Characteristics of PLM:

Product Lifecycle Management information should have the following characteristics:

1. Singularity
2. Correspondence
3. Cohesion
4. Traceability
5. Reflectiveness
6. Cued availability

1. Singularity:

i. Singularity is one of the most important characteristics of PLM. Singularity within PLM is defined as having one unique and controlling version of the product data.

ii. The development and use of computers compounded this problem of lack of singularity because now even the most complex and voluminous data could be duplicated at minimal cost and effort. Now there can easily be multiple copies of the most complex product data.

iii. At its simplest, PLM implements a mechanism whereby there is a unique reference to the product data. If someone wishes to work with the product data it is "checked out," worked on, and the revised version "checked" back in. The product data will be revised within that data file, but will be unavailable to anyone until it is checked back in.

iv. We do not expect to get singularity in the relatively near future, but every time we can reduce an instance of the same information being duplicated in various systems, we will get closer to our goal of a singular version of data. Doing so will increase productivity because there will be less waste of time, energy, and material from working with wrong product data.

2. Correspondence:

Regardless of whether we have the physical object first and extract the information about it or whether we have the information first and create the physical object from that information, a core characteristic of PLM is developing and maintaining a correspondence between the physical object and the information about the physical object. There are a number of significant reasons to do so.

The first reason is our interest in replacing wasted time, energy, and material with information. If we do not separate and maintain the information about our physical object, then any time we want the information about it we must expend time, energy, and material to get it.

Second, if we do not maintain this correspondence between the data and information about the physical object and the physical object itself, then the only way that we can obtain that data and information is by actually possessing the physical object.

Parts reuse is to a great extent driven by correspondence. If correspondence does not exist, then an engineer is going to design a new part instead of using an existing part. If the information about a part does not exist, then the only way an engineer knows it exists is having access to the actual part itself, something that is becoming increasingly rare as engineering goes global and manufacturing takes place far from the design engineers.

3. Cohesion:

If we are going to mirror the product's functionality in virtual space, we are going to need to have this cohesion between views. While cohesion is not a problem in real space since there is only one view of the product, the actual product itself, it is a problem in virtual space. In real space, we have a product that has the information about it as part of its very makeup.

In virtual space, we have attempted to create a representation of the product by consolidating its different views in different computer programs: one for the geometrical representation, one for the electrical schematic representation, one for the hydraulic system representation, one for a BOM view, etc. Rarely are these views brought together.

Not to do so is a cause for wasting time, energy, and material. If we work with non-cohesive views, we run the risk of thinking we have a specific functionality because it is specified in our

abstracted diagram, but it is not being implemented in the product because the actual components are inconsistent with the logic diagram.

One approach to obtaining cohesiveness is to reduce the number of independent views and derive the abstracted views from a limited number of richer views.

4. Traceability:

We addressed traceability in the physical world by creating physical evidence of this traceability—namely documentation. We created separate pieces of paper. We organized the documentation so that all the material, designs, notes, drawings, and tests that were related to a specific version were collected together. We then ordered those pieces of paper in chronological order so that we, in theory, could follow the path back to its origin.

It is a core requirement, and failure to be able to do so invariably carries criminal penalties and sanctions. It would be unconscionable for a medical device manufacturer to say, “We tested version A. We then made substantial changes to make version B. We don’t need to test version B because it should be good.” The CEO of that company would only be seeing his or her family on visiting day for a long time to come.

5. Reflectiveness:

Reflectiveness is directly related to the arrow in the Information Mirroring Model that connects the real space to virtual space and captures data and information from real space into virtual space. In real space, when we change the state of anything, trim a little material off a part, assemble two parts together, erase one line and draw another on a piece of paper, the informationchanges because it is intrinsically part of the atoms that are impacted by those changes. If we are going to separate that information and create an image of it in virtual space, then we need a mechanism to change the information in virtual space when the corresponding informationchanges in real space.

In the same way that the image in a mirror reflects changes in real space simultaneously with changes that occur to physical objects, so the ideal of PLM captures those changes in virtual space. In the same fashion that we can make decisions about the state of a physical object by looking at its image in a mirror and knowing that there is no lag time between the changes that occur and the image we see and no loss of detail between the physical object and its image in the

mirror, we would like to be able to rely on PLM to provide us with similar timeliness and fidelity of information.

The whole point of reflectiveness is to allow us to substitute this information for wasted time, energy, and material. If we can examine virtual space when we need information, it will be substantially less costly and time consuming than examining real space.

6. Cued Availability:

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If reflectiveness is related to the arrow indicating data movement from real to virtual space, then cued availability is related to the arrow indicating the movement of information and processes from virtual space to real space. Cued availability is simply being able to have the right information and processes when we need them. The term cued indicates that we might or might not be searching for this information and these processes, but because of the situation, we are presented with them. We are rapidly approaching the time when, if the information exists in virtual space, we are able to search and find it. That is one aspect of cued availability. However, fully cued availability requires something more. It requires that the information is presented to us when we may not be searching for it, but need it nonetheless.

The Environment Driving PLM:

WHAT IS DRIVING the need for PLM? Why aren't the previous techniques and technologies sufficient for today's organizations? This unit brings these issues into stark relief by comparing the changes in organizations and their environments over the last 30 years. While the changes appear incremental when looked at from day to day, the differences are truly dramatic when viewed over a longer time frame.

This unit explores how scale, complexity, cycle times, globalization, and the regulatory environment are changing the way organizations need to deal with product-based information.

This unit will also explore the fundamental requirements emerging from within the business environment that are driving PLM. These requirements include a need to improve productivity, the rate of innovation, collaboration, and quality. Finally, we discuss the fact that the ultimate driver of PLM and the boardroom decision to invest in PLM solutions will be their ability to create value for the organization. To conclude, unit will look at how that assessment is made by introducing the IT Value Map and comparing PLM to other information technology (IT) initiatives.