IS ACCOUNTING AN IMPEDIMENT TO COMPUTER INTEGRATED MANUFACTURING?

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ABSTRAK

Lonjakan kemajuan teknologi pabrikasi yang disebabkan kepesatan teknologi komputasi haruslah diimbangi perangkat-perangkat lain dalam dunia usaha. Perangkat akuntansi merupakan salah satu bidang yang selalu dituntut untuk segera mengantisipasi kemajuan perangkat dunia usaha maupun perangkatnya.

Computer Integrated Manufacturing (CIM) merupakan salah satu bentuk kemajuan teknologi pabrikasi. Artikel ini akan membahas hubungan CIM - Akuntansi. Kontribusi artikel ini adalah 1) memberikan gambaran bentuk sistem akutansi yang dibutuhkan dalam kemajuan teknologi pabrikasi dan 2) menggugah perhailan para profesional maupun pengamat tentang kesenjangan prosedur akuntansi dengan dampak kemajuan teknologi.

Manufacturing technology has gone through many changes over the years, ranging from the simple to the complex. The driving forces behind the changes began with the public's desire to improve basic needs such as food, clothing, shelter, and recreation. The evolutionary effect that computers have had an accounting systems has dramatically changed the ability of manufactures to fulfill the public's needs.

One of the powerful technology in manufacturing is Computer Integrated Manufacturing. The main topic in this article will be accounting system on CIM technology, so the author chooses data base system as an accounting system type. The reader will get the clear picture both the need of manufacturing technology and the current accounting procedure in current situation. So, the article stimulates a new thought on accounting and manufacturing.

Computer Integrated Manufacturing (CIM)

Regardless of the various definitions held by different segments of business, CIM represents computers in manufacturing, whether they be used early in the product development phase or throughout the manufacturing process. The IBM research and development team found that CIM:

> encompasses and provides the conceptual basis for integrating the applications and information flow of the following areas: product design (CAD/CAM), product planning and control (COPICS and MAPICS), and plant operations (industrial automation). *(Kochan,* 1986, p.254).
>
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The Computer and Automated Systems Association (CASA) of the Society of Manufacturing Engineers states that CIM is:

> A system that provides computer assistance to all business functions within a manufacturing enterprises from product design and order entry to product shipment. (Kochan, 1986, p.254).

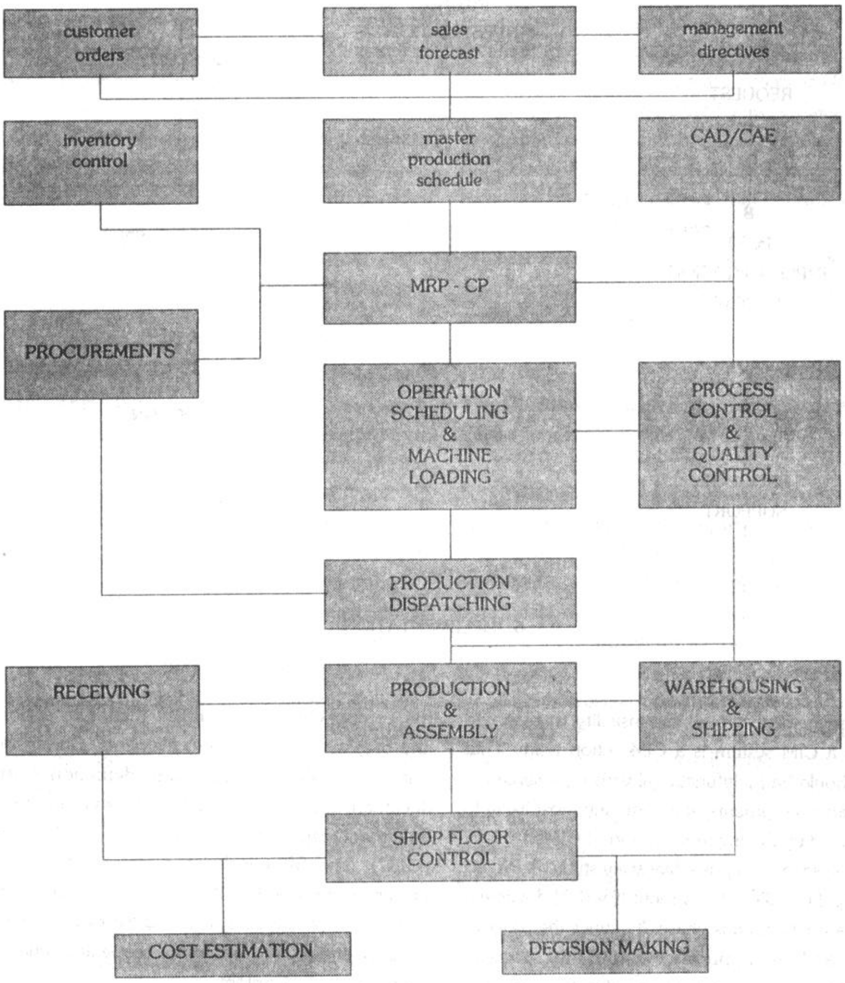
These definitions give examples of many CIM activities. They include master production scheduling, computer-aided design and engineering, computer-aided process planning, computer-aided quality control planning, numerical control programming, inventory control, material requirements planning, capacity planning, operation scheduling and shop loading, production dispatching, receiving, production and assembly, and production control. All CIM activities and their relationship can be computerized at the same level. Figure 1 depicts the relation shipamong these activities.

