Information as a Tool

Forging improved communications with your customer.

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The volume of data processed in a PCB facility is enormous and the possibility of error significant. To manage this barrage of data, fabricators have developed elaborate internal protocols. In this volatile environment was born the need for engineering information systems (EIS).

Recent research has indicated that 25% of a knowledge worker's time is spent performing marginally productive tasks, such as waiting, organizing information, seeking information, and scheduling.[1] It is therefore important to define what information a knowledge worker needs and then define how to provide that information in a timely manner. The logical route to this destination is an EIS.

Information Environment and Culture

Today's PCB manufacturing environments rely heavily on CAM for activities ranging from simple file viewing to complex analysis. Engineering departments analyze incoming data and add informational value to it. More data may also be generated for analysis by other departments.

The responsibility for a portion of the data usually falls on individual departments. Manufacturing environments rely on distributive archive systems that create islands of information accessible only by individual departments. This, in turn, creates an informational culture within the firm's corporate culture.

Corporate culture determines the firm's level of aggressiveness.[2] A nonaggressive company expects little change and encompasses stable engineering and manufacturing plans. An aggressive company has little resistance to change and understands the need for continuous improvement that can result only from continuous change.

In the continuous-change process, the manufacturing organization becomes lean, striving to reduce waste, maximize resource use, reduce cycle time, and manufacture in small lots. A major objective for such a firm is to become agile.

The agile organization finds ways to respond to constant change in market demand, identifying available technologies and the best ways to apply them. Such a manufacturer will be able to translate this into reduced cycle time by more quickly allowing new ideas and customer requests into production. Failure to achieve this goal will result in shrinking market share and potential loss of market leadership.[3]

Information Organizations

The underlying element of all managerial and engineering decisions is information derived from data. This information, like data, proceeds through a life cycle (Figure 1).[4] But this cycle is not traditionally followed within the manufacturing environment, which raises questions about information integrity. Companies create informational organizations to obtain a sense of control over such information.

There are two main forms of informational organizations: authority/ProductionLbased and knowledge/problem-based companies (Figure 2).[5] The latter struc-

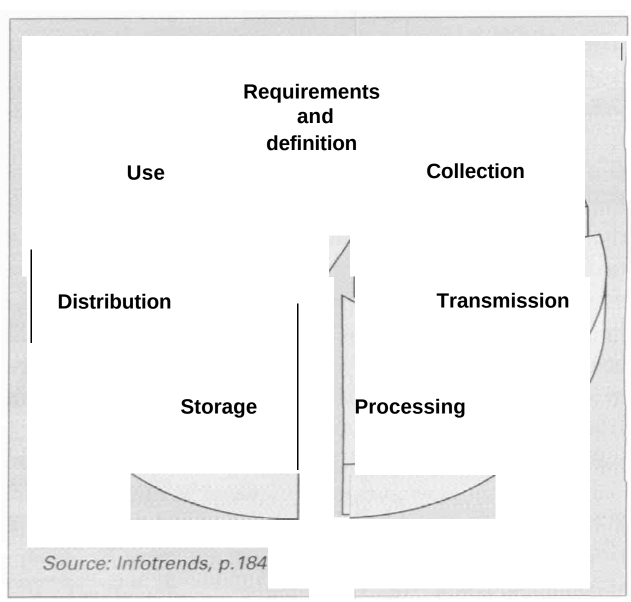


Figure 1. The information life cycle.

ture is preferred. The decision-making process that occurs in this environment requires that individuals gather the available information, determine what parts are relevant to the decision, and then implement the decision. This requires an open information system. The improved communication and enhanced accessibility to manufacturing data throughout the organization that result will increase business flexibility.

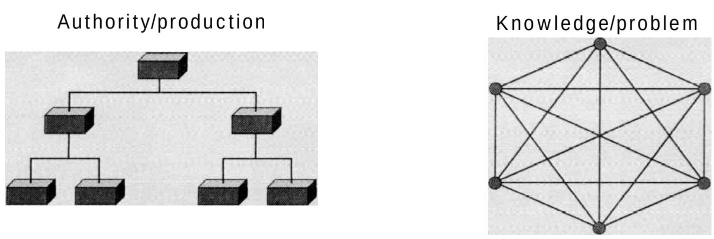
The Open-System Environment

Today's computer systems are the product of system providers' efforts to generate open systems. The first step in this evolution was a standard communications protocol called TCP/IP. X-Windows, with its standard user interface, Motif, has also had a significant impact on system evolution.

