

RAPID PROTOTYPING AND THE ECONOMIC CRISIS

Carmen Gabriela BĂCILĂ, Zoltan-Gabor BAKI-HARI

Abstract: *More than two decades ago nobody would have thought that the recently appeared Rapid Prototyping Technologies will become the producers' instrument of fighting against the effects of the global economic crisis. This is possible because these technologies offer a series of technical and economical advantages to the users, such as the concomitant reduction of the type and of the cost of products development. They also knew a very spectacular development, both in performances and in the area of usage. This development is anticipated to continue in the future, in spite of the recession. But we have to remind here that if we want this things to happen, like in the past, there must be granted funds for researches and development.*

Key words: *rapid prototyping, economic crisis, product development, concurrent engineering, CAD/CAE/CAM*

1. INTRODUCTION

It is well-known how important is the possibility of appearing on the market with a new product – or with the improved variant of an existent one – in the shortest time possible, but prior to competitors, for the survival of a company. This is first of all due to the radical change of human needs, which attracted after it also a very intense development of technique and science.

And in today's economic conditions – the full world recession – when numerous companies are forced to reduce their activity and even to suspend it, the first statement is holding the field more than ever. But there are also other possibilities to maintain profitability. We can remind here the introduction of new techniques both in designing and developing products, and also in their manufacturing. Rapid Prototyping Technologies (RPT) are also a part of these technologies.

This is possible in virtue of the spectacular development of these technologies (see Fig. 1) through the in-

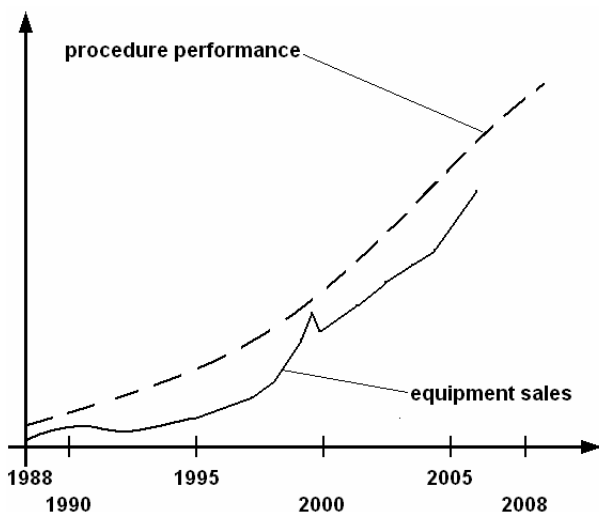


Fig. 1. The development of rapid prototyping technologies [7, 11, 19, and 20].

crease of performances, the combination of various methods and not last, the usage of an extremely vast range of materials, starting with the metallic powders up to the various plastic materials. And that happened in the last two decades, as you may see in Fig. 1.

2. THE USAGE OF RAPID PROTOTYPING TECHNOLOGIES – A POSSIBILITY OF AVOIDING THE ECONOMIC CRISIS

2.1. Generalities

Nowadays, in full world recession, each company is concerned in keeping its owned outlet. But this means a keen competition with the other companies. They have to launch first their new product, or the improved variant of an existing product.

This can be accomplished through the usage of some new methods of developing and manufacturing products, based on Rapid Prototyping, because this way the necessary cycles and costs may be implicitly reduced [1, 2, 5, 8, 10, and 11].

2.2. About Rapid Prototyping Technologies

Rapid Prototyping Technologies are relatively new technologies which appeared two decades ago, more accurate in 1987, when the first RP machine was sold. They have a revolutionary modality of making pieces, which are actually the RP models, namely trough depositing the material in the right place in the necessary quantity, without using any tool, at least in the classic meaning of the word. The making of the model is done *layer by layer*.

The Rapid Prototyping Technologies make the pieces directly, on special machines from their 3D virtual models made with a 3D projecting program, such as AutoCAD, Inventor, CATIA, SolidWorks, SolidEdge, UG-NX, Pro/Engineer, RHINO, I-DEAS, etc. The connection between the computer and the RP machine is the *.stl

