Business Strategy for Nordt Technologies

The Fall-Line

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Product Description

Nordt Technologies (NT) is an innovative R&D software tool for designing skis. Dr. Alison Nordt developed the technology as part of her dissertation with the Aeronautics and Astronautics department at Stanford University. Currently, R&D in the ski industry is conducted by trial and error. Nordt Technologies reduces the need for trials and provides information that is not currently available to designers. The software consists of two components: SKI-MECH and SKI-TURN:

- SKI-MECH takes the material composition and geometry of the design and computes the physical characteristics of the ski. The information provided by SKI-MECH is currently gathered by the expensive and time-consuming process of building and then testing prototypes;

- SKI-TURN takes the output from SKI-MECH and computes the performance characteristics of the ski. Currently, these performance characteristics are not rigorously predicted (or even determined after construction), but are subjectively estimated by test skiers using the prototypes.

Project Objective

Our objective is to develop NT's strategy for its ski design software. We focused on formulating and assessing NT's opportunities. The remainder of this report will address the following issues:

I. Defining the scope of the project;
II. Developing the alternatives for NT;
III. Pricing the product;
IV. Identifying the sales strategy;
V. Providing recommendations.

I. Defining the Scope

To frame NT's problem, we examine the industry to understand how NT should best position itself. We conclude from our extensive discussion with Dr. Nordt that she is looking for a reasonable expected payoff within the next three years. Based on our industry analysis, NT's best option is to sell and/or license the software directly to industry. The opportunities, and their respective tradeoffs, available to Dr. Nordt are summarized in Table 1. Further discussion will follow this section.

Table 2: Summary of NT's business opportunities

Opportunity	***Pros***	***Cons***
A. Enter the ski-manufacturing business	· Maintain exclusive control of software technology · Experience gained in ski-manufacturing could be applied to improving design technology	· Entry barrier: Low profit margins of 4% · Rivalry determinants: − Little industry growth − Production overcapacity exists. · High capital requirements · Requires long-term commitment · High uncertainty
B. Enter as a ski design consultant	· Low capital requirement · Reduced development costs of software, e.g., no need to develop GUI · Can maintain exclusive control of software technology	· Requires extensive industry contacts · Long commitment needed for sufficient return · High uncertainty · Opportunity cost of invested time
C. Sell/license the software directly to industry	· Low to moderate capital requirement · Low time commitment	· Software needs to be ported to C/C++ · Must develop a user-friendly interface

Each of the opportunities is discussed in turn.

A. Enter the ski-manufacturing business

While NT could enter the ski-manufacturing business and exploit the technical advantages of its product, significant entry barriers exist:

- **Profits in the ski industry are low.** Even the top tier companies make little profit:
  - K2 has a 4% average profit margin between 1994 and 1998 (see Appendix 1);
  - Rossignol has 4% average profit margin between 1996 and 1999 (see Appendix 2);

- **Little industry growth**. The number of alpine skiers appears to be constant (see Table 3). The appearance of other substitute products (e.g., snowboards) may be attracting any new customers that might be joining the market;

Table 2: Alpine skier participation in the United States.

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
(000's)	9,736	10,252	12,389	11,034	11,354	10,427	10,782	10,495	10,620	9,281	10,466

Source: *1996 NSGA Sports Participation Study*

- **Selling costs are high:** While the cost of manufacturing may not be high (see
- Table **4**), the selling costs are. This makes entry to the industry challenging given the low profits.

Table 4: Selling expense as a percentage of net sales for K2 (see Appendix 1).

1998	1997	1996	1995	1994	Average
15%	14%	13%	12%	12%	13.2%

Source: *Fall Line analysis, 10-K*

B. Enter as ski design consultant

There are some advantages to this option. The low capital requirement and reduced development costs of the software, e.g., no extensive GUI development, allow easy entry with minimal financial risk. Furthermore, NT can maintain exclusive control of the software technology so that piracy and loss of future revenue are minimized. However, there are also significant limitations. Extensive industry contacts are necessary to enter the consulting practice, and the potential revenue is highly uncertain. For this option to be worthwhile, a long-term commitment from Dr. Nordt is necessary. The commitment is likely to extend beyond our three-year timeframe.