Following these developments, computer systems became simple. ANSI standardized computer hardware elements. As a result, vendors that once sold complete hardware and software solutions could no longer do so because systems arrived ready to operate.

Software programs should be multi-vendor compatible; user definable; and capable of recovering quickly from system failures, through elements such as relational database management systems, or RDBMSs. Structured Query Language, or SQL, was developed to ensure the RDBMSs found their way into the open-system arena. With the use of client/server technologies, SQL allows multiple platforms with multiple operating systems to have access to a common database.

Hardware systems should also be modularly designed for easy repair, and used in conjunction with uninterruptible power supplies. Finally, the software provider should harness the power of the hardware's open-system environment to create an EIS.



Elements	Authority/production	Knowledge/problem
1. Levels of authority	Many	Few
2. Division of labor	High	Low
3. Links to other in the organization	Few	Many
4. Source of influence and power	Position in the hierarchy	Ability to identify and solve the problem
5. Use of rules and procedures	High	Low
6. Primary purpose	Maximize output	Analyze or invent knowledge to solve problems

Source: *Infotrends, p. 184*

Figure 2. Two ***basic types of informational organizations.***

Organizational Requirements

Before an EIS can be implemented, the organization's needs must be studied. The EIS developed must be capable of obtaining the minimal amount of information needed to achieve the company's goals on the most economical basis possible. The data must be made available in a timely manner, within the control of the system, and easily accessible by multiple users. It must be part of the company's total informational plan, have a mechanism to protect against data loss and misuse, and be multi-vendor compatible.

The Uses of an EIS

There are many opportunities for data sharing in a PCB facility. Planning and CAM departments can use an EIS to view CAM databdase formats, using PostScript to generate a hard copy of the data that can be faxed to customers. This translates into improved customer satisfaction and increased CAM capacity.

Other departments' productivity can be improved by the use of informational viewers, resolving many local issues that once required multiple departments. Electrical test, for example, should be able to view the PCB as it appears on the CAM systems. Providing the data graphically instead of via traditional diazo copies accelerates the troubleshooting process. Phototooling, which is currently denied the opportunity to review data graphically, would also be able to resolve many issues if such data were available through an EIS.

Product Information Management Systems

Quality manufacturing encompasses three management techniques total quality management (TQM), just in time (JIT), and theory of constraints (TOC). Each technique has similar goals but achieves them in different ways. Yet each method strives to gain control of the process, and each requires that information be accessible at the point of knowledge. The individuals directly involved in the process are best suited to resolve the issue.

The chief information officer must link all methods of the process to a central production information management system that will "systematize" speed into every facet of the organization.

The end result of an informational structured system is the use of analyze-for-manufacturing (AFM) tools that are just now being conceived. For manufacturers, the end result of this informational revolu-

"One ultimate goal is to better understand and communicate with the customer."

tion will be a better product at a lower cost, supplied to the market on a timely basis.

Conclusion

In the final analysis, where is information technology headed? What is the impact of an engineering information system on the PCB fabricator's bottom line?

Just as seven or eight years ago with the introduction of CAM, step-and-repeat cameras and artwork layup departments were replaced by the faster and more accurate CAM systems. Hence, engineering information systems will replace the many interdepartmental labor- and cost-intensive communication processes. In addition, interim hard-copy QC tools, such as silver or diazo copies for data reference, can be replaced by electronic graphical reference tools, fully accessible to any location at which a terminal can be placed on a network. Companies are eliminating costly processes like first-article drill by using multi-database graphical comparison tools.

Possibly one of the greatest advantages evolving from engineering information systems is a whole new set of information quality tools with which PCB fabricators can interact with their customers. After all, isn't one of the ultimate goals of the whole process to better understand and communicate with the customer?

References

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[3] Marchand, D, and F. Horton. Infotreands Wiley 1986 p. 184.

[4] Ibid p. 159.

[5] Ibid. pp. 243-245.

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