

Case Study on CAD Technology in Jewellery Industry

Deepa Sachin Ghag

Department of Mechanical Engineering, Bharati Vidyapeeth College of Engineering, Navi Mumbai, India

Abstract: This article represents the implementation of CAD processes in the jewellery design and manufacturing industry. The quantification is compared to conventional methods in term of time management, quality of product and manufacturing factors. The criteria to be considered for method comparison process are based on some technical parameters, which are identified through a case study on two different cad software. This work proposes parametric rating calculation of each software and identification of effective cost associated with current cad technology in jewellery industry.

Keywords: CAD, Rhinoceros, Matrix7

1. Introduction

The Basic software's being used in the jewellery industry nowadays "Computer Aided Design (CAD)". CAD is used to create images and virtual models, Following three step enough to explain about conversion of Cad design into RPT (Rapid Proto type) model.

1st STEP - CAD, Used for Creating 3D Model by using different design soft skill.

2nd STEP -Computer Aided Engineering Used for - Verifying 3D Model and its accuracy

3rd STEP - Computer Aided manufacturing, Used for making RPT model of cad product design.

CAD has developed drastic creativity in deign sector of Jewellery industry which is still at a nascent stage in the Jewellery market largely due to the traditional outlook or view of many Jeweller. Introducing technologies have brought in numerous jewellery manufacturing service providers who are now enabling CAD/CAM facilities at more affordable prices.

2. Literature Review

Rapid Prototyping and Tooling Technology in Jewellery CAD by Somlak Wannarumon and Erik L. J. Bohez In this paper presents the investigation of computer-aided design and rapid prototyping technologies in jewellery design and manufacturing.

Computer-aided design (CAD) and Rapid prototyping (RP) [1], The MJSA Technology survey published article on basis of cad cam technology in jewellery. Its research based on CAD/CAM programmed usages training methods for CAD proficiency & uses. This quantification help to framing this researched sequentially *et al.* [2].

Complexity and Cost effectiveness is measure for system design by Marine D. Guenov. Suggested complexity factor calculation based on design parameter. He suggested some method to measure design complexity in initial stage. It's not necessary design equation always linear especially in conceptual stage [3]. By Joan Dalrymple - ©

2010 in article The Impact of CAD/CAM on Traditional Jewellery Fabrication suggested, how jewellery can be designed, produced and how it is perceived [4].

2013 in article "Adoptability of CAD/CAM for Jewellery Making Industry Using Method Comparison technique "paper has been described the comparison between cad and cam software published by IJLTE [7].

3. Researched Methodology

By reference of published article related to cad cam technology and manufacturing. Performance measures was undergoes from various methodologies adopted by researchers were studied in different way and in different depth.

Theoretical Framework

The detail study on jewellery CAD software with technical specification of each system.

Case study

Case study based on making CAD model on different software and quantified with technical parameter. For detailing and process adoption, following methodology applied.

- 1) Step 1: Development of 2-Dimensinal Image constructive design structure.
- 2) Step 2: Transformation of 2-Dimensional image into 3-Dimensional model by means of different CAD tool.
- 3) Step 3: 3-Dimensional Modeling and construction.

Technical Statistical Analysis

This phase included the statistical analyses in term of accuracy analysis, productivity analysis, and quality analysis for the development of CAD technology particularly for Jewellery industry. CAD technology allows designers to simplify the iterative design or to easily modify or adjust specification of the sketches, to facilitate sketching of Jewellery products in any sizes, and to shorten the required time also.

Rhinoceros (Rhino).

Rhino is 3D Design software which works on the attractive NURBS based technology. It is easy to adopt and learn software. It can produce, annotate, resolve, and translate curves, surfaces, and solids and has immeasurable possibilities with respect to sizes, angles and complex designs. Complex shapes can be directly modeled or developed 3D MODEL with complete range of geometric data. in spite of whether you make a simple ring design or an complex neckpieces, this software helps you develop ideas into 3D model, render and animate them and also allow to control and maintained absolute accuracy in your model.

4. Case Study on Rhinoceros

This approach is non parametric means all dimensions in designs will be altered or modify without changing other part dimensions .whenever one dimension altered rest of dimensions will not be change. Following sketches described how two dimensional sketches transform into three dimensional views. It is also compatible with other designs, rendering and animation software. Complex IGES-MESH files can be read and repaired easily. An IGES (Initial Graphics Exchange Specification) is a standard that defines a neutral form for the exchange of information among dissimilar computer-aided design (CAD), and also with computer-aided manufacturing (CAM), and computer visualization systems. Various plug-in can be used with this software, for example Flamingo, Maxwell Render, V-Ray, for ray-trace rendering.