C. Sell and/or license the software directly to industry

Selling and/or licensing the software is best suited for NT because of the short-term commitment. While a moderate initial investment is needed to develop an end-product for distribution (e.g., port the existing code into C/C++ and develop a user-friendly interface), NT will expect the highest expected return given the timeframe.

Decision Hierarchy

A decision hierarchy is a useful tool for limiting the scope of a project. The hierarchy considers the entire set of decisions that must be made in a project and selects those for which decision analysis tools will be most useful (refer to Figure 1). Without such a tool to limit the scope, there would be far too many decisions to examine in depth.

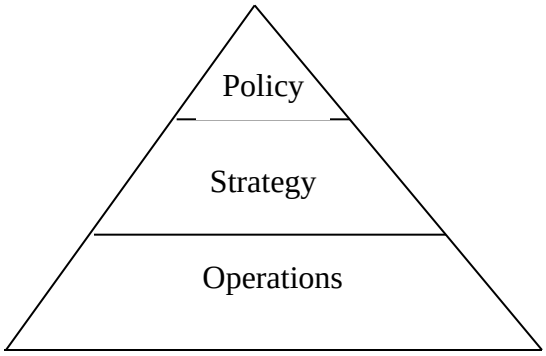


Figure 1: The decision pyramid

The first level of decisions is the Policy level. The Policy level decisions those that are assumed to be fixed. There are countless policy level decisions, depending on the scope with which we approach the problem, but we will discuss only the two that are most relevant to this project:

1. NT should not enter the ski industry as a manufacturer;
2. NT's existing software should be ported to C/C++.

1. NT should not enter the ski industry as a manufacturer:
See Section A above for a discussion of the unattractiveness of the ski-manufacturing business.

2. NT's existing software should be ported to C/C++:
The software is currently written in Matlab, a language that allows quick development of mathematical algorithms, but has several drawbacks for commercial distribution. First, code written in Matlab runs fairly slowly because Matlab is an interpreted, rather than compiled, language. A full analysis of one ski using the NT software currently takes 3-4 days of computing time on a fairly fast machine. While this could be reduced somewhat through parallel processing on multiple machines, the time reduction would be limited by some inherently serial processes and would become expensive. We feel that the software would be more valuable if its running time could be reduced. Porting the code to C/C++ is estimated to yield a ten-fold speed increase. Second, the interpreted Matlab code is very difficult to hide from users, making it quite simple to copy and modify the program. An executable C/C++ file would ensure that the underlying source code remain proprietary to NT.

The second level of decisions is the Strategy level. Strategy level decisions will be explored in depth using decision analysis/options tools. The strategy level decisions for this project are:

1. Sales strategy for each year, including pricing;
2. Strategy for handling the Consultant;
3. Deployment of a "Pilot Program" to test the market.

Strategy decisions 1 through 3 are discussed in detail in Section IV.

The final set of decisions are at the Operation level. Operational decisions will not be decided at this point, but will be left as future decisions. This allows us to focus on "big-picture" issues at the moment, letting details go until later. As with Policy level decisions, there are infinitely many Operational decisions. We will describe some important ones that have been raised:

1. Method for "branding" skis;
2. Upgrades and/or future versions of software;
3. Pricing strategy for non-manufacturers;
4. Software interface.

1. "Branding" method:
It may be desirable to "brand" the use of NT software in the design of skis. This could include the placement of a NT logo on the skis, perhaps in the form of a sticker. It seems unlikely that this would a permanent part of the ski's cosmetics. This would give clear evidence to the success of the software, which could provide leverage in future year's sales negotiations. There is also the possibility that customers would begin to look for the NT brand, adding significant value to manufacturers who use the software, and again creating leverage for NT in the future.