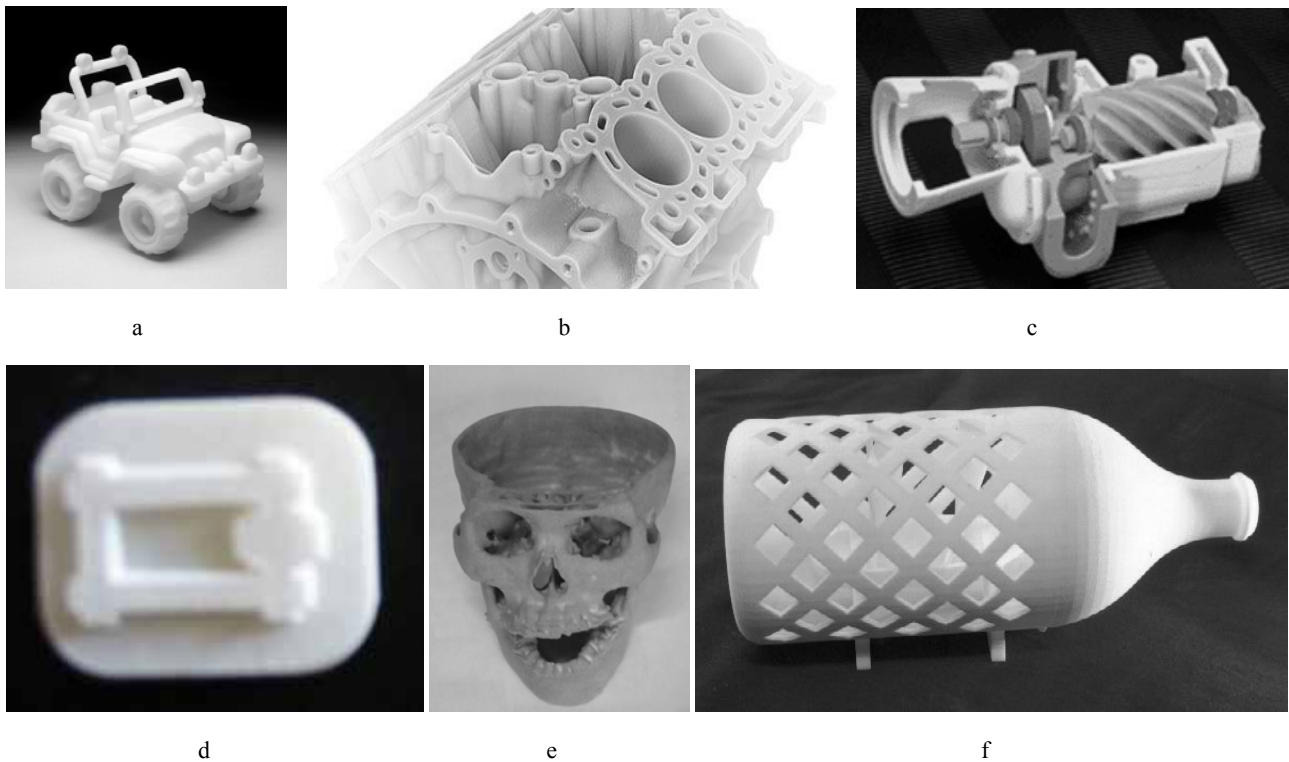


Fig. 2. Examples of various RP usages [4, 17, 18, 19, 20].

file, which is a presentation of the body through triangular facets. This thing leads to an error regarding the presentation of the body.

Usually these technologies range according to two criteria. These are the state of the material used: liquid or solid, and respectively the construction mode: 2D or directly 3D.

In Rapid Prototyping Technologies usually two types of materials are used, a main one for the making of the model itself and another one for making the supports, necessary for pieces with undercuts. Usually the generating of the supports is done automatically by the ordering soft of the RP machine [6, 7, 8, 9, 10, 11, 13, 14, 15, 16].

2.3. Usages of RP technologies

During their two decades of existence, the technologies began to know a very vast area of usage, starting from the industrial usage to the medical usage. Therefore, up-to-date, the most important and also significant applications are:

- a) product's verifications from the viewpoint of ideas of design (see Fig. 2.a);
- functional role (see Fig. 2.b);
- technology;
- mountability (see Fig. 2.c);
- economical requirements;
- b) the usage of Rapid Tooling, like
- models for flexible tools (moulds) manufacturing (see Fig. 2.d);
- models for tools verification and design;
- c) medical usage, like
- the realization of various implants (see Fig. 2.e);
- models for the study of damaged areas;
- models for the realization and adjustment of implants;
- models for the stimulation of surgical interventions;

- d) product visualization (see Fig. 2.f);
- e) appraisal of the products' cost;
- f) manufacturing offers;
- g) market analysis;
- h) small and very small lot manufacturing;
- i) others.

You can also see some examples in Fig. 2.

2.4. Today's economic conditions

We'll talk very short about this theme because the present work doesn't have an economic subject.

We all know that financial, economical crises appear periodically. Today we pass through such a period, and this situation lays a finger on the whole development of society.

