A comprehensive business model for Rapid Manufactured products

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A COMPREHENSIVE BUSINESS MODEL FOR RAPID MANUFACTURED PRODUCTS

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Abstract: *The use of Rapid Manufacturing (RM) in a mass scale depends on a sustainable business model. The context of RM functionality can be segmented into two scenarios: Scenario 1 being the potential of RM to manufacture products with complex design. Scenario 2 presents that, once identified, if a product is viable to be produced using RM technologies, then how would the supply and demand paradigm work? This paper tries to answer these questions through the means of an e-business platform for RM products. The principle function of the platform is to electronically settle the supply and demand over a virtual trading system.*
Key Words: *Rapid Manufacturing, Supply Chain, Batch Size, E-Business, Reverse Auction*

1. INTRODUCTION

Rapid Manufacturing (RM) is still thought by some people as a mere extension of Rapid Prototyping (RP). In practice, the major difference between the two is in the supply chain where RM products are intended for end use, not just as prototypes. However, a number of companies are undoubtedly performing RM with RP methods (Hopkinson *et al*., 2006). The use of these technologies for the manufacture of end use products in terms of speed, cost and quality, which is acceptable by the general consumer, is still not in existence today (Hopkinson *et al*., 2006) and thus, it can be argued that a fully functional supply chain for the RM industry is yet to be realised. This paper addresses this problem in two scenarios; in Scenario 1, it investigates the possible application of RM in the spare parts industry; and in Scenario 2, it analyses the possibility of an e-business model through which the supply and demand paradigm for RM products could function.

1.1 Related Research

There has been previous work published on RM implementation strategies, with Table 1 listing the factors involved in such an RM implementation strategy (Reeves, 2007). Additionally, there has been significant work on cost estimation models for RM technologies, that can provide guidelines regarding cost estimates of RM implementation (Ruffo *et al*., 2006).

Identifying business benefit	Material selection
Process selection	Process constraints
Process cost	Cost benefit

Table 1. RM implementation factors

1.2 Research Methodologies

In order to investigate Scenario 1, the authors have undertaken a series of interviews with appropriate businesses that includes: motorcycle spare parts manufacturers, aerospace supply chain manufacturing businesses, designers and RM consultants. The second part of this research, Scenario 2, involves a feasibility study on the prospect of an e-business model which can settle the supply and demand of RM products electronically.

2. SCENARIO 1

The use of RM could possibly solve some long standing supply chain problems. According to the Pareto rule, 20% of items make up 80% of sales, whereas 80% of items are not in high demand. These are parts where inventory holding logistical costs are high in relation to production costs (Walter *et al*., 2004). The expense of repairable spares for aircraft engines and avionics contributes greatly to the financial outlay of airline operators. In the course of this research, it has been identified that it is more expensive to produce spare parts with complex geometry. These products which are high value and low volume are ideal candidates for RM production, provided there is appropriate certification (e.g. in the case of aerospace components). Another potential user of RM technologies is the automotive industry including suppliers of classic motorcycle spares (Hasan & Rennie, 2008). There is definite potential that RM could be used to manufacture some of these spare parts due to the geometrical complexity and exclusive nature of the demand. A situation where parts could be manufactured on demand is more ideal; that is implementing the concepts of lean and just-in-time manufacturing.

2.1 Batch Size

RM could further provide a solution to the batch size problem. It is understood from this research that spare parts manufacturers supplying to the aerospace industry, are often approached with orders for repairable spares comprising very small batch sizes; this could even be down to a batch size of one. Currently, the manufacturers are unable to comply with such orders due to the higher break-even batch size of conventional technologies. However, RM can be used to manufacture such products since it is cost effective for products with small batch sizes compared to producing them using, for example, high speed machining techniques.

3. SCENARIO 2

Once identified, if a product is viable to be manufactured using RM technologies, then the subsequent question that arises is "*How would the supply and demand paradigm work*?" This paper argues that an e-business platform could potentially provide an alternative to the RM

industry, in terms of supply chain functionality. E-business or electronic commerce, can be defined as any electronic communication that facilitates the exchange of goods, services or other assets between suppliers and buyers (Stein & Hawking, 2002).

3.1 Reverse auction and e-catalogue

This paper proposes the concept of reverse auction as a method for settling the demand of RM products online. At the heart of any auction model is the concept of personal price elasticity. That is, customers will determine the price depending upon the price/value trade-off (Friedman & Barbara, 1999). A reverse auction can be defined as a process where buyers set up an auction to receive bids from suppliers. Suppliers bid down the price for fulfilling that order (Wyld, 2000). The e-catalogue is another proposed method to buy and sell RM products through the e-business platform. Online catalogues, as a means of selling products, are firmly established in the market (Sweets, AEC info, Barbour Index, etc.) (Amor & Kloep, 2003).

3.2 Potential services:

The feasibility study conducted has identified five potential services that the e-business platform should offer and these are described in Table 2.

Services	Description
Sourcing or discovery	Giving buyers an easy access to a pool of suppliers, a process that can save time and offer buyers better prices due to the increase in competition amongst suppliers.
Demand identification	Suppliers can identify customers and their demands in a free market economy.
Content	Through the e-catalogue, that could contain a vast volume of products, the buyer can acquire the required product.
Transaction	The actual exchange of procurement information, such as purchase orders, between the buyer and supplier.
Promotion	Advertisement for suppliers through the e-catalogue.

Table 2. Potential services to be provided by the e-business platform

4. CONCLUSION

The discussions that have been put forward in this paper are concepts resulting from current research on formulating supply chain and implementation strategies for RM technologies. It is understood from this research that there is a role for RM technologies not just in major aerospace and automotive companies but also with spare parts manufacturers supplying to the aerospace and other industries. It is expected that the potential services of the e-business model, as described in this paper, could provide an alternative way for the supply and demand of RM products to function. However, the biggest impact it could have is perhaps to increase the existing market size for RM products; that is impacting Scenario 1, increase the potential use of RM.

5. FURTHER RESEARCH

It is understood that certification could be an issue in the widespread uptake of RM usage in the aerospace industry. A sample survey amongst aerospace and other spare parts manufacturers is currently underway to clarify this critical issue and generalise the arguments put forward in this paper.

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