2. Upgrades and/or future versions of software:
NT has not expressed interest in expanding the current capabilities of the software, but this may become attractive in the future as demand builds for future versions.

3. Pricing strategy for non-manufacturers:
We have recently learned that several universities are interested in the software. Sales strategies for these and other non-ski manufacturer customers are unlikely to have a large impact on NT's total profit. Sales to very small ski companies could also fall in this category, as they are likely to have significantly different cost and benefits relating to the software.

4. Software interface:
NT is considering several alternatives, including a Web-based interface and a PC-based interface. This decision has been postponed, as it is unlikely to significantly affect our other recommendations.

II. Developing the alternatives

To determine how NT may best position itself in the ski industry, the analysis focuses on:

- The pilot program;
- Licensing vs. outright sale;
- Exclusive vs. multiple (license/sale);
- Sale to consulting firm.

These alternatives will be further discussed in Section IV: Sales Strategy.

III. Pricing the Product

An important decision for NT is how to price its software. This is a difficult question to answer, but we use bounding techniques to estimate the software's value. First, the lowest price possible must be NT's marginal cost of selling the software. A reasonable asking price is the expected profit increase to a manufacturer from the use of the software. We have a great deal of uncertainty regarding this value, as the value is derived from many aspects of the software and is likely to be very company-specific. An upper bound on value is the cost of replicating NT's software, either internally or through outsourcing. This value is likely to be fairly stable across companies and easier to estimate. We will show that it is very likely that the added value to a manufacturer is higher than the replication cost. If this is true, it makes sense to set the price of the software at the replication cost. The final selling price may be lower than this asking price, but it is certainly a good starting point from which to begin negotiations.

Replication Cost

The cost of reproducing NT's work from scratch would be quite high, as it was created as part of a Ph.D. dissertation over the course of four years in a well-funded, sophisticated laboratory at Stanford University. However, because all results are contained in the dissertation and it is publicly available, replication costs are much lower than original production costs. While the source code for the software is not in the dissertation, the necessary formulas, derivations, test data, and results are. NT estimates that it would take approximately one year for a programmer with a B.S. in computer science to reproduce the source code using Dr. Nordt's dissertation, with limited support from ski design engineers. Even allowing for the possibility of somewhat earlier completion, a conservative estimate of the cost of such a person is $50,000. Because this value will be compared with yearly revenue figures, we convert this value to $20,000 per year, using NT's three-year time frame and a discount rate of 10%. This rate reflects uncertainty in the expected gains.

Asking Price

NT's asking price should be driven by the potential to increase profit for its buyers. Three factors drive profit:

(1) Cost savings from reduced need to prototype;
(2) Cost savings from input substitution;
(3) Sales increase due to improved ski design.

The cost savings factors are likely to be recognized by the buyers with some confidence, but the sales increase has the greatest upside and the highest uncertainty. Our median estimate of cost savings from reduced prototypes is $32,500. This is based on data from Volkl's racing department, which quoted $1,500 per prototype and 60 prototypes per year. We estimate that NT's software could build 25% less prototypes and allow one employee (with salary + overhead = $100,000 per year) to redistribute 25% of his time annually.

Savings from input substitution will depend on the ski designers to use the software to identify viable, less expensive raw materials while retaining the required performance characteristics of more costly materials. For example, if a particular model sells 30,000 pairs per year, our median estimate of $1 cost savings in material results in $30,000 more profit.

Finally, the sales increase due to improved design is quite plausible; innovations have been seen to significantly affect sales. In 1995, the popular K2 Four model contributed to 28% net sales growth of K2. This is 9% higher than any other year of sales growth (See Table 5). It is true, however, that only one or two companies could increase their market shares significantly unless the market as a whole grew, which seems unlikely, given our industry analysis. Our median estimate uses 5,000 additional pairs of skis sold per year, a 2% sales increase for a company with 5% market share, for a value of $50,000.

