerned with data confidentiality and protection [16].

Visual Application

- A hologram is a term that refers to a technology that utilizes a three-dimensional image created by a light area in three-dimensional geometry.
- VR “Virtual Reality” is a term that refers to the technology used to construct three-dimensional images using a computer and the interaction with that space using electronic technologies to give the user the sensation of being "immersed in a synthesis world."
- AR “Augmented Reality” is a technology that overlays a computer-generated three-dimensional numerical format on top of the actual world but does not allow for interaction.

Since these innovations include the development of a visual description of an object using electronic technology, they can be regarded to be a subset of the visual technology cluster, where figure (4) describes the different innovations that are used in a cluster of visual technology [14].

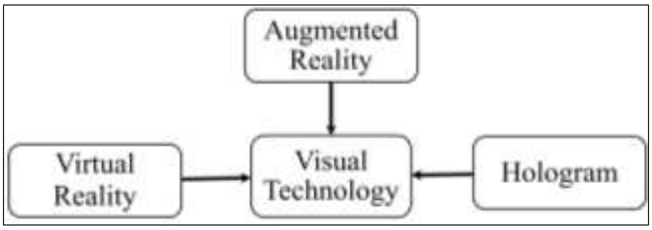

Fig 4: Graphical description of visual technology cluster with associated attributes and technologies

Analyses of Data

The word "data analytics" refers to the process of transforming the number, variety, speed, and factuality of information within a manufacturing system into actions and insights [17].

- Big data is a term that refers to a technology that enables the analysis of vast data account, mostly actual data that are challenge to evaluate using conventional methods.
  Although evaluation of data may process a large amount of data, the common technology referred to as "big data" could be considered a subset of this technology; however, since evaluation of data can analyze data at a maximum rate, it can coordinate with customers in a specific time
- Machine learning is the process by which computer programs personality themselves based on their interactions and structure; since it must not require human’s intervention, it can also be used for smart control.
  Since it identifies trends when applied to new data, we believe it must be consistent in the data analytics cluster.
- Predictive analytics discovers findings by analyzing data for measurable parameters and information mining is the study of vast quantities of information. Although analysis of the future mostly involves data analysis, it is classified as data analytics.
- Data visualization is a practice for visually representing data using graphs as well as other graphical information, which can result in the creation of data patterns for data analysis.
  Additionally, it must be regarded as a subset of data evaluation instead of the graphical technologies cluster, since the subsequently is more concerned with technology and data visualization is more concerned with information [18].
- GIS “Geographic Information Science” offers spatial and temporal information. This knowledge aids in the presentation and analysis of data. It may be debated which GIS could be used in smart parts/products/materials as well, as the device could include a sensor for data storage.
- Modeling is the process of expressing a real situation mathematically and/or simplifying the real-world system.
- The simulation generates data by the utilization of a model, which can then be analyzed.
- Forecasting is concerned with the estimation of future events using available data.
- Decision-making strategies are those that assist in decision-making. These include MCDN “multi-criteria decision-making”, mathematical processing techniques, and synthetic intelligence techniques.
- SPC “statistical process control” is a technique for enforcing quality control by the use of analytical statistics. It has been used in manufacturing for a long period and is still commonly used to manage and track processes today. Statistics have been used in several industrial methods for example, in the diagnosis of intelligent chemical processes.
- Proactivity, monitoring tracing, and smart materials are all components of other clusters and may have been used in this cluster.
  The data analytics cluster's different technologies are represented in figure (5).