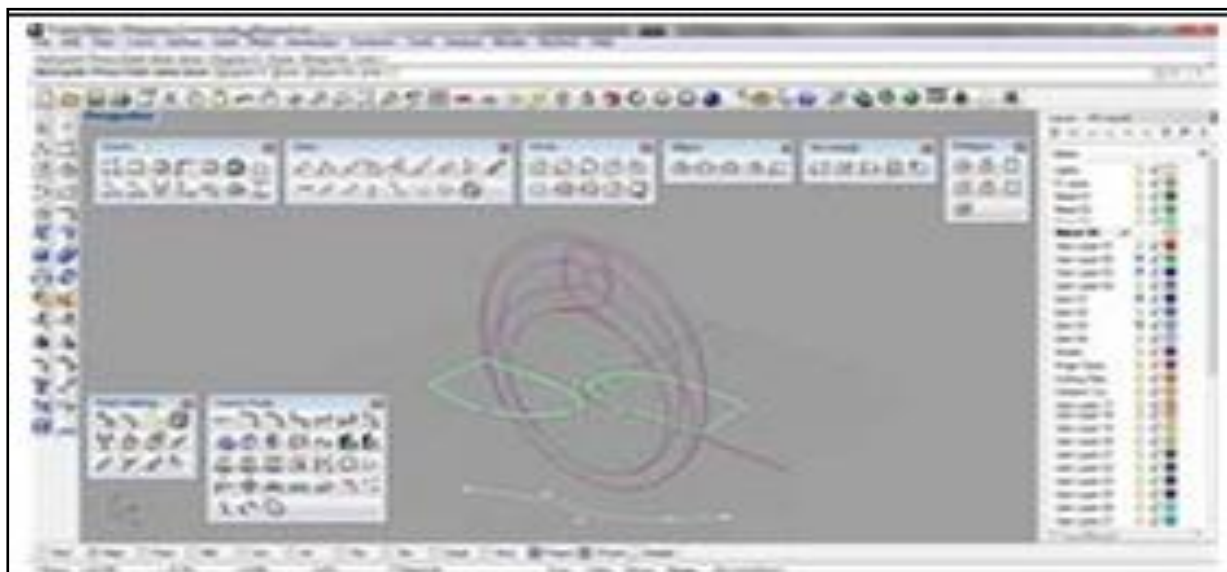


Figure 1: Rhinoceros Cad 2d Model

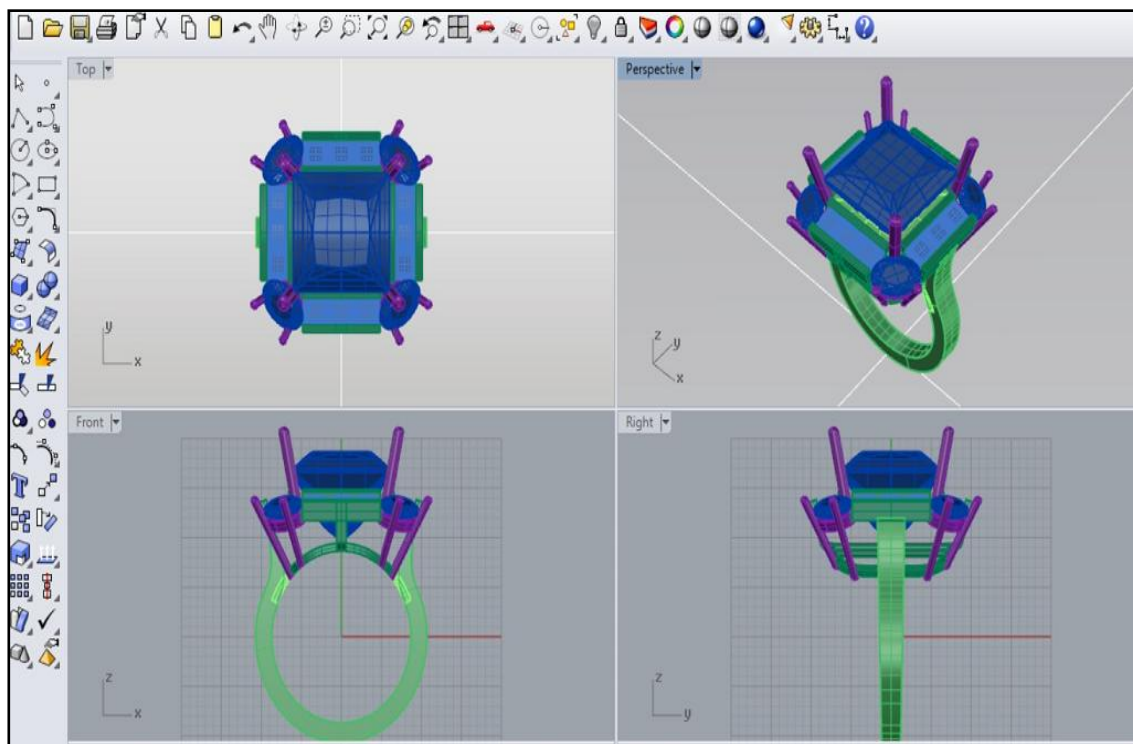


Figure 2: Rhinoceros Cad 3d Model in perspective view

Software Cost.	\$ 1295 to \$ 1495 (Including supporting flamingo software)
Total Investment Year	2 approximately
CAD Proficiency	3 to 6 Months.
Time required to complete design	3 Hrs. required complete cad model. If one design required 3 hrs. To make, then in an 8 hrs. Approximately (2.2)numbers of designs can be made per day on an average (as every organisation worked on 8 to 10 hrs per day)
CAD Software model per month	(2.2 *26 = 57 models per month) depend on complexiy of cad model , if complex model designed , it will take more time also. still if one complex model required 6 hr. to complete (Approximately 1.2 no's designs would be made per day on an average). (1.2 *26 = 31 models per month)
CAD Model Cost (Month).	\$1.8 - \$2.2

than Rhinoceros, like builders that create jewellery-specific models, interactive controls that allow users to immediately adjust aspects of a model & save customized library of designs. It contains more prosaic rendering & animation tools which gives more realistic Images and animations files. Matrix has a whole series of additional builders tool and special tools for making all the repetitive and painstaking tasks of jewellery design (such as pave setting and prong settings) fast and easy in matrix . Because of all these additional tools, Matrix will get you unforeseen production fastly. Matrix is completely parametric software developed only for jewellery industry. It has huge Flexibility because – Library items enable to developed 2d model into 3d model with quick builds, Make it all sizzle with enhanced presentations. Apply fast and consistent looks with Style Sheets. Turn 2D art into 3D designs .Matrix Art is a completely featured height field from bitmap modeling tool program which is integrated into Matrix. Let proceed for case study in matrix same cad model which design in rhinoceros cad software.

Gemvision Matrix

Matrix is jewellery-specific software which is plug-in for Rhino, which content parametric jewellery-related features so they are faster and easier to construct , control & change. In Matrix also added more parametric functions