Table 5: K2's Percentage annual growth in net sales[1]

Year	1992	1993	1994	1995	1996	1997	1998
Growth %	3%	9%	14%	28%	19%	12%	13%

Source: *Fall Line analysis, 10-K*

In conclusion, the combination of the expected cost savings and the expected sales increase should easily exceed the replication cost of $50,000 for the outright sales or the $20,000 for the yearly license. Specifically, using full probabilistic estimates, we estimate the probability of a given manufacturer exceeding $20,000 per year at 98% (or 94% ignoring potential market share increase). Hence, our asking prices for the sales and the licensing are appropriate.

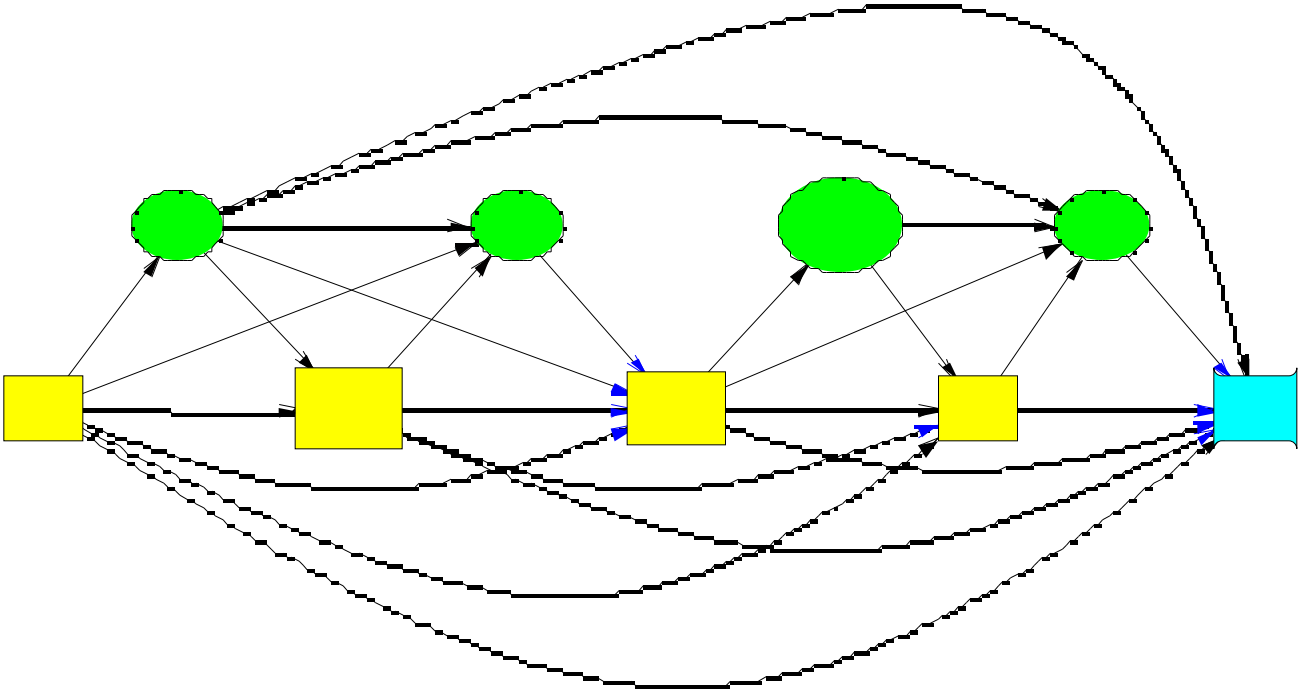
IV. Sales Strategy

As shown in the pricing analysis, the possibility of relatively inexpensive replication creates a narrow price range for the product. At the same time, however, replication creates new uncertainty because of the possibility of new entrants to NT's market. In fact, one ski-industry consulting firm has already expressed its intention to develop a

[1] Adjusted for mergers and acquisitions

similar product independently if it is unable to purchase the software for less than the cost of development.

