CIM (21-548)

Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 18

Course Description

- *Instructor*
  - *Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology*
  - *Email: FValilai@sharif.edu , Tel: 6616-5706*
  - *Website: Sharif.edu/~fvalilai*
- *Class time*
  - *Sunday-Tuesday   09:00-10:30*
- *Course evaluation*
  - *Mid-term   (30%)*
  - *Final exam   (50%)*
  - *Quiz   (5%)*
  - *Exercise   (15%)*

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Course Description *(Continued ...)*

- *Mid-term session:*
  - *Sunday: 16th Azar 1393, 09:00 ~ 10:30*
- *Final Exam:*
  - *Tuesday: 30th Dey 1393, 15:00 ~ 17:30*
- *Reference:*
  - *Schaefer, D., Cloud-based Design and Manufacturing (CBDM): A Service-Oriented Product Development Paradigm for the 21st Century, . London: Springer, 2014*
  - *Koren, Y., "The Global Manufacturing Revolution", Wiley, 2010*
  - *Nasr, A., "Computer-Based Design and Manufacturing An Information-Based Approach",Springer, 2007*
  - *Mitchell, F.H., "CIM Systems: An Introduction to Computer-Integrated Manufacturing", Prentice Hall College Div; 1St Edition edition (January 1991), ISBN: 978-0131332997*

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Course Description *(Continued..)*

- *Contents:*
  - *Globalization and Manufacturing Paradigms*   *(8 sessions)*
  - *System Concepts*   *(3 sessions)*
  - *Evolution of Manufacturing systems*   *(2 sessions)*
  - *Manufacturing System Design*   *(4 sessions)*
  - *Manufacturing Layer Design*   *(3 sessions)*
  - *Information flow in Manufacturing Systems*   *(4 sessions)*
  - *Product design and Manufacturing System*   *(3 sessions)*
  - *Manufacturing System Implementation*   *(5 sessions)*

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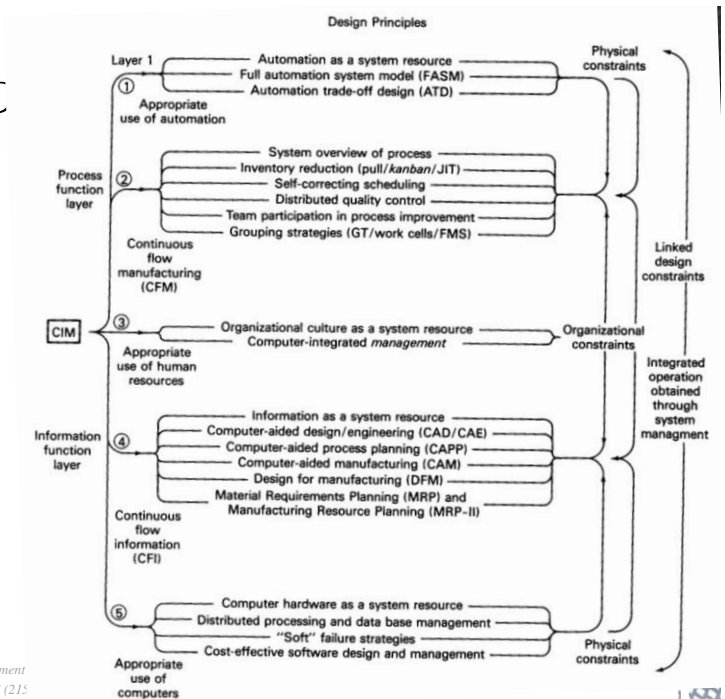
Course Description *(Continued..)*

- *Contents:*
  - *Manufacturing Layer Design*   *(3 sessions)*
    - *Equipment unit parameters*

