IDENTIFICATION OF THE KEY ENABLERS FOR COMPUTER AIDED DESIGN AND MANUFACTURING IMPLEMENTATION IN AN ORGANIZATION

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ABSTRACT

Today CAD systems are an integral part of the innovations to existing products and development of new products. They help to improve and speed up the development process with reducing costs. In order to implement CAD/CAM system, there are some key enablers of CAD/CAM are identified through expert opinion from academic and literature review. To study the role of these key enablers in CAD/CAM integration offers designers, analysts, and manufacturers the opportunity to share data throughout the product development process.

Keyword; CAD/CAM , enablers of CAD/CAM

• INTRODUCTION

Computer-aided design (CAD) is the use of computer systems to aid in the creation, modification, analysis, or optimization of a design (Narayan and Lalit 2008) and its software is used to increase the productivity of the designer, increase the quality of design, improve communications through documentation and to create a database for manufacturing (Narayan and Lalit 2008). CAD is also used to produce computer animation for special effects in movies, advertising and technical manuals, often called DCC digital content creation. The modern omnipresence and power of computers means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by engineers of the 1960s. Because of its enormous economic importance, CAD has been a major driving force for research in computational geometry and computer graphics (Pottmann et al.2007).

Computer-aided manufacturing (CAM) is the use of software to control machine tools and related ones in the manufacturing of work pieces. This is not the only definition for CAM, but it is the most common; CAM also use of a computer to assist in all operations of a manufacturing plant, including planning, management, transportation and storage. Its initial purpose is to create a faster production process and components and tooling with more accurate dimensions and material consistency, which in some cases, uses only required amount of raw material, while simultaneously reducing energy consumption. CAM is a subsequent computer-aided process after computer-aided design (CAD) and sometimes computer-aided engineering (CAE), as the model generated in CAD than verified in CAE can be input into CAM software, which then controls the machine tool.

• LITERATURE REVIEW

The Literature has been reviewed and related literature has been presented as under:-

Sharma et al. (2014) defines smart CAD/CAM technologies for superior product modeling in the intelligence of designing complete product variants become more and more pertinent in future. Many design techniques to help interdisciplinary design actions in different engineering domains in addition to consequent processes have to be developed. A necessary job to achieve this aim is to permanently investigate the present state of the art, emerging trends, new approaches, in addition to industrial problems and requirements about the entire CAD/CAM area.**Riesenfelda et al. (2014)** presented a critical analysis of the effectiveness of the current field of CAD, and discuss some of the forces that have taken it so far off course from its strikingly foresighted origins. Armed with the ensuing understanding of the operational forces that have taken CAD adrift, we conclude that the disparity between CAD's mired state-of-the-art condition relative to more appropriate, inspired and achievable goals for CAD calls for more drastic measures. **Kirkwood and Sherwood (2017)** conclude that CAD/CAM integration offers designers, analysts, and manufacturers the opportunity to share data throughout the product development process. Such integration reduces product development cost and supports the development of better products. Finite- element (FE) meshing applications integrated with solid model data from CAD systems represent a major subset of CAD/CAM/CAE integration. Many practitioners find that sustained integration with the CAD geometry is often not economical because of mixed CAD formats and the need to simplify geometry before modeling. This article assesses those circumstances and the cost/benefit trade-offs that lead to the not-economical conclusion. **Lee (2004)** stated that spite of the widespread use of CAD systems for design and CAE systems for analysis, the two processes are not well integrated because CAD and CAE models inherently use different types of geometric models and there currently exists no generic, unified model that allows both design and analysis information to be specified and shared. In this paper, a new approach called the CAD/CAE- integrated approach is proposed and implemented by a feature-based non-manifold modeling system. The system creates and manipulates a single master model containing different types of all of the geometric models required for CAD and CAE.**Mares and Senderska (2012)** define CAD systems are now an integral part of the development of new products and innovations to existing products. They help to speed up and improve the development process while reducing costs. Looking at the current market with CAD systems, he find that there are numerous available CAD systems, which differ in price, functionality, support, and so on. Therefore, the question arises in choosing which of a number of CAD systems to choose for the job. The article deals with the selection of CAD systems, focusing on the criteria that influence the selection of CAD system. **Tolouei-Rad (2006)** concludes that the integrated CAD/CAM system for milling operations has been developed which helps designers to solve machining problems at the design stage. A methodology has been employed which provides all necessary information for machining products automatically. Use of these system results in reduced machining lead times and cost through designing machinable components; using available cutting tools; improving machining efficiency. The system is menu driven with a user friendly interface.**Li et al. (2017)** state that teaching of the traditional mold courses focus on the illustration of theoretical knowledge. Therefore, associating the design, evaluation, and manufacture links as a whole is difficult. Students cannot shape system knowledge, thereby making the study difficult. In addition, traditional teaching cannot meet the current enterprise