Taking into account this information, we have modeled the situation as a sequence of four decisions over the next two years. As shown graphically in the decision diagram below, there are a number of embedded options in Nordt Technologies' current decision frame.



This decision diagram includes each of the four major decisions to be considered. The first of these, "Pilot," is the decision whether or not to undertake a pilot program that would consist of visiting ski manufacturers to allow them to test out the product firsthand. It is assumed that NT will absorb the cost of these visits, including the cost to her in time spent (these costs are then deducted from "Revenue"). If the Pilot is undertaken, it will affect the distribution of "Year 1 Interest." This distribution on the number of ski manufacturers interested in purchasing the product will be higher when the pilot is conducted (i.e., when the manufacturers have a chance to try out the product) than it would be otherwise.

Once the uncertainty over the degree of interest is resolved, then NT faces the "Year 1 Strategy" decision concerning how to market the product. There are the following four alternatives:

Alternative	***Description***
Multiple Sale	The product is sold outright to as many companies as possible.
Multiple License	The product is licensed for one year to as many companies as possible.
Exclusive Sale	The product is sold outright to the highest bidder.
Exclusive License	The product is licensed for one year to the highest bidder.

The choice among these alternatives affects a number of downstream decisions and uncertainties. If one of the exclusive alternatives is selected, then clearly there is only one "Year 1 Contract." If Multiple Sale or Multiple License is selected, then the number of contracts is uncertain. The distribution on the number of contracts is lower if the Multiple Sale alternative is selected than if the Multiple License alternative is selected since sales would require a greater up front commitment from the manufacturer. Of course, as one would expect, the number of contracts will be some subset of the interested manufacturers. Finally, in the case of the Exclusive Sale option, it is assumed that all cash flows from the product end there.

Once NT has decided on a first year strategy and any uncertainty regarding the number of contracts is resolved, then it can decide whether or not to sell the product to the consulting firm. The sale to the consulting firm will be structured as a forward contract to deliver it after one year in exchange for the price of replication. By selling the product in this manner, NT will retain the rights to monopoly rents for the product in the first year. At the same time, the consulting firm should be indifferent between this agreement and developing the software itself. In fact, it may find this agreement preferable because there will be no uncertainty regarding the success of product development. The potential drawback to NT of such a sale is that the presence of a potential competitor in the market for the product in the second year is likely to decrease potential revenues. If NT chooses not to sell the product to the consulting firm, then there is uncertainty regarding whether the firm will succeed in developing the software on its own in one year. This is captured by the "Consultant Success given No Sale" node.

By the start of the second year, any uncertainty regarding the consulting firm's role will be resolved, and NT faces the "Year 2 Strategy" decision. Because the product is only assumed to have a three year life (by then, Dr. Nordt expects that someone will develop superior technology), this is modeled as the final decision in the frame. The two alternatives are multiple sale and exclusive sale. While it would be possible to create another cycle of licensing and an additional decision point at the start of the third year, it was jointly decided by Dr. Nordt and Fall-Line not to do so. It appears that no major uncertainties would be resolved after this time and the benefit of adding such complexity would be unlikely to exceed the cost. The second year alternatives, therefore, are both sales with expected lifetimes of two years. The decision between these alternatives is made with knowledge of the three prior decisions and of the resolution of the "Year 1 Interest," "Year 1 Contracts," and "Consultant Success given No Sale" uncertainties. If NT decides to sell the product to multiple buyers, then the number of sales is uncertain as represented by "Year 2 Contracts." This uncertainty is influenced by two main factors. The first of these is the level of "Year 1 Interest" which indicates how the industry initially perceived the product. If there were great interest among ski manufacturers in the first year, then the number of buyers in the second year is likely to be higher than if interest in the first year were low. The second factor affecting sales is whether the consultant has entered the market. If so, then the distribution of potential sales is likely to be lower than if the consultant does not enter the market and NT is able to charge monopoly rents once again.

Finally, "Revenue" from the product can be calculated for each possible decision and outcome path. It is a function of the number of buyers or licensors, the price charged for each type of sale, and the discount factor applied to second year payments.

