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Analysis of the impact of technological changes in the plasma derivative industry on its two main products, normal serum albumin and antihemophilic factor in the United States

Grossman, Jerrold B., D.P.S.

Pace University, 1989

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ANALYSIS OF THE IMPACT OF TECHNOLOGICAL CHANGES IN THE PLASMA DERIVATIVE INDUSTRY ON ITS TWO MAIN PRODUCTS, NORMAL SERUM ALBUMIN AND ANTIHEMOPHILIC FACTOR IN THE UNITED STATES

A dissertation submitted to the faculty of
Pace University Lubin Graduate School of Business
in partial fulfillment of
the requirements for the degree of
Doctor of Professional Studies in Business Management

Jerrold B. Grossman
1989

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Abstract

Analysis Of The Impact Of Technological Changes In The Plasma Derivative Industry On Its Two Main Products Normal Serum Albumin And Antihemophilic Factor In The United States

The purpose of this study was to investigate and analyze the likely impact of technological changes occurring within the United States plasma derivative industry affecting its two main products, normal serum albumin and antihemophilic factor.

The ability to produce human albumin and antihemophilic factor by genetic engineering is nearly a reality. The industry has also been traumatized by the realization that viruses can be transmitted through the transfusion of blood and blood products. These factors will have an imminent impact on the industry.

Though changes are taking place, there does not appear to be any consensus between the various sectors of the industry as to which changes are approaching implementation. There does not appear to be an industry wide consensus as to how these changes will affect availability, production, safety and pricing of these products.

After a review of the literature, a determination was made of the changes that are likely to take place in the near future. A questionnaire was developed with input from medical clinicians and executives of the blood and plasma derivative industry. The questionnaire was mailed to the survey population to enable comparative information to be obtained from various industry groups, including manufacturers, distributors, researchers and

end users of the products.

The information from the questionnaire was used to determine how the industry perceives the technological changes affecting production and use of serum albumin and antihemophilic factor. It was also used to determine if there is a consensus or a great divergence of perceptions among the various sectors comprising the plasma derivative industry. An analysis of the factors which will impact the manufacture and marketing of the industry's two main products was also was conducted. The responses indicated both, that price is the most important factor for serum albumin while virus safety is the most important factor for antihemophilic factor.

The study also concluded there is a perceived need for a genetically engineered substitute for antihemophilic factor and that such a product will be available in the near future.

Fear of viral transmission by plasma derived antihemophilic factor provides the major impetus toward genetically produced product. It was clear that the respondents perceived that higher prices for antihemophilic factor will be paid if there are improvements in technology, packaging, safety and distribution.

Fear of transmission transmitted infection does not enter into consideration of a genetic substitute for human albumin and there was no unified perception that a genetically prepared albumin product is needed. Price was the single most important issue affecting this product. Though there was a statistically significant number of respondents who would be willing to pay

higher prices for improved technical services, improved distribution or improved packaging but in all instances the majority of respondents did not agree that improvements in these areas would be worth having to pay increased prices.

The industry respondents did not view serum albumin and antihemophilic factor as products that could be treated similarly even though they are derived from the same source material, human plasma, and are both used in treating serious medical disorders.

The industry will have to change by developing improved antihemophilic products, perhaps by developing joint ventures with genetic research companies, and as well as by meeting the safety needs of patients more effectively. To continue as a viable and profitable industry the manufacturers will have to concentrate on producing additional products from human plasma.

Recommendations for future study include analyses of the impact of the non-profit sector on the plasma derivative industry; the impact of new biological products, currently unavailable but under development, might have on the plasma derivative industry; and an analysis of whether it would be effective for the manufacturers of human derived products to continue to produce additional new plasma derivative products from human plasma.

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George, who passed away before this work could be completed. It was through his ability and talent to motivate, encourage and discuss that I truly learned the art and discipline of business. It was his teaching that provided me with the skill and motivation to complete this work. This dissertation is dedicated to the memory of my dad.