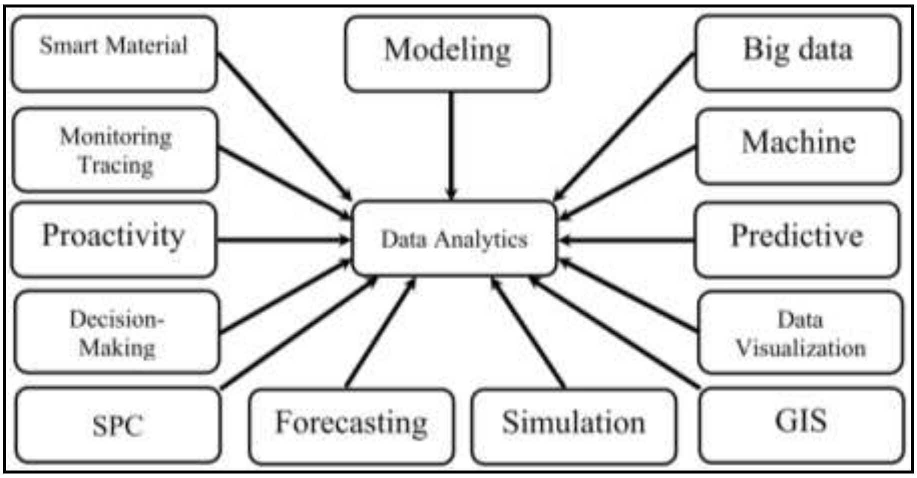

Fig 5: Graphical description of data analytics cluster with associated attributes and technologies

Cyber-Physical Production System (CPPS)
CPPSs are sometimes used synonymously to refer to technologies that algorithmic computations utilize to rectify and interact with specific mechanisms/components. CPPS is a kind of cyber-physical system (CPS) that is used in manufacturing. Both of these innovations will be considered in CPS [19].

Internet of Thing (IoT)
The Internet of Things facilitates connectivity between virtual and Internet-enabled machines and has the potential to significantly change current manufacturing processes. Several terms are often used; however, when IoT capabilities are viewed as utilities, the term "Internet of Services" is used (IoS). However, CPS, IoT, and IoS all accept the real and artificial worlds, a significant distinction is that algorithmic computations might or might well not utilize the network [16].

Advancements Manufacturing
Advancements manufacturing is a process that enables the integration of technology-based manufacturing systems like FMS “flexible manufacturing systems”, RMS “reconfigurable manufacturing systems”, CAM “computer integrated manufacturing”, and automated production. Other than that, it might be worth debating whether different developed manufacturing systems should be related to SM systems. One potential difference is that SM places a higher premium on data-driven manufacturing (data analytics), while advanced manufacturing places a higher premium on functional manufacturing technology.

Cloud Manufacturing
- Cloud computing could be used to determine production preparation and scheduling based on real demand. Although evaluation of data could be included as a component of cloud manufacturing, due to the breadth of its implementations, it must not be regarded as a component of cloud productions [20].
- Real-time communication refers to the advanced technologies that enable users and devices to share information in real-time. It is not a component of compatibility since it requires the sharing of data between systems and individuals. The cloud-manufacturing cluster is described in figure (6) with a variety of technologies.

Fig 6: The Graphical Description of Cloud Manufacturing Cluster with Associated Properties.

3D Printing Production
Technology production is a process that uses a laser, electron beam, or other types of the beam to print a three-dimensional image onto an object; the procedure is frequently referred to as additive manufacturing, as items are constructed level by level. Additive manufacturing is sometimes referred to as a subfield of developed manufacturing.

Intelligent Products
- Reusability refers to the attribute of products that enables them to be reused or repurposed in the system. It is debatable whether reusability must be incorporated into energy-efficient or intelligent products. If the recycling component is taken into account, reusability could be regarded as part of energy conservation; however, if intelligence is regarded as an attribute of a products that can alter its arrangement to be reused within the same or a different form, the material is intelligent.
- Resilience is the capacity of a commodity to revert towards its original state. Resilience could be incorporated into the smart control cluster if a component needs smart control to revert to its original condition.
- Monitoring and tracing are the technique that enables the determination of the historical and present positions of specific artifacts that serve as information carriers.
- Smart sensors are a form of technology that enables monitoring and tracing to be monitored.
- Additional uses involve the utilization of anti-metallic RFID “radio-frequency identification” in industrial

environments, as well as the demonstration of printed circuit boards. As smart sensors incorporate processors and software to facilitate data sharing, they are referred to as intelligent products.
Monitoring and tracing also can be utilized to supply location information, and if that data is analyzed, this could be included in the information analytics cluster. Monitoring and tracing may indeed be substituted for real-time monitoring and tracking as we can now control the position of events in real-time.

- Smart materials could detect changes in the environment and procedures utilizing sensors and take preventive steps using actuators; additionally, they could provide information for evaluation which can result in improved component design. Because smart materials involve the utilization of sensors and effectors they must be grouped [20].
Additionally, smart materials could be capable of changing their structure in reaction to specific stimuli. Also, a study of smart products was conducted, including piezoelectric tools and shape storage alloys, and also their industrial applications.
The cluster of intelligent products has a variety of attributes and technologies as shown in figure (7).