This crisis is characterized mainly by the lack of liquidities and this block up the market by payment disability. Therefore the manufacturers who have the necessary funds for valorizing the development of new products and/or succeed to maintain low costs in order to assure a minimal price are favoured.

We have to mention here that much fewer funds for research and development can be granted in these economic conditions. This fact has a negative effect upon the appearance of some possibilities of adjusting costs.

2.5. Rapid Prototyping – boosting survival during the economic crisis

From the facts previously presented you can see that the usage of Rapid Prototyping has good economic results. That is, it allows the diminution of the cycles needed for products development; respectively it can also determine the reduction of costs.

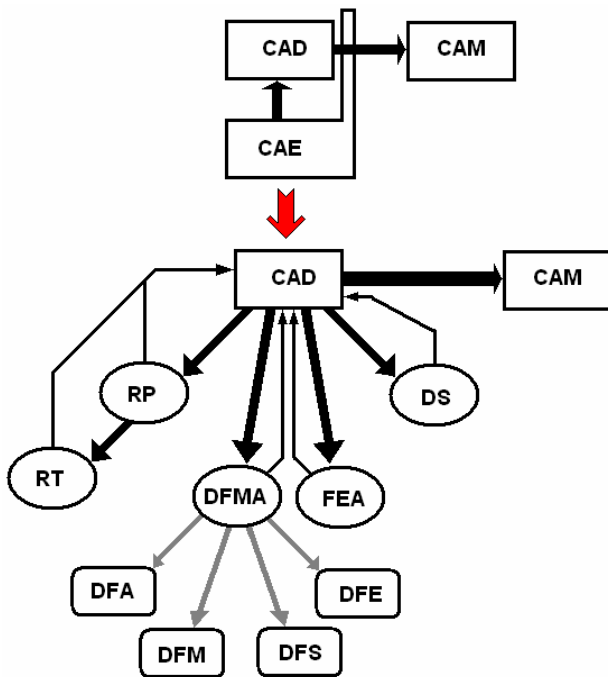


Fig. 3. The liaisons between CAD/CAE/CAM within the Concurrent Engineering [12, 14].

This is possible because these technologies belong to a new product development method, based on the Concurrent Engineering [3]. Most important in this method is the special liaison between the CAD/CAE/CAM techniques, as you may see in Fig. 3. It can be observed that the constitutive elements of CAE techniques have a direct influence upon the effective design, and this assures the possibility of error eradication from the initial phase of development. This way they assure much smaller cycles and costs of development.

They also make possible an extremely easy subsequent development, because the model doesn't have to be resumed from the very beginning. There can be made even families of products. This way of developing products is shown in Fig. 4.

In this case, the visualization of the product through RP is very convenient for the marketing researches that aim at the target group.

As the RP equipments are still rather expensive, not all the producers are able to make investments in such a field, especially in today's economic conditions. But there are also companies that realize output almost exclusively through RP. Their services can be used because they work at an easy rate. This option is also determined by the experience of these companies, experience that guarantees the quality.

Having the necessary logistics, these companies are also specialized lately in developing products. But this can also lead to the appearance of a new producer on the market, finally.