needs of talents who have mold CAD/CAM technology. **Tan et al. (2013)** presents a methodology for implementing the feature recognition system for achieving the Computer Aided Design/ Computer Aided Manufacturing (CAD/CAM) integration goals. The Feature based modeling is being used to model the solid models. The features being considered in this paper is form feature. The input of the feature recognition system is the Standard for the Exchange of Product

• IDENTIFICATION KEY ENABLERS OF CAD/CAM

On the basis of literature review and expert opinion from academia enablers are identified that play crucial role for implementation of CAD/CAM system in manufacturing industries as depicted in Table 1.

Table 1:CAD/CAM enablers and their references

S.No.	CAD/CAM/CAE enablers	References
1	Top management commitment and support	Rockart (1982), Ives and Olson (1984),Nagar and Raj (2012)
2	Effective long term planning	Huang and Sakurai (1990), Noble (1990),Nagar et.al (2012)
3	Communication between design office and other users	Rainer *et al*. (1992)
4	Availability of resources	Nagar and Raj (2012)
5	Team spirit and motivation	Narain et al.(2004), Nagar et.al (2012)
6	Organizational effectiveness	Soliman et al. (2001)
7	Training of CAD/CAM staff	Hylas *et al*. (1989), Hoffman (1992), Lucas (1981)
8	Security of CAD/CAM interface	Soliman et al. (2001)
9	User interface	Klein (1991)
10	Work culture of organization	Needle (2004)

The different type of enablers of CAD/CAM on the basis of literature review and expert opinion from academic are explained below:-

1.Top Management Commitment and support

The success or failure of any business effort is findout by the amount of top management support (Rockart, 1982; Ives and Olson, 1984). Engineering and production managers properly participate in the organizations planning process with senior managers and top managers help engineering and production management and line management to shortout the problem of understanding top management's objectives, thus facilitating good communications among management levels. Managers who participate in the planning process also tend to promote communication and a best relationship with top management. Thus, such managers will more likely perceive the changing business objectives and thus help engineering and production management to achieve the new business objectives.Top management that is better able to understand the idea or the problems of CAD/CAM management during the process of CAD/CAM integration will have a better image of the CAD/CAM integrationGinzberg(1981).

2.Effective Long Term Planning

Exercise aimed at formulating a long-term plan in CAD/CAM implementation in current manufacturing, to meet future needs estimated usually by extrapolation of present needs of CAD/CAM in manufacturing. It begins with the current status and charts out a path to the projected status, and generally includes short-term (operational or tactical plans) for achieving interim goals (Huang and Sakurai 1990, Noble 1990).

3.Communication between design office and other users

In the case of integration of CAD/CAM, the design office could improve communication and assist users in communication with the design office. Thus, users could be less anxious and their attitude toward implementation more favourable (Rainer *et al*., 1992). In the environment of CAD/CAM, communication with users is more complex than in the classical environment of computing. Therefore, this study stresses the importance of communication between users and the design office and that there will be a positive relationship of CAD/CAM integration. Communication between users and the design office is positively related to the success of CAD/CAM integration.

4.Availability of Resources

Availability means capable of being used or the extent to which resources are available to meet the project's needs. As it relates to project management, it typical refers to resources or funding. The level of availability of a resource may vary over time in implementation of CAD/CAM.(Nagar and Raj 2012)

5.Team Spirit

Team spirit is the feeling of pride and loyalty that exists among the members of a team and that makes them want their team to do well or to be the best in current manufacturing (Narain et al.2004).