CIM System Development Cycle

Figure 2 presents the development cycle of CIM. CIM exists because of customer requests, so the demand of customer/users will have great influence on its development cycle. The first step of system development is initial investigation. In this step, a team will receive a CIM system change request (CSCR), which is the formal mechanism for requesting team effort in system development. (Groouer, 1984, p.448). This request lists the needs and requirements for system development and the potential benefits.

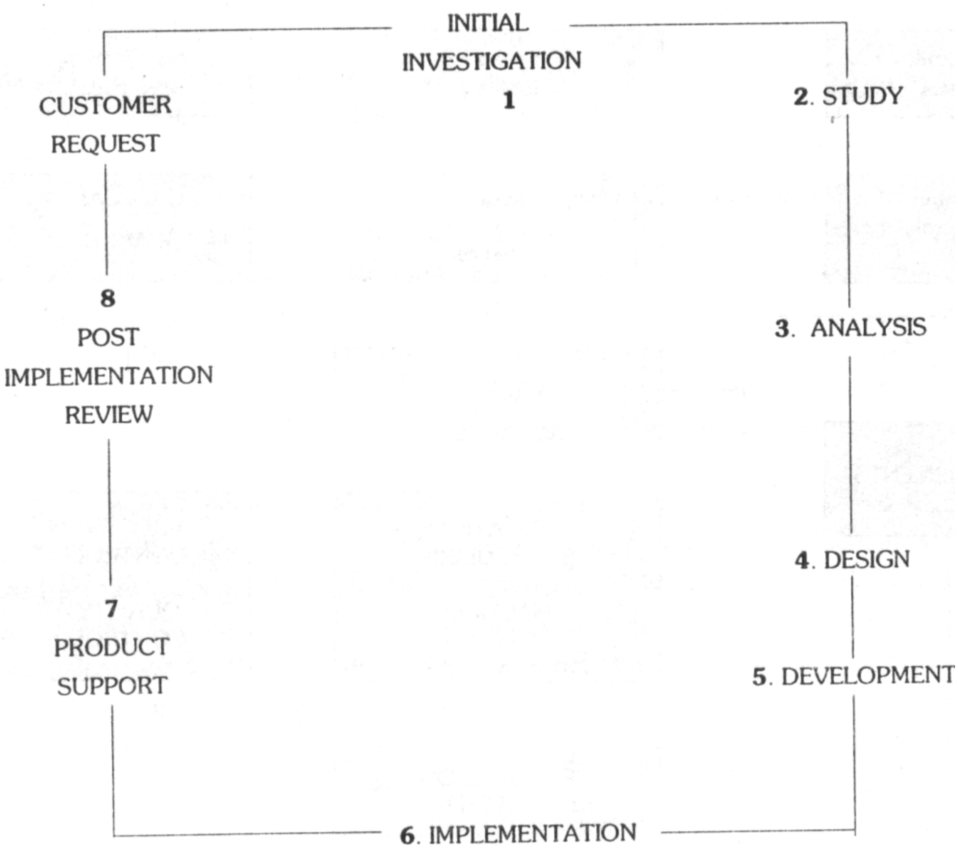
Figure 1

CIM Activities



Source: *Bertain (1987).*

Figure 2
CIM System Development Cycle



The team that has responsibility to plan and control a CIM system is a CIM action team. That team should be multifunctional with representation from various segments of a company most likely to be affected by the implementation of CIMs.

