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Case Studies of Innovations

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CASE 1: PAST INNOVATION: INVACARE CORP.'S POWER ROLLS® IV

Description

The Power Rolls® IV, made by Invacare, was chosen as the subject of this case study because of its demonstrated improvement in performance, its capture of a significant market share, and Invacare's cooperation.¹ One model is shown in figure 1.

The Power Rolls® IV introduced dynamic braking, regenerative braking, and self-correcting steering. Dynamic braking is the ability to maintain a constant speed (not accelerate) on a downgrade. Regenerative braking means that the batteries are wired to recharge themselves during braking. The self-correcting steering keeps the wheelchair from veering to one side when it is on an uneven surface. This wheelchair is also lighter than many similar wheelchairs.

Development

An ambitious new group of investors and a new president took control of Invacare in 1979. They first identified the need for the Power Rolls® IV in January 1980, following extensive market research. This research sought to answer the questions:

- What is currently available in wheelchairs?
- What do users want?
- What end product will satisfy these desires?

Invacare's study took about 4 months to complete. During that time Invacare talked with therapists in rehabilitation centers and hospitals and with dealers and users.

¹Information for these case studies, was obtained at the Invacare Corp. in Elyria, OH, on Aug. 17, 1983. The authors visited two manufacturing plant sites, headquarters offices, and the testing unit, and interviewed a number of company officials including the president, vice presidents in charge of engineering and marketing, product test technicians, and others.

The marketing and engineering departments worked together to translate the comments and suggestions they received into technical concepts for an end product. For example, a user's comment that, "I don't want my chair to run away from me. Why does it gain so much speed going downhill?" was translated into the concept of dynamic braking. The technology developed had to be simple enough for dealers to service, and safe enough to convince therapists of its benefits for users.

While conducting its market survey, Invacare hired a market research firm to study wheelchair design. Talking to many of the same types of people, this research firm investigated what people would like a wheelchair to look like and presented a series of intermediate drawings and a final composite to Invacare. This design had to be modified to fit the limitations of the mechanics. For instance, the spacing of the wheels had to allow room for the batteries.

It took approximately 9 months from the time the idea was introduced to the time the first prototype was made. Several different prototypes were tested over the following 6 months for mechanical and electronic problems. Testing included subjecting the prototypes to extremes in temperature, testing battery life and battery heating during use, and using the prototypes in the field to make sure they performed appropriately.

Commercial Introduction

The product was first introduced into commercial use through demonstrations in July 1981, with the first dealer delivery being made in September. The marketing strategy was developed along with the wheelchair. It was based on answers to the questions:

- What does the competition have?

Figure 1.—The Power Rolls® IV “Maxtra” by Invacare



SOURCE: Invacare Corp

- How do they sell it?
- What success and failure are they having?
- How can we improve upon our competitors' problems?
- How can we explain and sell technical innovations such as “dynamic braking?”

When the product was ready in final form, Invacare's sales force attended demonstrations and were trained in the product's functions and use. The sales force was then authorized to begin to tell dealers about the product. Although the Power Rolls® IV was not yet for sale, dealers were

made aware that a new, substantially different power chair would be available shortly. They were discouraged from making large orders for other chairs until they saw what the new one had to offer. When the chair was finally made available, a promotional price was offered.

Diffusion of the Innovation

By the end of 1983 (2½ years since its introduction), the chair had captured 25 to 30 percent of the power wheelchair market.

Invacare credits its success in marketing the Power Rolls IV to its sales force. It was responsible for convincing dealers and therapists that the product is worth selling and prescribing. Invacare also conducted training sessions for therapists. If the therapist was part of a large rehabilitation center, demonstration models were made available for use. Dealers were educated in the maintenance of the product. The product was priced to dealers to allow them a reasonable markup within their reimbursement allowance.

The two largest impediments to the innovation were price and product liability. The price had to be within the range the market would bear, given the prices of existing power wheelchairs and reimbursement constraints. Product liability was a crucial factor in the development of the Power Rolls IV because the electronics were a new design. Product liability has not been a great concern in the revisions since then, as the product has now been proven.