6.Organization effectiveness

CAD/CAM integration should be designed to achieve an organization's objectives. If CAD/CAM integration improves an organization's effectiveness, then integration is more likely to be regarded as a success. During such major organizational changes, CAD/CAM support may ease the tedious maintenance of drawings, BOM and specifications, thus improving the quality of managers' decision making and easily the management of change. This study examines the relationship between the success of CAD/CAM integration with organisational effectiveness. Organisational effectiveness is positively related to the success of CAD/CAM/CAE integration(Soliman et al. 2001).

7.Training of CAD/CAM staff

Hylas *et al*. (1989) indicated that not all systems applications are appropriate for implementation. Selection of the wrong business functional area or the wrong application or lack of adequate training can result in system failure. Not only lack of IT/IS implementation experience can cause an IT/IS manager to choose an inappropriate application; incompetent IT/IS staff may have difficulty recording or developing software for IT/IS implementation, while a deficiency of software packages for IT/IS implementation can cause rigidity and difficulty for IT/IS implementation (Hoffman, 1992). Lucas (1981) suggested that human factors affect the successful implementation of a new IT/IS more obviously than do organizational factors. In addition, when applications are moving from the mainframe to the desktop, compatibility should be maintained. To ensure software compatibility, the design office should review syntax, software features and external behaviour and provide training to

its users. Training CAD/CAM staff is positively related to the success of CAD/CAM integration.

8.Security of CAD/CAM interface

Applications should be solve business problems, not create problems. Data are interchanged between CAD/CAM system and other applications. Many older applications often employ unique, antiquated and somewhat incompatible software coupled with unsophisticated security protocols. One of the design office functions is to use CAD/CAM systems to design products and create confidential design documents such as BOM. Therefore, the security of files and data bases used by the CAD/CAM system become a major concern. In which the CAD/CAM interface operates. The development of the integrity environment needs to mitigate the organisational risks and ensure that the controls implemented in the system do not encumber the business. The interface between CAD/CAM and other applications needs to be designed specifically for cross-platform use. This study examines the positive relationship between the security of the CAD/CAM interface and CAD/CAM integration success (Soliman et al. 2001).

9.User interface

If chosen a complicated system involving significant amounts of data manipulation, this could be inadequate for successful CAD/CAM integration. The candidate application for IT/IS implementation should be simple, familiar and based on an application's basic merits, not on its politics (Klein, 1991). Accordingly, organizations in which to define the use of CAD/CAM application and software for implementation. This study examines the positive relationship between the user friendliness and the success of CAD/CAM.

10.Work culture of organization

In which to see the behaviours that "contribute to the unique social and psychological environment of an organization". According to Needle (2004), organizational work culture represents the collective values, beliefs and principles of organizational members and is a product of factors such as market, product, technology, strategy, type of employees, management style, and national culture; culture includes the organization's vision, employees dedication and environment of shop floor in industries.

• IMPLEMENTATION OF CAD/CAM SYSTEMS

Effective implementation of CAD/CAM systems offers manufacturers a number of benefits such as: cutting design costs, reducing cycle time, reducing matching time and improving information flow. For firms that have already implemented CAD/CAM systems the rise in their productivity will also coincide with a marked decrease in design and production costs, thus freeing valuable staff time so that they can concentrate on pro-actively managing customers' demands and value added activities. There are two implementation scenarios which may be considered (Soliman et al.2001).

Full scale implementation- In this scenario the focus during the implementation is on improving the business (Soliman et al.2001).

Short-cut implementation- In this scenario the focus during the implementation is on technical migration with enhanced business improvements introduced at a later stage (Soliman et al.2001).

• CONCLUDING REMARKS

In the past fifteen years, the modern technologies have been increasingly used in order to increase product quality and productivity of the manufacturing process. Implementation of advanced technologies, especially the application of computers and commercial (for market) is being developed. The process of implementation must be planned, because the direction of the company development depends on the selection of systems for product development. Practical advantages of the implementation of the CAD/CAM systems must be explored. In this research, an attempt has been made to identify various enablers, which facilitate the effective implementation of CAD/CAM. Sometimes manufacturing companies take quick decisions regarding the adaptation of new technologies just by following the production manuals. It is essential that the interested companies must do the introspection before implementing the CAD/CAM system. They must find out how many enablers for the implementation of CAD/CAM system are available to them. The results of this study show that all the considered enablers are very important for implementation of CAD/CAM system. Hence, superior performance of CAD/CAM system can be achieved by continuously focusing on these enablers.

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