Figure 3: Matrix Cad 2d Model

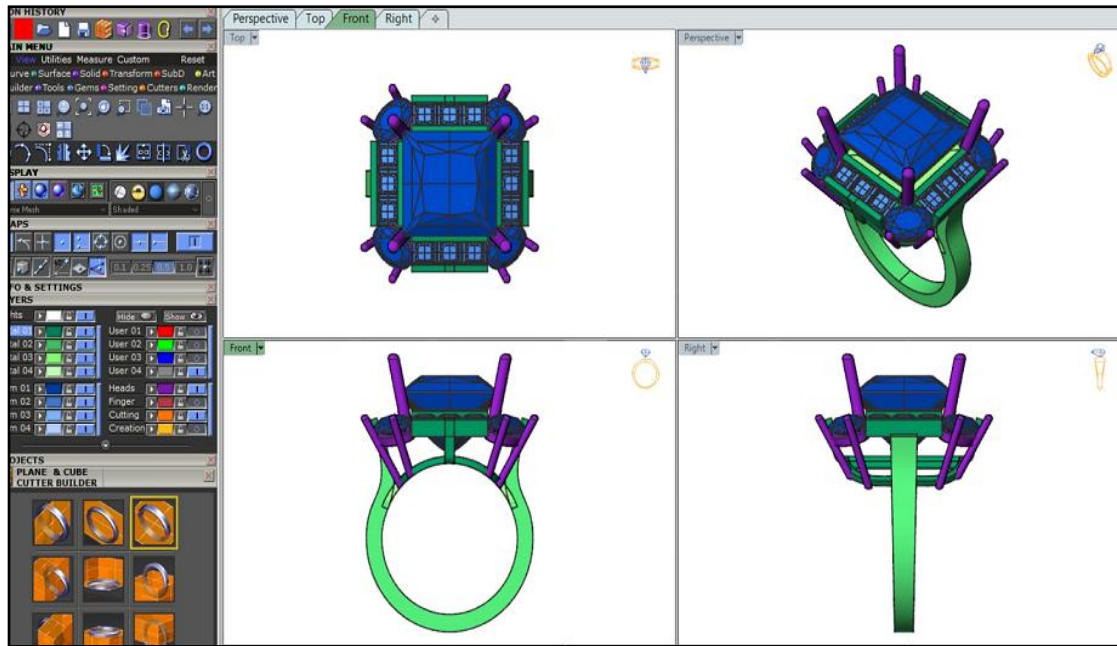
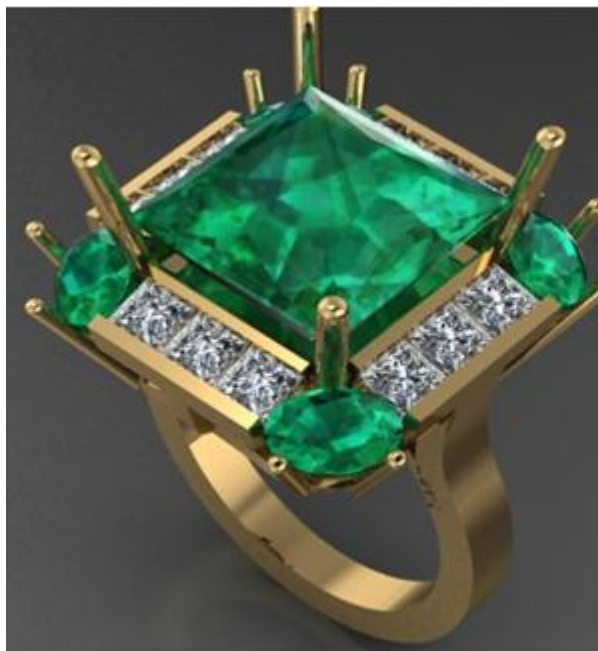
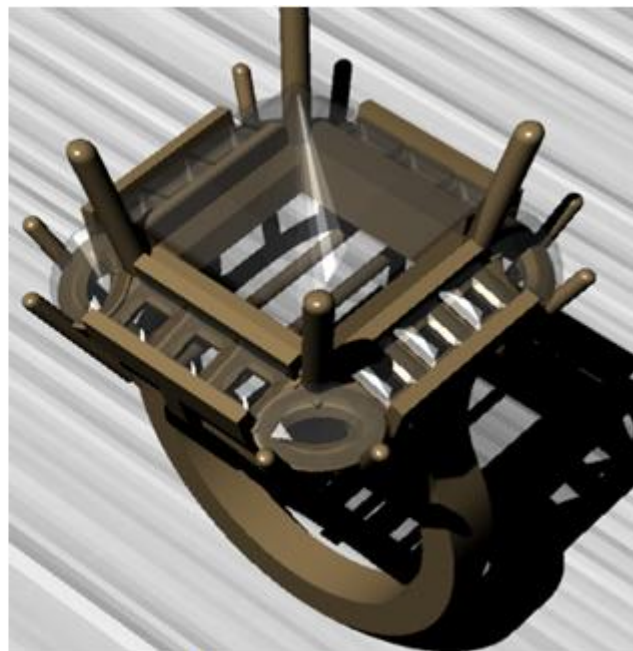


Figure 4: Matrix Cad 3d Model in perspective view



(a)



(b)

Figure 5: (a) Matrix Render Image (b) Rhinoceros Render Image

Software Cost	\$ 6000
Total Investment Year	2 approximate
CAD Proficiency.	3 to 6 Months
Time required to complete design.	If one design required 2 hrs. To complete then in an 8 hrs. approximately 4 no's designs would be made per day on an average). (4 Models per day. Ex. 4 *26=104 Models Per Months.) still if one complex model required 5 hr. to complete .(Approximately 1.6 no's designs would be made per day on an average). (1.6 *26 = 41 models per month)
Monthly Productivity	41-104 model per month
CAD Model Cost (Month)	\$2.5 -\$ 5..5