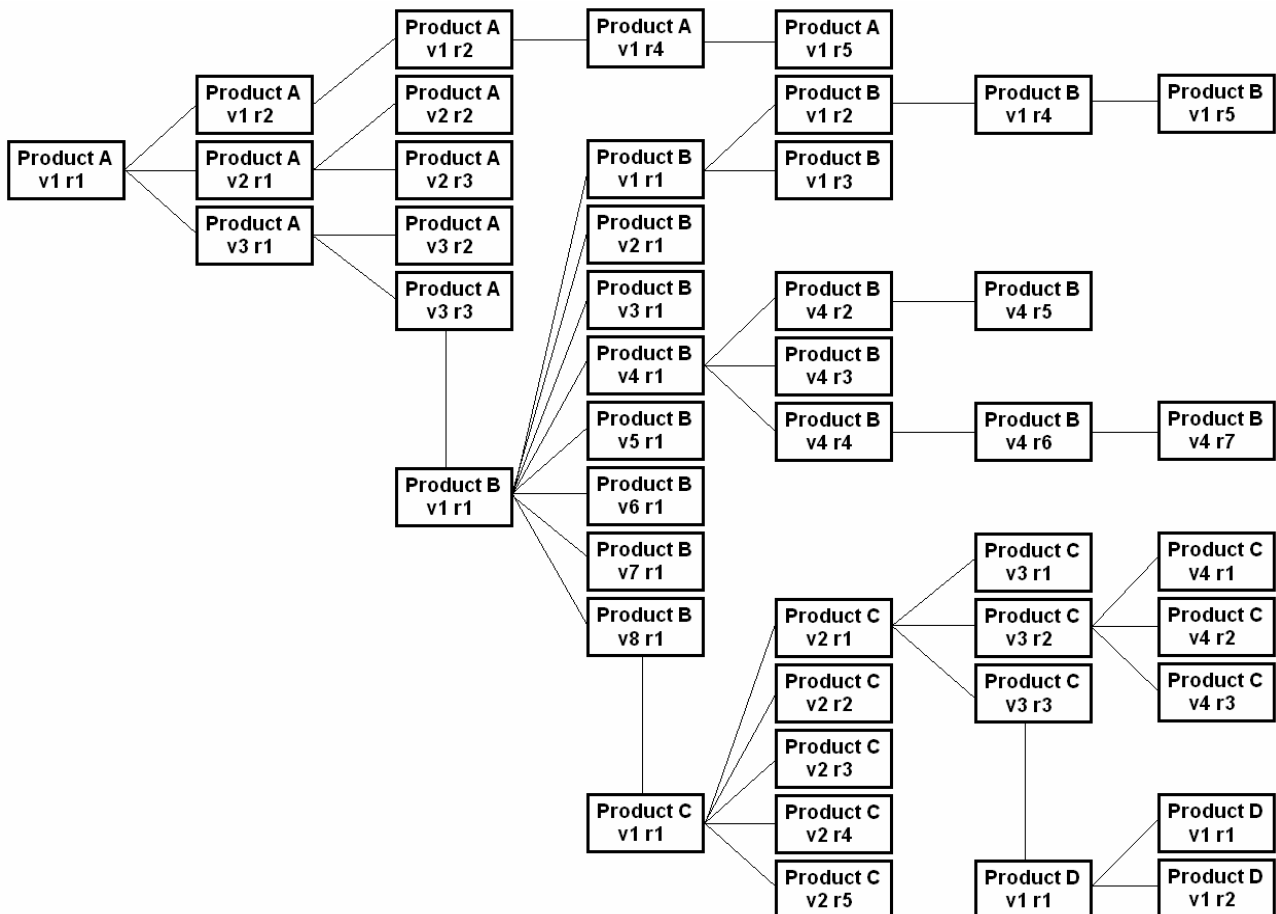


Fig. 4. Development of families of products.

3. CONCLUSIONS

Keeping in view the facts presented in this paper we have to realize that a well-defined and unanimously accepted formula for eliminating or at least reducing the effects of today's global economic conditions doesn't exist. We can only lay down a few broad lines.

One of the broad lines previously mentioned is the introduction of a new method of developing products based on the new RP technologies, because these technologies offer a series of technical and economical advantages, respectively they still have a great affinity for development. But for this development (wanted also for the future) we have to grant adequate funds.