    - *Range of equipment technologies and automation available*

    - *Technology assessment*

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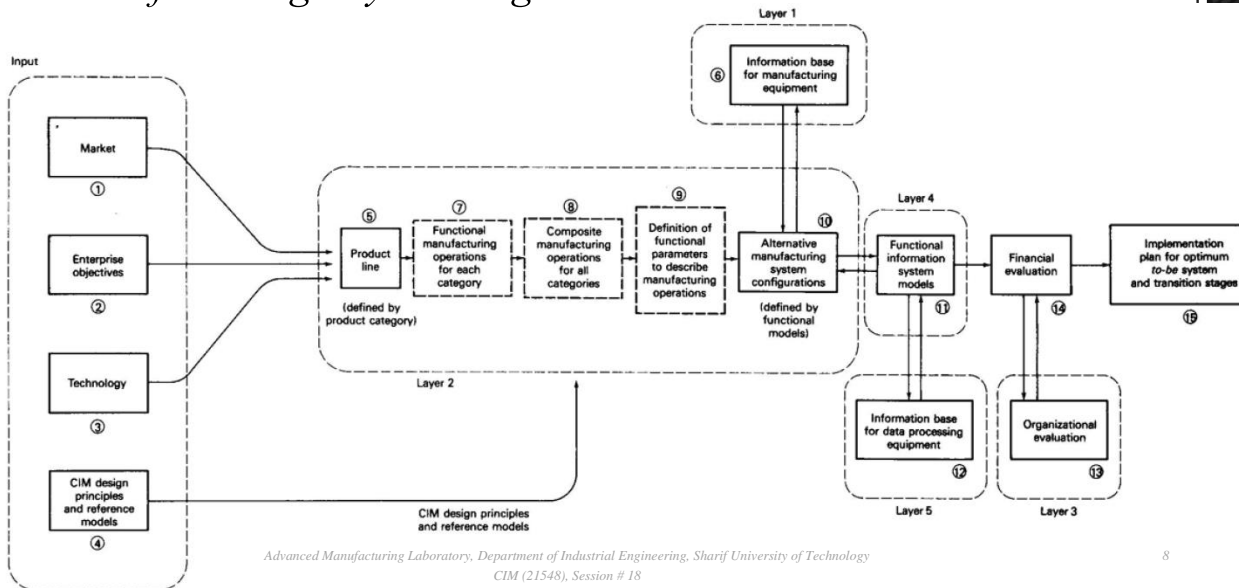*CIM (21548), Session #16*