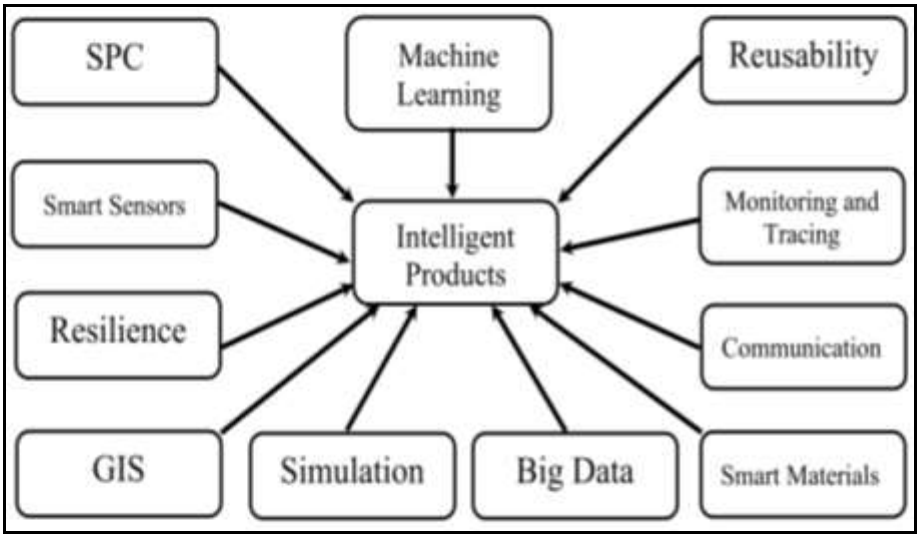

Fig 7: Graphical description of intelligent products cluster with associated attributes and technologies

Management of Manufacturing Based on IT

- ERP "enterprise resource planning" is an information system that enables the integration and coordination of various functions within an enterprise, Marketing, stock control, and management of human resources are also included.
- SCM "supply chain management" is the managing of information, materials, and funds between members.
- MESs "manufacturing execution systems" are information technology-enabled systems that handle all product improvements from raw resources to finished products.
- PLM "product lifecycle management" is the process of maintaining a product successfully during its life.
- OP "operations planning" is the process of managing all of an organization's processes to accomplish a goal.
- CAD "computer-aided design", CAM "computer-aided manufacturing", and CAx "computer-aided technology" are all terms that refer to tools that allow designers to create, evaluate, and encourage the design and manufacturing processes.
- Interfaces and moderate structures such as SCOR "supply chain operations research", DCOR "design chain operations reference", MESA "Manufacturing Enterprise Solutions Association", and "ISA 95/88" take into account the different levels of manufacturing activities and provides application support for computer-based applications.

It appears as if the life cycle of a product, when managed within an IT system, might be called MES, while MES, ERP, SCM, and activities planning might be viewed as resources for connecting all that occurs within an enterprise through the use of IT [21].
Although digital production is the implementation of techniques such as (CAD), (CAM), (VR), (ERP), and modeling and simulation, these papers addresses why these technologies may be grouped into distinct technology classes. As a result, these CAx resources are also integrated into the IT-based manufacturing management cluster. The cluster IT-based manufacturing management system described in figure (8) combines a variety of technologies.

Facilitating Factors: Attributes and expertise may not the only framework needed to SM, additionally, there are criteria and facets of organizational culture that must be addressed for an effective transition to SM. The NIST "National Institute of Standards and Technology" has also introduced and designated as standards several of the attributes and technologies mentioned in this article [22].
However, this paper treated attributes, technologies, and enabling factors (similar to the NIST-defined standards) as distinct categories and attempted to combine those that overlapped. The following portion discusses selected principles and elements of organizational culture that have been linked to SM in the literature, contributed to as facilitating factors.