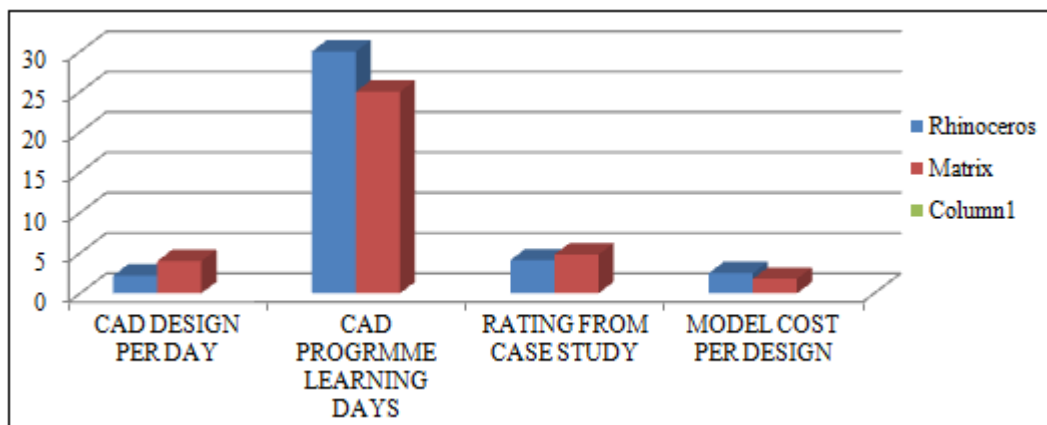
From Above Case Study it's Concluded Following Parameter Rating. By ref of journal [7] CAD/CAM for

Jewellery. (Rating Criteria is 0.1 is Minimum & 1 is for Maximum)

Parameter	Matrix	Rhinoceros
Accuracy	NURBS based software with Engineering approached gives Precision and Accuracy. (1)	NURBS based software with Engineering approached gives Precision and Accuracy. (1)
Compatibility	MATRIX can import & export more than 50 new compatibility enhancements. <i>Library</i> allows 100 of other application to read and write MATRIX native 3DM file (1)	Similar to Matrix Rhinoceros software import & export more than 50 new compatibility enhancement. <i>Library</i> allows 100 of other application to read and write MATRIX native 3DM file. (1)
Flexibility	MATRIX is highly flexible due to fully furnished library and advance database also advance Jewellery Designing CAD tool. Only for jewellery purpose (1)	RHINO is flexible but no database library. Rhinoceros is also suitable all manufacturing industries. (0.5)
Ease Of Use	Matrix required approximately 30 days to become proficient (0.8)	RHINO is required approximately 25 days to become proficient. (0.9)
Productivity	Matrix can Produced 42 -104 CAD models per months (1)	Rhinoceros can produce 31- 57 models per months (0.7)
Rating out of 5	4.8	4.1

CAD Software Conclusion

	Rhinoceros	Matrix
Cad design per day	2.2 model	4 model
Cad programmed learning day	30	25
Rating from case study	4.1	4.8
Productivity per month	104 (from case study type of model may vary according to complexity)	57(from case study type of model may vary according to complexity)
Model cost per design	\$2.5	\$1.8



5. Conclusion

This researched based on case study on two software which basically used in jewellery design. Quantification done on base of productivity, Investment, Approached, Accuracy & flexibility. CAD software allows designers to simplify the iterative design or to easily change or edit details of the raw sketches, to facilitate sketching of jewellery products in any sizes, and to reduced required time for making models. Matrix software has engineering approached of parametric & non-parametric for producing jewellery 3D CAD models with high rate productivity, high rate accuracy , and quick editing in models possible because several specialized jewellery designing tools available, good presentation tool with rendering images & animation tools for Sales & Marketing. This approach will increased sale as well as reduce the cost of maintaining physical inventory of model. As software can produced real image of product by various rendering tool.

References

- [1] Somlak Wannarumon. Product Design and Manufacturing using in The Jewellery Industry, Master M. Eng. Thesis, Asian Institute of Technology, Thailand, 2000.
- [2] The MJSA Technology Survey <http://www.mjsa.org> 05/08
- [3] Complexity and cost effusiveness measures by system design by Marine D.Guenov.mk 43 oal from united kingdom
- [4] By Joan Dalrymple - © 2010 in article The Impact of CAD/CAM on Traditional jewellery fabrication.
- [5] Terry Wohlers. New developments and trends in product design, prototyping, tooling, and reverse engineering, Wohlers Associates, Inc., 2000. Colorado, USA.
- [6] Chris McMahon, Jimmie Browne. Rapid Prototyping. In CAD/CAM Principle, Practice and Manufacturing Management, second edition, pp. 386-388, Addison Wesley Longman Limited 1998, USA.

[7] “Adoptability of CAD/CAM for Jewellery Making Industry Using Method Comparison Technique” by deepa ghag and jayesh dange in IJLTE journal vol3 issue 1, sept 2013.