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Manufacturing System L

Manufacturing Layer Design

Manufacturing Layer Design

- *A number of inputs are required for the design strategy*
  - *The market environment and selected market sector to be addressed by the factory must be specified*
  - *Documentation of the enterprise objectives must be compiled*
  - *These information bases, combined with an understanding of state-of-the-art technology in the field will enable the formation of product definitions in terms of manufacturing categories*
  - *The functional manufacturing operations for each product category can then be de fined, making use of insights regarding the CIM design principles to be applied.*
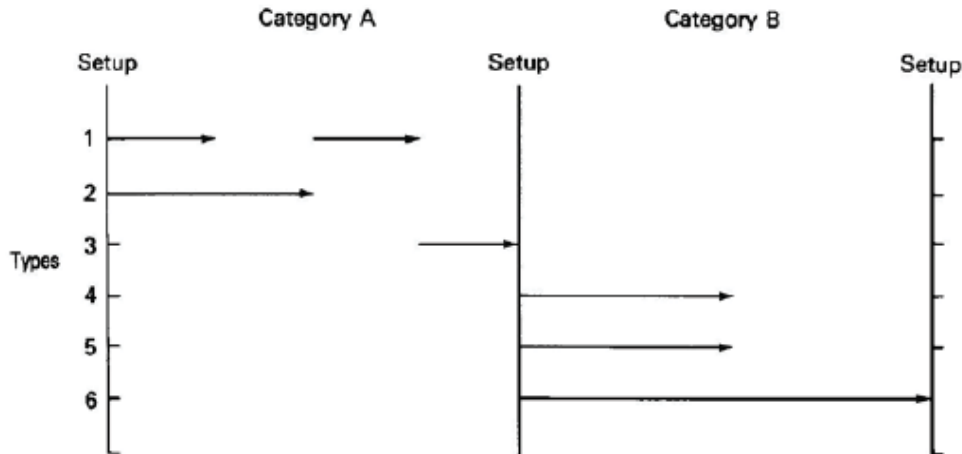
Manufacturing Layer Design
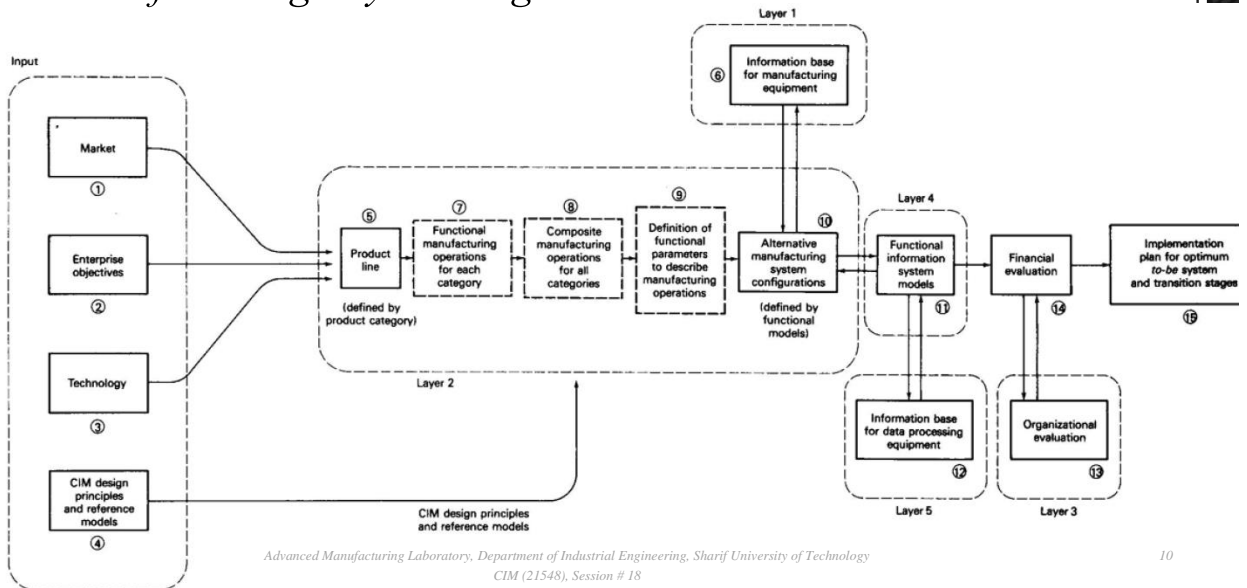
Manufacturing Layer Design