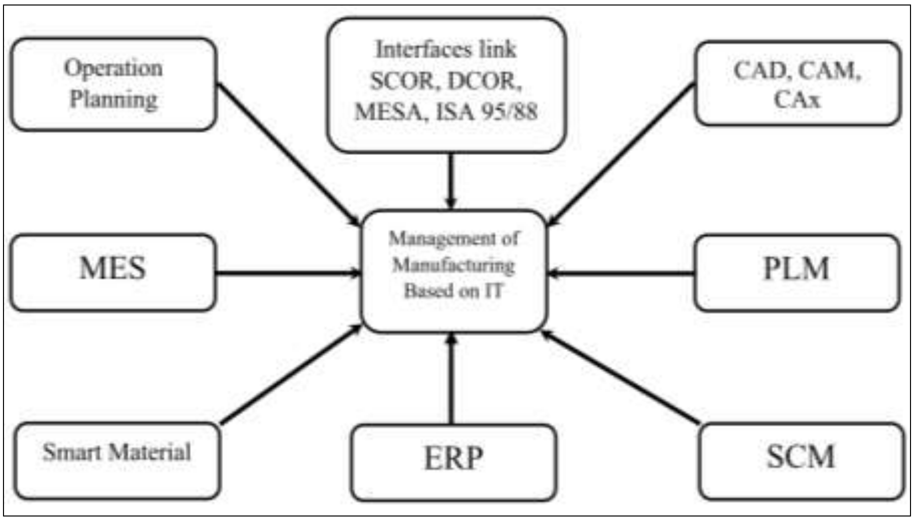

Fig 8: Graphical description of management of manufacturing based on IT cluster with associated attributes and technologies.

Regulatory Framework
Based on the scope of the organization's activities it must comply with a variety of regulations and standards including environmental rules intellectual property protection and labor law. These regulations must be strictly adhered to for an agency to continue operating [23].

Innovative Learning and Development
Learning should facilitate a person to think regarding what the product or utility for which he or she is functioning can be enhanced for the good of the end-user, in addition to doing their job. Only proper preparation and innovative culture will instill this experience and creativity mentality in employees. As a result, creative learning and development should include knowledge employees [24].

Systems and Principles for Information Sharing
STEP AP 242 and other STEP modules have been described by the ISO "International Organization for Standardization" as uniformly standardized information models which can be used by different organizations to share data and specifications in standard computer formats.

Likewise, from CMSD "core manufacturing simulation data" can be shared. Additionally, enterprise collaboration enables data exchange between SMEs "small and medium enterprises" and OEMs "original equipment manufacturers". Since all organizations, such as "STEP AP 242" and "CMSD", are attempting to provide a shared forum for the processing of information they may be regarded as standards for various data processing systems and thus be grouped within data sharing systems and their specifications [25].

The chosen techniques are only a sampling of those available and in operation with SM systems. These basic examples were chosen based on the defined source in the literature. Compatibility is distinct from information-sharing systems and their specifications in that compatibility refer to the capability to share data and access a networked device, while information-sharing systems and their specifications have permission to do so. This is a manufacturing industry-standard platform for collecting data from numerically controlled machines and subsequently analyzing it.

The cluster of knowledge exchange systems is depicted in Figure (9).

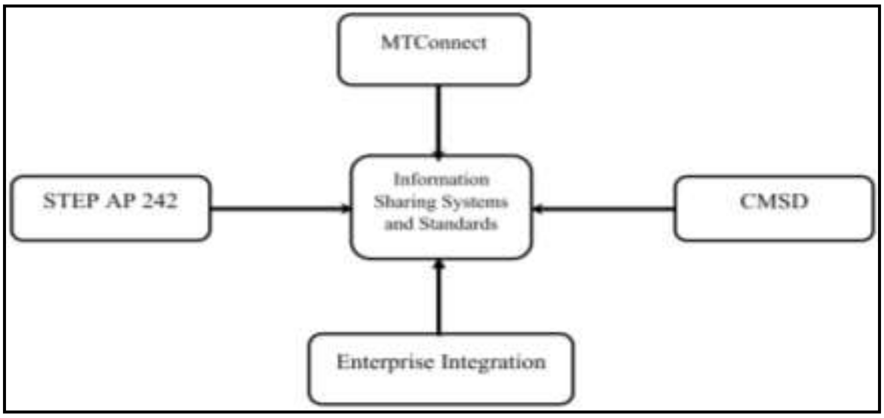

Fig 9: Graphical Description of Information Sharing Systems with Associated Facilitating Factors.

Discussion
We may notice that several of the attributes identified function as technology foundation frames but the technological description does not permit them to combine into an attribute cluster.

All technology and attribute, on the other hand, can be associated with some technology cluster.

Additionally, the smart control cluster contains 12 attributes, including extensibility, ability to adapt, versatility, autonomy, totally automated operation, proactivity, robustness, durability, agility, accessibility, and precision, as well as two technologies, and smart control.