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OVERVIEW

Statement Of The Purpose

The purpose of this study is to investigate and analyze the impact of technological changes in the plasma derivative industry on its two main products, serum albumin and antihemophilic factor, within the United States.

It is hypothesized that the various segments of the industry have differing perceptions of what changes are actually taking place, how soon they will occur, and whether they will significantly affect the market for serum albumin and antihemophilic factor.

"Although it is common knowledge that major organizations can become obsolete when technological breakthroughs occur, history shows that most organizations do little to prepare for such eventualities." (Smith 1983, 53).

In view of the volatile nature of the impending changes occurring in the industry and in order to plan for effects of technological developments, the industry must be aware of which changes are most likely to occur. It must also be cognizant of how these changes are likely to affect different constituencies within the industry as well as in the general marketplace.

Specific Problems

The first problem is to analyze the industry and its current status.

The second problem is to determine how the industry perceives the likely technological changes which will affect its two major products, serum albumin and antihemophilic factor.

The third problem is to analyze the factors which will impact the manufacture and marketing of the industry's two main products, serum albumin and antihemophilic factor.

Delimitations

This study focuses on the two major products produced by the plasma derivative industry, serum albumin and antihemophilic factor. The research concentrates on products which are currently produced by manufacturers in the United States licensed by the Food and Drug Administration and substitutes for these products which are currently under development. Although the market for albumin and antihemophilic factor is a global one the research was limited to data from within the United States due to the difficulty in obtaining reliable manufacturing, marketing, distribution and user data from sources outside the country.

Information from all licensed manufacturers was included in the study as well as all companies known to have been working on

genetic formulations for the products under consideration. The study was limited to manufacturers, researchers, distributors, and representatives of the hospitals who are the end users of the products under consideration.

Published financial information was obtained from secondary sources since the current manufacturers are either subsidiaries of major pharmaceutical companies which do not provide detailed information on their subsidiaries or are privately owned and do not provide information on costs of manufacture or sales. The information and data used were obtained from a questionnaire mailed out in September 1986. All completed questionnaires returned by December 31, 1986 were included in the survey.

The Need For The Study And Hypotheses

The production of plasma derived products that are safe from the transmission of AIDS, hepatitis and other viruses, in adequate supply, at prices that are economically affordable, are major assignments still before the leaders of the blood and plasma derivative industry. (Allen 1987, 48)

The plasma derivative industry is changing because technological developments have created the ability to produce its two main products by alternative methods. The ability to genetically reproduce human albumin and antihemophilic factor

proteins is nearly a reality. At the same time, the transmission of viruses, particularly the AIDS virus, through blood and blood product transfusion has traumatized the industry. There is a need to address these factors that are changing which will have imminent impact on the industry.

Hypothesis # 1

It is hypothesized that various segments of the plasma derivative industry have differing perceptions of what changes are actually taking place within the industry.

Although changes are taking place, there does not appear to be any consensus within the various industry sectors regarding which changes are most rapidly approaching implementation or how these changes will affect the products. The impact of these pending changes are not viewed similarly by all industry participants.

These two medical products, serum albumin and antihemophilic factor, are of vital life saving importance and they deserve major consideration. The technological changes in the methods of production of these products may have an effect on almost all patients undergoing surgery as well as on the lives of hemophiliacs who require antihemophilic factor to prevent life-threatening bleeding episodes.

The new technology that is being developed could make the current methodology for manufacturing plasma derivative products obsolete in a short period of time. The need to eliminate or

minimize transmission of viruses by blood products has also placed substantial strains on the financial and manufacturing resources of the current producers and has made the potential for creating a recombinant product, appear to some, to be the only answer.

Piet Hagen, author and editor of the Dutch Hemophilia Journal and an expert on blood supply systems and policies, wrote in 1982 in Blood: Gift or Merchandise;

> The further development of biotechnology in general and DNA recombinant research in particular, influence many aspects of blood transfusion. If it becomes possible, for instance, to produce plasma proteins by genetic engineering, there will no longer be any shortage of antihemophilic factor, which is one of the scarcest and most expensive blood products at the moment. Such developments would change the scene dramatically. (Hagen 1982, 22)

Hypothesis # 2

It is hypothesized that various segments of the plasma derivative industry have differing perceptions of how the other sectors of the industry perceive the likely technological changes affecting its two major products, serum albumin and antihemophilic factor.