- *It is important to select a means for categorizing the market and product line that will be specifically useful for the planning effort to follow.*
- *Each product category includes a variety of different specific product types.*
  - *A category is defined so that all product types within a category require similar manufacturing processes.*
  - *Categories should be formed in anticipation that equipment changes will not be required in shifting production among product types.*
  - *Within a given category, product types can be comingled to achieve an effective lot size that includes all types within the category.*
- *The CIM facility will be able to produce all of these products by making changes in the operator and software instructions provided to the equipment.*
- *Various product types within a category can be manufactured by changes in operator actions or by downloading different software programs to the manufacturing equipment.*
  - *All product types within a category can thus be treated as a single lot size for purposes of economy of scale.*
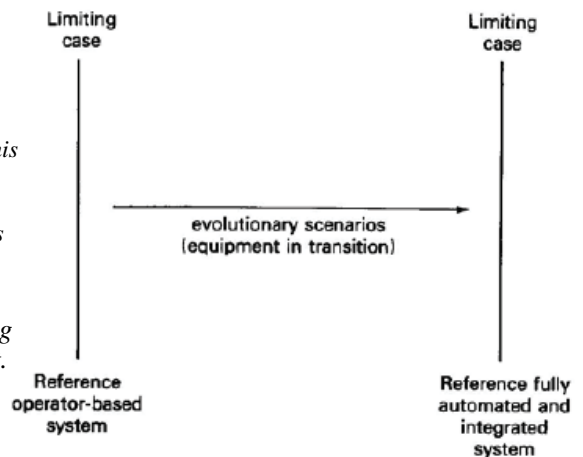
Manufacturing Layer Design
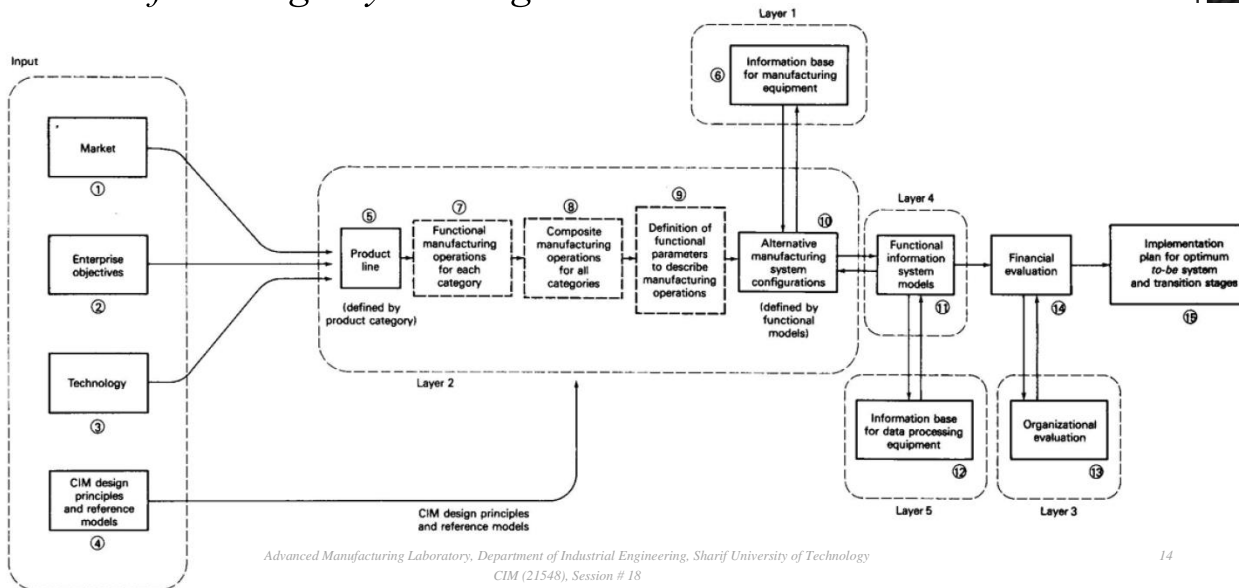
Manufacturing Layer Design

▪ *An idealized fully automated CIM reference system is defined here as being able to operate between setup times without operator intervention and produce 100 percent yield.*

  ▪ *The full variety of products can be manufactured during this period, where each category consists of multiple product types.*

  ▪ *Software control can be used to shift equipment operations among product types.*

▪ *At another extreme is a system in which manufacturing requires maximum use of continuing operator support.*

  ▪ *For this second reference case, equipment is manual or minimally automated and requires ongoing operator servicing*

Manufacturing Layer Design

Manufacturing Layer Design

- *The degree of operator intervention in any of the transition scenarios can be viewed as a way to contrast the scenarios.*

- *It is possible to associate required operator services with a mean time between operator interventions (MTOI) parameter.*
  - *The MTOI provides a means for measuring how a transition system configuration (or equipment unit) relates to the two reference CIM systems.*