The second step is a feasibility study. A Project Viability/Feasibility Assessment (PV/FA) document is prepared during this phase. It defines the project's scope and assumptions, taking into account management, imposed constraints, budget limitations, and technical considerations involving other systems under development for the future.

In the third step, the analysis function determines and lists the precise relationships among the components of a complex matter or system, and breaks them down into elements. During this phase, a system requirements definition (SRD) document and a system design alternatives (SDA) document are prepared. (Foston, et.al.,1991, p.287). The SRD includes a description of the present system, a definition of requirements to be met by the proposed systems, a list of anticipated benefits, and the recommended scope and schedule for the proposed system.

The fourth step is a crucial step. The design function prepares the plans for building a product or a system. System external specification (SES) and system internal specification (SIS) are prepared during this phase. (Foston, et. al., 1991, p.228). The SES provides a complete statement to the designer of the needs and expectation and provides the user with an understanding of the inputs, outputs and functions of the system. The SIS defines how to build the system described in the SES. It identifies required programs, delineates the modular structure of each program, and specifies report layouts and records and files structure. The preliminary database structure is the main focus of the design step.

The fifth step develops the work from previous stages. Development consists of designing, testing, and evaluating the system. The program code, database structure, tests, and manuals are developed during this phase.

The sixth step of the CIM development cycle is implementation of the data base management system. This phase involves installing the system into manufacturing operations. All remaining steps necessary to operationalize and document the system are concluded during this stage.

The seventh step entails providing on-going system support. The user organization assumes primary responsibility for operating the system, educating and training the operators, maintaining the system, and upgrading the system as necessary. In this phase, the development team identifies and solves practical problem in systems operation.

The eight step consists of a post-implementation review. This review evaluates accomplishments - successes and failures - as a result of the development project. This evaluation may result in identification of potential improvements that may lead to a new CSCR and repetition of the cycle.

A successful CIM system depends on management commitment; employees' motivation, interest and participation; education and training at all levels of the enterprise; and a well-developed plan.

CIM Database Management Systems

Understanding the activities and life cycle development of a CIM system will contribute to the comprehensive design of a database system. A database management system in CIM is a software package designed to operate interactively on a collection of computer-stored files~a database. A CIM data base system is organized with a complex set of software. A typical DBMS consists of a high-level computer language that controls access, storage, retrieval and manipulation of data in the database. This software provides the means to describe the location, contents, relationships, and security level of elements in the database.

The Roles of Database Management in CIM

There are four possible positions that a DBMS may assume in CIM: no role, use of a database as a directory, use of a database to store data and continued use of file-oriented applications, and full use of data management technology for both data storage and application development and maintenance.

In most existing CIM implementation, database technology plays little or no part because the applications are all file-oriented. If database technology is used at all, it is limited to two completely different parts of the system. The first part includes design, analysis, and process planning. The second part involves the many business-oriented manufacturing management packages, like Cullinet. *(Bennett, Early & Sarah,* 1991).

A database plays a directory role on top of existing file-oriented systems. This is the easy way to introduce DBMS into a large file-oriented environment.

The directory approach uses a database to keep track of this design information in a computer. This approach can be used on several levels of complexity. It sometimes allows the engineer to ask for design documents without having to remember the file name. The engineer can ask draw and save without knowing the name of the file. This program is classified as a generator program. *(Gremillon,* 1985).

This approach also has the capability to work with a multiple CIM systems and in a distributed environment. So, it enables a user to find and manage the company's design and manufacturing data without technical assistance. The flexibility of CIM will show up in this approach because it can work in a heterogeneous environment.

One important thing that management needs to decide is the type of data structure to be used. The data structure should be adequate for implementing a basic data directory. The database system functions as a librarian. To add some functions to the system, additional attributes are given to each file. Each file has a status to indicate whether it is available or checked out. Each time the file is checked out, the time and identification of the user is stored.