Furthermore, there is potential revenue from sale to the consultant and there are costs associated with running the pilot program for each interested company. By transforming each of these revenues into a utility value based on Dr. Nordt's risk tolerance, it is possible to take an expected utility over each of NT' decisions and to determine its optimal strategy. Once the certain equivalent of the optimal strategy is determined, then if it exceeds the costs (identical across all decisions) of final development of the product, NT should proceed according to plan.

V. Recommendations

Our strategic recommendations are as follows:

1. Launch the Pilot Program;
2. Sales Strategy and Pricing depends on the response to the Pilot Program:
   - If interest is high (8+ potential buyers), use Multiple License Strategy, price at $30,000/year each;
   - If interest is fair (3-7 potential buyers), use Multiple Sales Strategy, price at $50,000 each;
   - If interest is low (1-2 potential buyers), use Exclusive License Strategy, price at $100,000/year;
3. At the current time, we recommend selling to the Consultant for each Strategy choice. This recommendation might be updated if more information becomes available before the Consultant decisions must be made;
4. At the current time, we anticipate using the Multiple Sales Strategy in year two if the Multiple License or Multiple Sales Strategy is used this year and the Exclusive Sale Strategy if the Exclusive License Strategy is used this year. This recommendation also could be updated if more information becomes available.

The certain equivalent of NT's opportunity, before costs, is $230,000. This is the price someone would have to pay NT to remove all opportunity to sell the software. This figure does not include costs, other than those of the Pilot Program, because these costs (reprogramming, legal, etc.) are estimated to be fairly constant across the available decisions and we have a fairly narrow confidence interval for their value at $60,000. The gives a net certain equivalent of $170,000, using the fact that NT follows the Delta Property at this range.

The intuition for our recommendations is fairly straightforward. NT's assessment of the impact of the Pilot Program is that it outweighs the cost of the program, currently estimated at $3,000 per participant in the program. This figure accounts for Dr. Nordt's time only, as we anticipate participants paying for her travel expenses. The Pilot Program recommendation is robust to costs up to $4,500 per participant, at which point the program becomes inadvisable.

The Multiple License Strategy is employed at high interest because high interest in the current year is a good indication of high interest in the future. At high interest levels, the option value of retaining the possibility of making multiple sales in the future is high. A license in the first year coupled with a sale in the second brings adds more revenue to NT than a sale in the first year. The downside of this strategy is that an initial sale has less uncertainty. Thus when there are more potential buyers and the expected

value from licensing is higher, it makes more sense to take the risk of licensing rather than selling in the first year. If there are fewer buyers, it is better to lock in the guaranteed large revenue today.

The Exclusive License Strategy is employed only when the number of potential buyers is very low. At this point, little can be lost by offering an exclusive license for the first year. The difficulty may be convincing the buyers that the exclusivity is worthwhile. Hopefully the fact that overall interest is low can be withheld from them.

The Exclusive Sale Strategy is never employed at its current price of $150,000. It would have to be priced at over $210,000 to become a viable alternative. The reason that the Exclusive Sale Strategy could be used at slightly less than the certain equivalent before fixed costs is that it would be used without the Pilot Program, reducing the variable costs. The Pilot Program is not worthwhile when looking for only one buyer.

Selling to the Consultant is advised at this point because of the sure income of the sale ($50,000) outweighs the uncertain reduction in future sales. Selling is advised at any price over $37,500.

In the second year, the Multiple Sales Strategy is advised if the number of buyers has been high, indicating there are a large number of buyers for the second year. Conversely, if few buyers were found in the first year, few are likely to be found in the second and the Exclusive Sale option is advised.

All prices are fundamentally based on the reasoning in the Pricing section, with an upward adjustment for the fact that replication cannot be completed until one year after it has started. This allows NT to charge more than the replication cost for the first year of a contract. A complete list of prices and their derivations is included in Appendix 3. Further sensitivity analysis is included in Appendix 4.