- *In many cases the MTOI will be much less than the mean time between failures (MTBF) for the equipment being used, and will dominate process activities between setups.*
  - *This framework, which allows comparison between various intermediate scenarios and limiting reference systems, is further applied.*
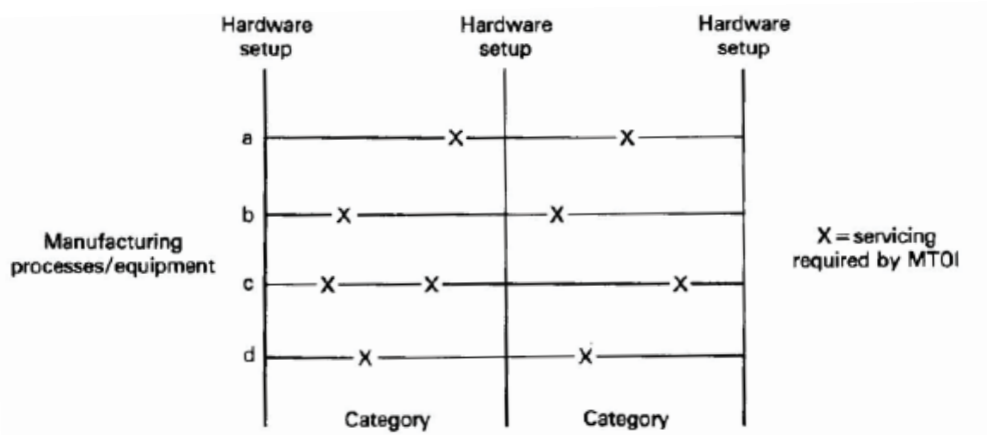
Manufacturing Layer Design

- *The definitions of product categories and types given above should be applied during the product definition stage of a planning effort.*

- *A set of parameters that can be used to describe all equipment in the factory*
- *These parameters should provide an adequate description of each equipment unit in the factory for the purposes of deciding on a preferred factory configuration.*
    - *Scope of operations: this parameter is measure of the flexibility of the equipment in terms of addressing the desired market environment and product line.*
    - *Mean time between operator interventions: Between setups, it is desirable that the factory operate with a preferred level of operator intervention.*
    - *Mean time of intervention: This parameter describes how long it will take, on the average, to provide the required servicing for the equipment each time an operator intervenes.*
    - *Product yield: The fourth parameter is the percentage of the product produced by each item of equipment that is of acceptable quality.*
    - *Processing time: The fifth and final parameter is the time required for each item of equipment to process the work-in-progress (WIP).*

Manufacturing Layer Design

Manufacturing Layer Design

Manufacturing Layer Design

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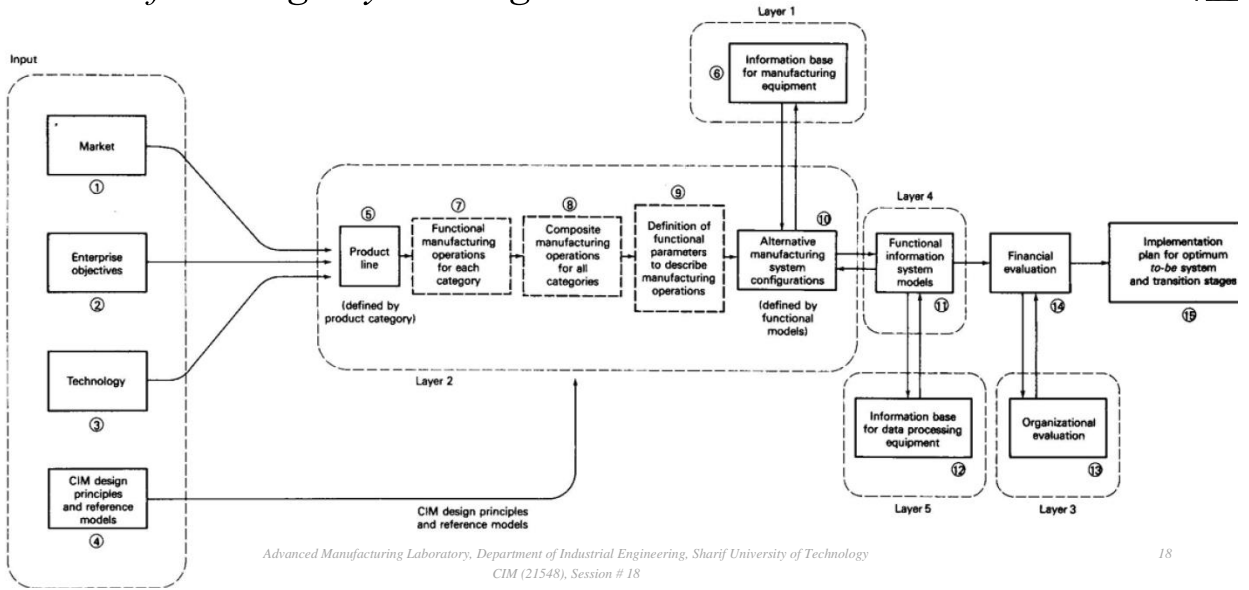# Manufacturing Layer Design