Events in the field of plasma derivative technology are occurring very rapidly. In December 1983, one company announced it had cloned part of the gene for factor VIII. In April 1984, Genentech announced it had succeeded in cloning the entire factor VIII gene. (Cutter Biological 1984)

The Office of Technology Assessment report points out that; "...technologies for producing both albumin and factor VIII, the foundations of the plasma derivatives industry, are rapidly being developed." (U.S. Office of Technology Assessment 1985, 20) This implies that the research and development needed to produce albumin and factor VIII are almost completed and shortly there could be human protein products produced by artificial means.

Dr. William V. Miller, Chairman of the Food and Drug Administration Blood and Blood Products Advisory Committee in 1984 made a presentation at which he noted some significant industry developments.

> There are now two clones of Factor VIII, both of which remarkably correct the in vitro deficient plasma. If we have two clones which correct deficient plasma it would seem to me to be a matter of time until those clones are available in amounts significant enough where we are dealing with in vitro and, ultimately, with clinical trials of that material." (Miller 1984, 14)

The major portion of revenues received in 1986 by companies that produced plasma derivative products was from sales of albumin and antihemophilic factor (factor VIII). (Reasor 1987, III) It is estimated that sales of albumin and antihemophilic factor in the United States, in 1987, amounted to approximately $350 million. (Laughter 1988)

The introduction, marketing, and sales of a competitive, profitable large scale process is difficult, costly and time consuming. In many instances the production technology is not available. Research and development and clinical trials can go

on for many years, until the United States Food and Drug Administration grants approval for marketing and sales of the product. "...many, outside the venture capital community, perceive some of the biotechnology claims, statements, and time tables as extravagant and unobtainable." Total cost to one company could grow to $50 million before a product is ready for market. (Reasor 1987, 56)

Technology will have an impact on the cost of the products and the methods of production within the plasma derivative industry. "Gene-splicing specialty companies know they must prove safety and efficacy and improve production systems before recombinant factor VIII makes its way to market. When it comes, though, the billion dollar a year [world wide] plasma fractionation industry will undergo some profound changes." (Klausner 1985, 119) This statement appeared in an article, authored by Arthur Klausner, published in Bio/Technology in 1985, quoting and referencing information about the plasma derivative industry supplied to him by many leaders and experts in the field.

Hypothesis # 3

It is hypothesized that the industry perceives serum albumin and antihemophilic factor to have different factors which will impact the manufacturing and marketing of these products.

The supply of both these products could be affected by changes in manufacturing technologies, patient requirements, or a

multitude of other possibilities. Any change in the amount of serum albumin or antihemophilic factor that is required could rearrange the participants involved in the manufacturing and sales of these products.

The price and supply of these products are some, but not the only important factors. As significant, or possibly more important, is the safety of the products required by patients to provide life sustaining treatment. The appearance of safety related problems which cause unplanned and unforecastable market changes can play havoc with any manufacturer's ability to project market growth in a systematic manner.

Gabriel Schmergel, President of Genetics Institute stated, in reference to recombinant factor VIII, "we think the most likely scenario is that once the recombinant factor VIII is available, hemophiliacs and the doctors who treat them will refuse to accept the current product because of the risk". (Klausner 1985, 121)

Disagreement with this view was clearly enunciated stressed by Alan Brownstein, Executive Director of the National Hemophilia Foundation. He stated, "that by the time a recombinant factor VIII enters the market, manufacturers may have perfected heat treatment or other methods to eliminate or minimize the danger of disease transmission." (Klausner 1985, 121) If Brownstein's view is correct then there will be minimal need for a genetically engineered product unless it is cheaper or has other advantages over the natural protein products.