Diffusion of the innovation to other manufacturers has taken several years. Everest & Jennings is said to be working on a similar product. They

have marketed a product whose performance falls between those wheelchairs previously available and the Power Rolls® IV.

Discussion

The introduction of the Power Rolls® IV represents a combination of “technological push” and “demand pull.” “Technological push” is a theory of innovation that says innovations are a product of improved technology’s making innovation possible. Without the technology of dynamic braking and self-correcting steering (a capability of the electronic controller), the innovation would not have been possible. However, had it not been for users wanting a product with those features, i.e., “demand pull,” the chair would not have been made (23).

The speed of the diffusion of the Power Rolls IV may have been enhanced by the demand pull, but diffusion to other manufacturers has been time-consuming. The two main reasons for the lag are: First, the competitor must watch the sales of the new product to determine if it is successful and worth imitating. Second, once that decision is made, the competitor must develop and market the product. This process can take as much time as the original development of the innovation.

Diffusion to users can also be aided by directly approaching the users through, for example, advertising in user journals, such as *Paraplegia News* or *Accent on Living*. Users may also be reached in rehabilitation centers. The same training sessions that are conducted for the therapists may be open to the users.

CASE 2: POTENTIAL INNOVATION: CURB-CLIMBING WHEELCHAIR

Description of Innovation

Users of wheelchairs face obstacles to daily living that most people never think of, such as sidewalk curbs and other uneven surfaces. An innovation that has yet to be introduced to this country, although it is available elsewhere, is a curb-climbing wheelchair. It can also climb hills and navigate on ice and snow. A German model has trac-

tor tread, much like that used on a tank. A Swedish model, available for 15 years, has large wheels and a large motor.

Obstacles

Why, if the technology exists, has this type of wheelchair not been introduced in the United States? Although some U.S. manufacturers are,

in fact, working on just such a chair, there is still a considerable lag time. Four reasons for this delay were identified (23).

First and most significant is product liability. The German model can sit on a steep stairway, but many people would have a difficult time maintaining balance at such a steep angle. The addition of a seat belt and shoulder strap is no guarantee of safety; people can forget to use them, and seat belts can break. Regardless of whether an accident is caused by a neglectful user or product malfunction, the manufacturer is at risk.

The second reason is funding. The R&D efforts to produce a curb-climbing wheelchair as a safe product are very costly and would need to be reflected in the price to the purchaser, estimated at \$10,000 (23). It is doubtful that many third-party payers would be willing to pay for such an item, or that many users would be able to afford it themselves. Even if third-party coverage was obtained, a copayment of 20 percent or more (depending on allowable charge limitations) under private insurance or Medicare would be a significant obstacle. The market is too small and reimbursement too limited to make this innovation a priority for any company. Apparently, this has not been a problem for European manufacturers, as the Government and private insurance reimbursements tend to be more complete.

The third reason relates to user preference. U.S. manufacturers believe that American consumers like streamlined devices; the curb-climbing chair,

as it is currently designed, is very heavy and bulky. Manufacturers believe that even if users have the desire and money to purchase such a wheelchair, they will be displeased with the design.

The final reason has to do with the technology transfer between countries. Although U.S. manufacturers could design their own models of a curb-climbing wheelchair, it is less costly to obtain the technology from companies already making the product. These companies are, in principle, willing to license their knowledge to U.S. manufacturers; but the U.S. manufacturer finds the licensing negotiations difficult, feeling that the foreign companies have an exaggerated conception of the size and wealth of the U.S. market. The U.S. companies have so far been unable to meet the demands of the foreign companies and are not likely to invest the money needed to develop the product on their own.

Foreign manufacturers have not yet exported these chairs directly to the United States and are unlikely to do so for almost the same reasons that innovations are not being made in this country. The cost of manufacturing is high and is increased even further by import taxes. Under U.S. reimbursement systems, the importing manufacturers would face the same reimbursement difficulties as domestic manufacturers. Last, European manufacturers, who have sufficiently valuable assets and reputations, are subject to the same product liability risks as U.S. manufacturers.