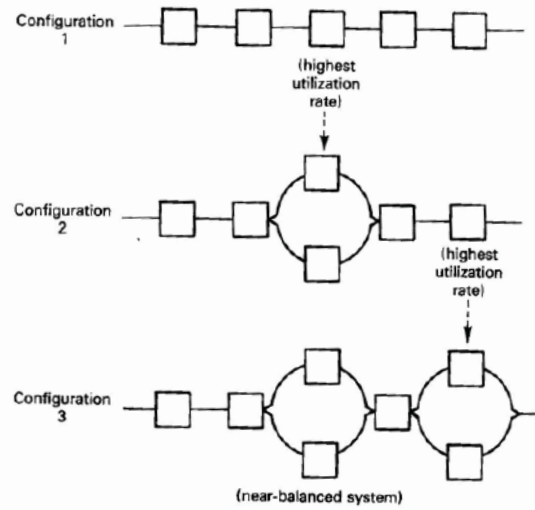# Manufacturing Layer Design

Manufacturing Layer Design

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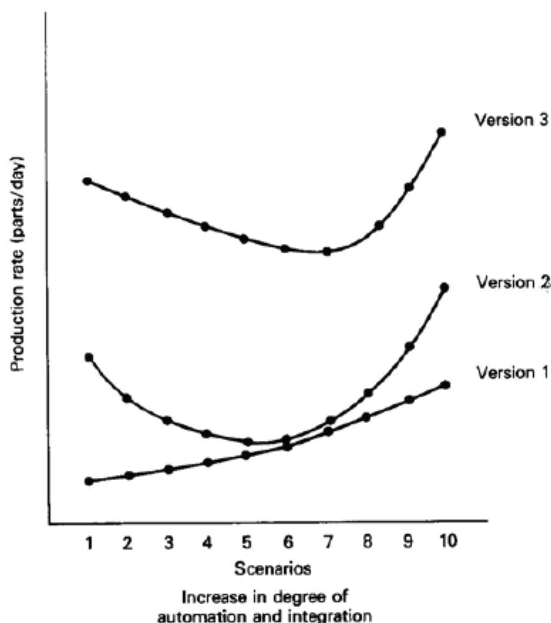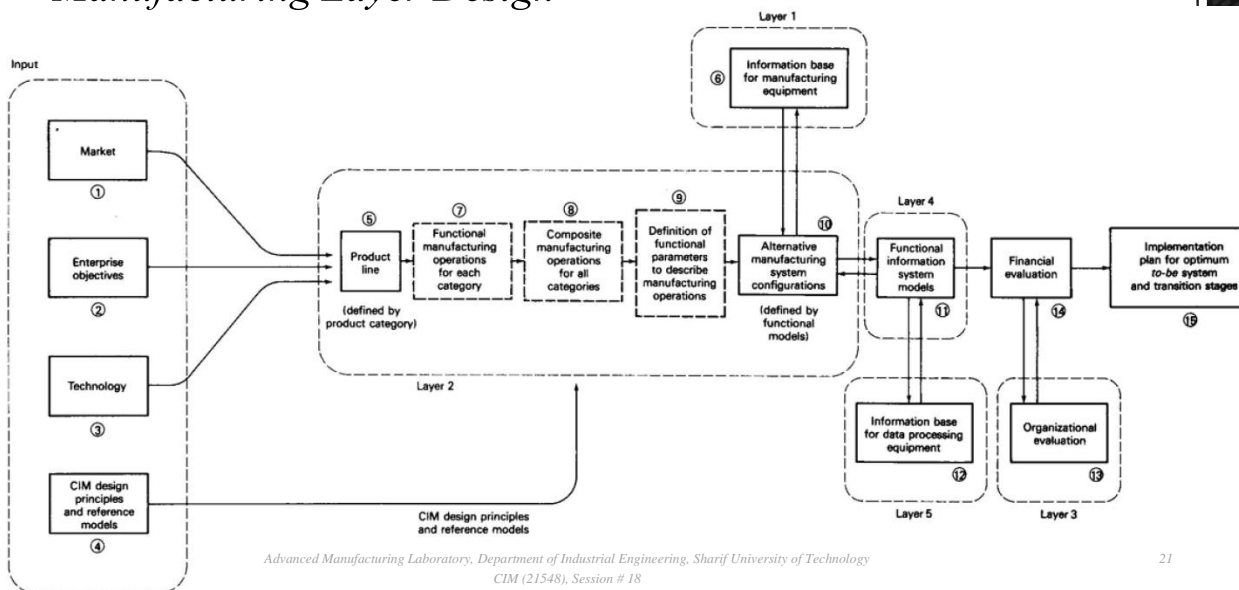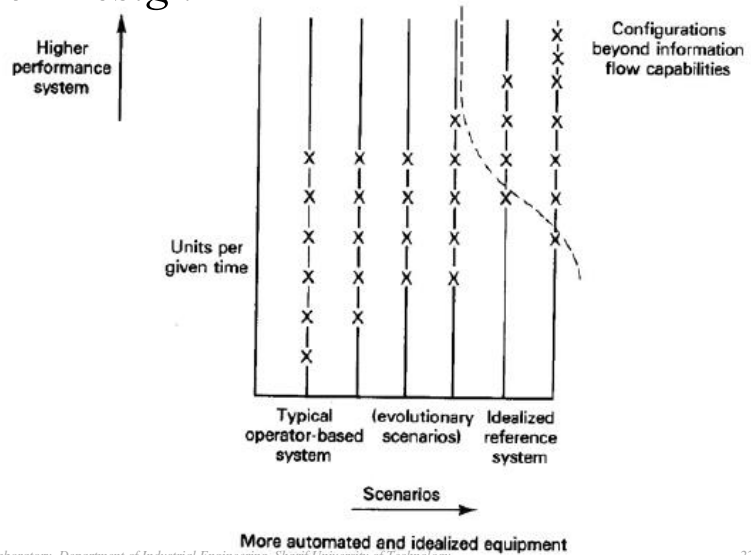CIM (21548), Session # 18

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Manufacturing Layer Design

- *Organizational/Management Issues (Layer 3)*

- *It is necessary to review the organizational requirements of each of the remaining data points.*

- *Any scenario/ configuration combination that cannot be effectively implemented due to organizational constraints must be removed from the set.*

- *each configuration must be evaluated in terms of organizational opportunities and constraints.*

- *This aspect of evaluation may include the costs and difficulties associated with reorganization and retraining, educational programs, hiring of new employees, and the development of an organizational culture that will provide effective use of the new factory.*