REFERENCES

- [1] Bâlc, N. (2001). *Tehnologii neconvenționale* (Non conventional technologies), Edit. Dacia, ISBN 973-35-1130-7, Cluj-Napoca.
- [2] Berce, P., et al. (2000). *Fabricarea rapidă a prototipurilor* (Rapid Prototyping), Edit. Tehnică, ISBN 973-31-1503-7, Bucharest.
- [3] Cătuneanu, V. (2001). *Ameliorarea calității* (Quality improvement), Edit. CIMER-ES, ISBN 973-99519-1-5, Bucharest.
- [4] Baki-Hari, Z. G. (2001). *The Vacuum Casting - An Interesting and Spectacular Application of Using the RP Models*, Annals of MTeM for 2001 & Proceedings of the 5th MTeM Symposium: "Modern Machines and Technologies", pp. 19-22, ISBN 973-85354-1-7, Technical University of Cluj-Napoca, Romania.
- [5] Baki-Hari, Z. G. (2003). *Hybrid Patterns - Application of Rapid Prototyping Models*, Annals of MTeM for 2003 & Proceedings of the 6th Modern Technologies in Manufacturing, pp. 15 - 18, ISBN 973-656-490-8, Technical University of Cluj-Napoca, Cluj-Napoca, Romania, October 2003.
- [5] Baki-Hari, Z. G., Băcilă, C. G., (2005). *Metallic Materials in Rapid Prototyping*, Annals of MTeM for 2005 & Proceedings of the 7th International Conference Modern Technologies in Manufacturing, Cs. Gyenge (Ed.), pp. 27-30, ISBN 973-9087-83-3, Technical University of Cluj-Napoca, Romania.
- [7] Baki-Hari, Z. G. (2002). *Flexibilis szerszámok gyártása metalizálással* (The production of flexible tools with metal coating), Műszaki Tudományos Füzetek, Fialat Műszakiak Tudományos Ülésszaka VII., Kolozsvár, Cluj-Napoca, March 2002, pp. 41-46, ISBN 973-8231-16-7.
- [8] Baki-Hari, Z. G. (2006). *Gyors prototípusmodellek minőségének javítása* (Quality Improvement of Rapid Prototyping Models), Műszaki Tudományos Füzetek, Fialat Műszakiak Tudományos Ülésszaka XI, Cluj-Napoca, March 2006, pp. 19-22, ISBN 973-8231-50-7.
- [9] Baki-Hari, Z. G. (2007). *Gyors prototípusgyártás az iparban* (Rapid Prototyping in the Industry), Műszaki Tudományos Füzetek, Fialat Műszakiak Tudományos Ülésszaka XII, Cluj-Napoca, March 2007, pp. 11-14, ISBN 973-8231-67-1, ISBN 978-973-8231-2.
- [10] Baki-Hari, Z. G. (2008). *Új tendenciák és lehetőségek a gyors prototípusgyártásban* (New Trends and Facilities in the Rapid Prototyping), Műszaki Tudományos Füzetek, atal Műszakiak Tudományos Ülésszaka XIII, Cluj-Napoca, March 2008, pp. 17-20, ISBN 978-973-8231-75-7.
- [11] Baki-Hari, Z. G., Băcilă, C. G., (2008). *On the Evolution of Rapid Prototyping Technologies*, Proceedings of the International Conference on Manufacturing Systems ICMS 2008, C. Ispas, A. Ghionea, G. Constantin, (Ed.), pp. 267-270, 13th-14th November 2008, Edit. Academiei Române, ISSN 1842-3183.
- [12] Băcilă, C. G., Baki-Hari, Z. G. (2003). *Concurrent Engineering - A New Product Development Strategy*, Proceedings of The 3rd International Conference on the Management of Technological Changes, pp. 347-352, ISBN 960-8475-03-1, Technical University of Crete, Chania, Greece, August 2003, Vol. 1, Venus Publishing House, Chania.
- [13] Băcilă, C. G., Baki-Hari, Z. G. (2004). *Mold Tooling via Rapid Tooling*, Proceedings of the International Conference on Manufacturing Systems ICMS 2004, October 2004, Edit. Academiei Române, pp. 493-496, ISBN 973-27-1102-7, ISSN 0035-4074, Bucharest.
- [14] Băcilă, C. G., Baki-Hari, Z. G. (2006). *The Rapid Tooling in the Product Development*, Proceedings of the International Conference on Manufacturing Systems ICMS 2006, C. Ispas, A. Ghionea, G. Constantin, (Ed.), pp. 433 - 436, University Politehnica of Bucharest, Machines and Production Systems Department, Bucharest, Romania, 26th - 27th October 2006, Editura Academiei Române, ISSN 1842-3183.
- [15] Băcilă, C. G., Baki-Hari, Z. G. (2007). *The Rapid Tooling in the Product Development*, Proceedings of the International Conference on Manufacturing Systems ICMS 2007, C. Ispas, A. Ghionea, G. Constantin, (Ed.), Edit. Academiei Române, pp. 11-14, 22 November 2007, România, ISSN 1842-3183.
- [16] Baki-Hari, Z. G. (2005). *Mold Tooling via Rapid Prototyping*, Annals of the Oradea University, Fascicle of Management and Technological Engineering, CD-ROM Edition, Volum IV (XIV), 2005, Proceedings of „IMT Oradea - 2005”, Annual Session of Scientific Papers with International Participation, May 2005, Oradea, Felix Spa, Edit. Universității din Oradea, ISSN 1583-0691.
- [17] *** <http://www.ada-mould.com/> Accessed: 2009-04-24.
- [18] *** <http://www.derco-mould.com/> Accessed: 2009-05-06.
- [19] *** <http://www.pt.bme.hu/> Accessed: 2009-03-29.
- [20] *** <http://www.prototype.hu/> Accessed: 2009-04-21.

Authors:

Eng, Carmen Gabriela BĂCILĂ, PhD Student, Technical University of Cluj-Napoca, Management and Systems Engineering Department,

E-mail: gabriela_bacila@yahoo.com

Eng, Zoltan-Gabor BAKI-HARI, PhD Student, Transylvanian Museum Society, Technical Section, Cluj-Napoca,

E-mail: bakihari@yahoo.com