Using database technology in conjunction with traditional file-oriented application is an intermediate stage between use of the database as a directory and the full DBMS approach. This approach involves only converting the data; therefore, the user can not benefit from the database approach. Because of the limited conversion necessary, the application of this approach should be stable. This approach has three benefits. First, existing applications do not have to be converted. Second, data are available under a DBMS so all new applications can be beneficial, and the data can be accessed directly by users with high-level query languages. Third, there will always be some applications that are so process-intensive that the company can not afford a DBMS. So, this approach require an extension to some DBMSs.

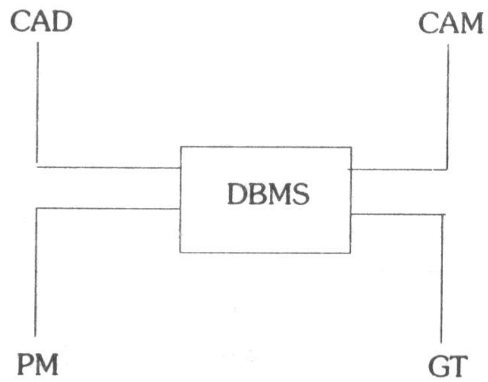
Full Database Management Systems implementation uses DBMS in a normal mode. All data are stored in the database, and the DBMS directly manages the data at the record and item level. Only this approach provides the full benefits of database management technology, but it also has two significant drawbacks - performance and conversion. DBMS seldom perform as efficiently as compiled application software. Hence, full DBMS implementation entails *a* trade off between performance versus benefits, such as ease of use, faster development, and reduced maintenance and costs. Most CIM applications are not designed for its database approach and require significant modification of application programs. In turn, these modifications can result in substantial additional costs.

After understanding the roles of a database in CIM, management should choose that role which provides the greatest benefits for the company.

A Basic CIM Database Structure

The concept of Computer-Integrated Manufacturing evolved from developments in CAD/ CAM and Production Management. (Carberry, 1985). CIM integrates concepts of CAD, CAM and PM (production planning and production control) through Group Technology and DBMS techniques. Figure 3 depicts this integration.

Figure 3
CIM



Source: *Bertain (1987)*

Because each of these activities has its own huge amount of data, the CIM database can logically and/or physically be divided into three distinct databases. As figure 4 illustrates, these databases may each be a composite database in themselves.

a CAD database which contains design data to record bill of materials and a Group Technology number of some product series. Documentation data are also frequently accessed by designers.

a CAM database which specifies how to manufacture a product or a part. It is composed of a manufacturing database concerned with the equipment and hardware. It will include the database or library to store standard or constant technological data about work materials and the rate of them, a PM database which contains administrative data about the company products, personnel, customer, supplies, status of inventories, master schedule and MRP.

Accounting problems and CIM

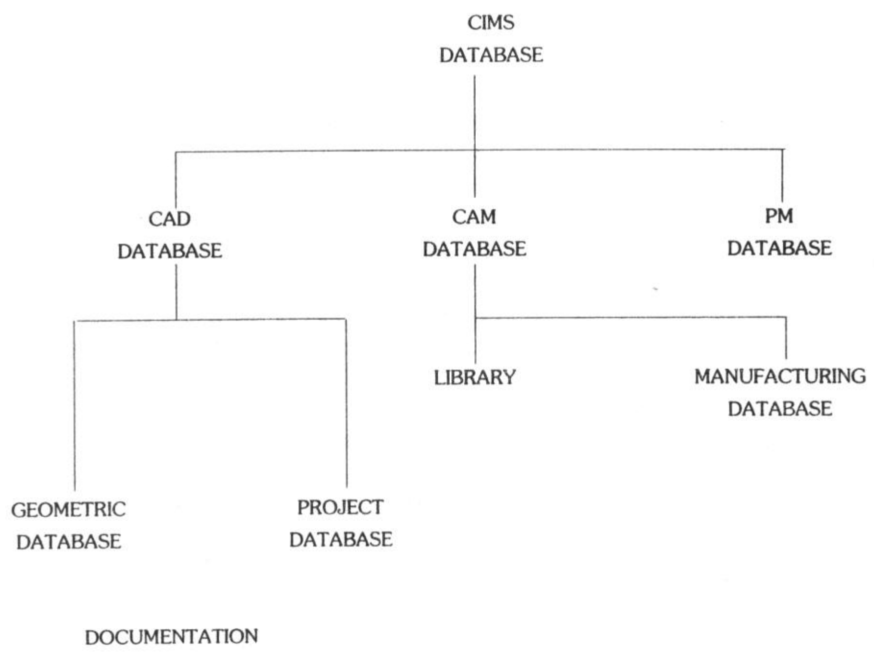
The impact of accounting problems on manufacturing can be seen in terms of two of the functions of an accounting systems. First, an accounting system relates how funds are used to generate revenues by changes in inventories and to measure profit or loss. A second function of an accounting system is to help managers make decisions regarding products, prices, and costs, so they can attain successful operations. However, operating decisions are made for individual jobs or increments, not total overall operating condition.