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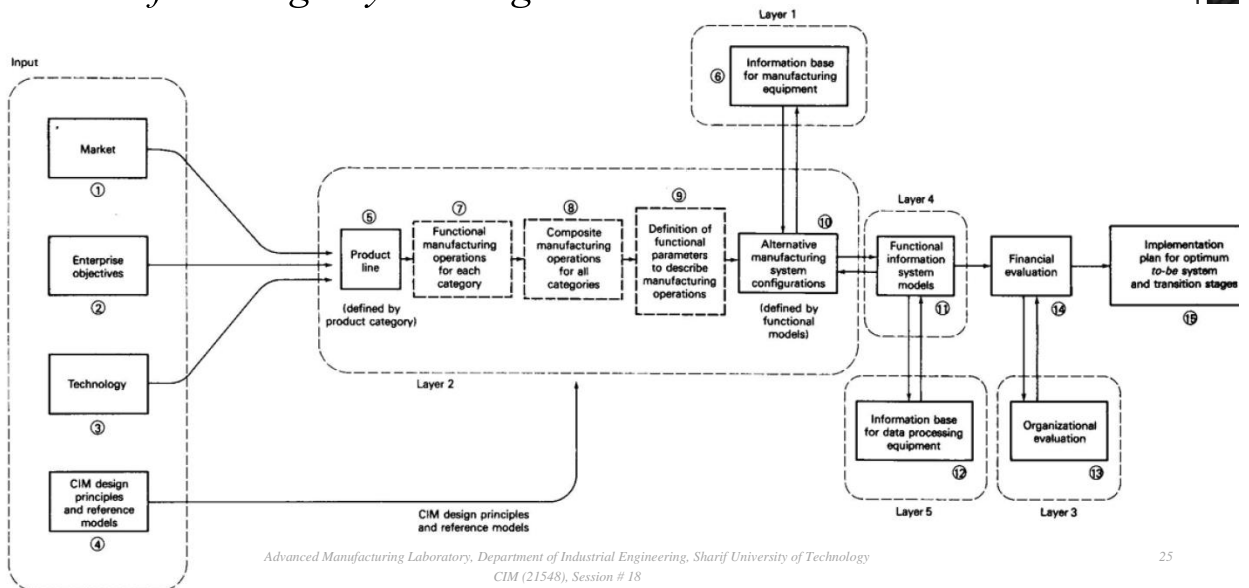CIM (21548), Session # 18

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Manufacturing Layer Design

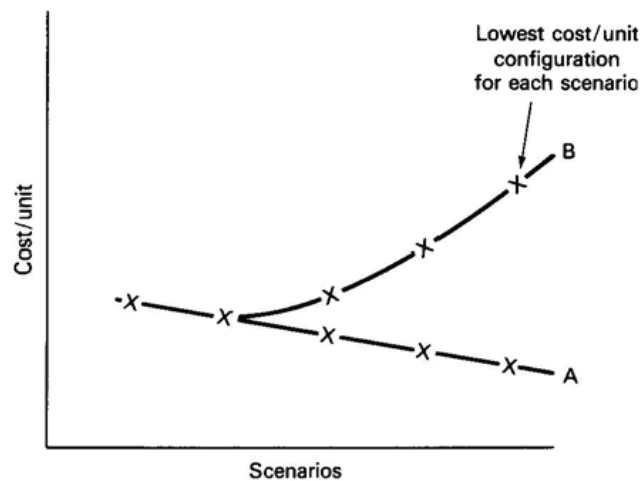| Information Restrictions	Organizational/Management Restrictions
Data rates too high Memory size requirements too large Does not accommodate presently available computer capabilities of company	Type of employee not available Present employees do not have necessary skills Management system would have to be changed, resulting in unrest

Manufacturing Layer Design

Manufacturing Layer Design

- *Financial Evaluation*
- *The financial evaluation must include not only an analysis of pro posed CIM configurations using appropriate methods, but also comparative analysis with standard manufacturing systems that could be developed for the same product line.*

- *Cost-benefit ratios can be calculated for each facility configuration.*

- *The analysis moreover should deal with other relative advantages of the system, including market responsiveness and adaptability and the advantages of producing a product that is more responsive to customer desires.*

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Manufacturing Layer Design