Additionally, it was mentioned why studies of these technologies, like data analytics and cloud production, are being regarded separately while sharing numerous components.

We extracted a detailed account of 27 attributes and 38 related innovations with SM in the existing literature from our research. We suggest that these attributes become aspirational "qualities of being" (QoB) or intelligent features which existing and future production methods can seek to achieve a certain level of intelligence and progress toward becoming an evolved "smart" production system.

On the other hand, these main attributes and technologies are intended to serve as the capabilities that allow SM to QoB.

On the other hand, they are intended to serve as the requisite "smart features" for considering a production process to be "smart". While technologies developed over time the intelligent functionality will remain consistent. For instance, a (CPS) based structure that employs (PLCs) and enables energy management assumptions must be built around technology clusters like CPS, intelligent products, evaluation of data, and energy efficiency. Additionally, illustration of how (VR) and (AR) can contribute to sustainability, improved preparation, and increased awareness [26].

On the other hand, these main attributes and technologies serve as the capabilities that allow SM to adapt to the six design concepts of Industry four possibilities, these principles are [27];

1. Interoperability refers to the capacity of SM applications and technologies (e.g., computers, software, sensors, processes, and individuals) to link to and interact with one another.
2. Virtualization or visibility of data is the capability to produce digital copies of physical objects by connecting sensor data to virtual devices and simulation technologies.
3. Decentralization is the capacity of SM systems and techniques to make decisions alone, as autonomously as possible, and execute their activities, including deviations, interventions, and/or contradictory goals.
4. Real-time efficiency is described as the capabilities to gather and process information in real-time and also to immediately share the resulting perceptions.
5. Service orientation is described as the provision of tasks through the Internet of Things.
6. Modularity refers to the ability of production processes to adjust to evolving requirements through the replacement or expansion of individual components.

These main attributes and technology direct the design and engineering of Industry four enabled SM systems. Additionally, various representations that correspond to them are described. However, the defined SM main attributes and technologies must also be considered as core enabling technologies for production systems' intelligence, including;

1. Accessibility to detectors and networks (like IoS and IoT).
2. On-demand cloud storage and info (like cloud production).
3. Model and memory in cyberspace (like CPSs).
4. Definition and correlation of the content (like analytics).
5. The collaborative effort and community exchange (like smart control).
6. Customisation and value-added customization (like IT-based manufacturing management).

Therefore, SM will be able to supply actionable feedback to manufacturing management, allowing them to leverage information and knowledge to improve the efficiency of production processes and react quickly to improvements in demand at a minimum expense to the SM enterprise.

Conclusion

These papers described addressed, and clustered attributes, technologies, and enablers that could be used to describe SM systems, thus laying the groundwork for a potential detailed SM ontology [28]. In general, five attributes have been identified; Contextuality, Modularity, Heterogeneity, Compositionality, and compositionality, also twelve technologies, including smart control, efficient use of energy, cyber protection, CPPS, visual technology, IoT, cloud manufacturing, 3D printing production, intelligent products, analysis of data, and management of manufacturing based on IT, in addition to three facilitating factors, including regulatory framework, innovative learning and development, and systems and principles for information sharing.

These attributes, technologies, and facilitators factors can also be used to categorize a manufacturing system as intelligent.

In addition, these attributes and technologies are associated with Industry Four design concepts and the critical attributes of CPSs and big data. It also was discovered that all of the established attributes and technologies adhere to Industry Four and CPS design concepts.

Additionally, we can see in this paper that there are fewer clustered attributes than consolidated technologies. One potential reason for this phenomenon is that certain attributes are required as inputs to the technologies, and it could have been unnecessary to consider them individually. Scalability, adaptability, robustness, agility, totally automated operation, and proactivity, for example, were all clustered under the technology smart control.

The research further reveals that certain technologies, like GIS, smart materials, and monitoring tracing, can be classified as components of both machine teaching and smart manufacturing. The cluster where technology is applied is determined by its implementation, as a result, the application can differ according to the SM purpose. The resultant list aims to initiate the creation of an extensive compilation of commonly accepted social media features, technology, and facilitators. The authors solicit contributions from business and educational specialists to assist in refining this list.

This will result in further expansion or contraction of the current list. Significant advancement is expected if an increasing volume of fresh SM literature, particularly applications, is released that includes extra or more precisely defined technological qualities and facilitating aspects in the future.

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