The advantage of a CIM system is its ability to produce short runs of many different parts. But, such a system still requires many decisions, involving which orders to accept and what price to charge to yield a desired profit, what new products to make or what mix of new products and repeat runs, and the number of production runs to use as the basis for spreading the preparatory costs.

The CIM system has two economic characteristics. (Scott, 1989). The first is large start-up costs in relation to modest operating costs. This characteristic applies to the initial facility and each new product to be made. The second characteristic is the ability to learn how to perform a series of operations. Because the facility can remember and build a repertoire of all that it has done, the cost to make a *repeat* batch of parts can be far less than the cost of the first batch.

Standard accounting practice requires a company to record expenditures that were used to develop computer software, do strategic market analysis, train people and make other provisions for the future. This treatment of strategic costs reduces reported current profits so that the company appears to be in a poorer position, because it fails to record the intangible benefit derived from these efforts.

Figure 4
CIM
DATABASE



Another effect of this treatment is to lose track of early strategic costs after they are incurred. So, the true cost of future production is understated. The time lag between outlays and the sales produced revenue may cause a great risk of not recovering the expenditures. In addition, the cost of capital during the period of negative cash flow is of critical importance.

When a company pays for the research and development necessary to make new products, train its people, or develop a repertoire of computer encoded production technology, it is investing in knowledge. Because accountants can not measure the value of knowledge accurately, they assign it a value of zero.

For example, consider inventories. If a company is willing to use the just-in-time concept, it may reduce inventory levels and retain only the knowledge of how to be productive in an CIM database program. On the company's books, the physical inventory is replaced with a repertoire, which may be a very valuable list but is treated as having no value at all.

Traditionally, accounting has been largely a process of relating labor and material costs to particular jobs and to thesales generated from those jobs. All costs are charged to production through material, labor and overhead. Thus by using CIM, direct labor cost can be reduced.

Traditional cost accounting treats material, labor and depreciation as similar costs and ignores the interest cost of unrecovered money used to buy capital equipment and pay for strategic costs. Hence, out of pocket costs are overstated and the cost of idle capacity is understated. The same problem exists with depreciation and labor cost.

Advanced manufacturing is becoming increasingly dependent on quantifiable information other than dollars. The measures used in statistical process control, product reliability, and short-run setup times are examples of information that may be more important to factory operations than typical cost numbers. Yet, accounting ignores these measures of operational efficiency.

Historically, strategic costs were modest in relation to overall operations, and they tended to occur at a relatively constant rate. Accounting assumes that the problem will go away as the continue the operational requirement for staying in business.

Both types of problem solving are useful in the long run. However, people understand the problem will come from time to time. They need relevant information to solve current problems, not future problems. Some people are working on an idea based on cumulative cash flow.

Accounting has become more a function of strategy than of measurement. Consequently, then the strategic plan or multiyear budget of a company may be

the best basis for evaluation. Two sets of numbers really matter from an operating management standpoint - the cumulative outlays and the cumulative receipts.
The idea of using the cash flow statement for problem solving appears a very weak procedure. They will not satisfy all requirements for an accounting system. However, this procedure may help as an accounting technique.

Conclusion

Accountants should recognize that in a highly competitive world, generally accepted principles inject a strong bias against modernization while failing to project the consequences of inaction. Machines are capitalized and depreciated to reflect obsolescence. Yet, expenses for workforce training are expensed as incurred. Market share is an asset that is never recognized, and gains or losses are often un-matched with costs incurred.

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