A short presentation of OptiSensor Inc.

OptiSensor was founded in the fall of year 0 by NordInvent, a company based in Göteborg. The idea behind the start-up of OptiSensor was to exploit the invention of the optical touch key. Two products were developed and marketed.

The first was a window key intended (designed for) as an aid in shop-window displays, trade fairs, etc. The other was an ITD key (interactive touch display) designed as a built-in component for different types of machines, such as dishwashers, ovens, and industrial robots. Product development occurred primarily through agreements with ABB and Electrolux. Marketing was carried out under personal management and in agreement with retail distributors in the Swedish market.

New stockholder’s equity was infused several times from Swedish venture capital companies, NordInvent, ABB, and the 4th AP fund. During year 3, the firm employed three people and had a business volume of 0.5 million SKr (US$70,000).

OptiSensor had problems exploiting the key commercially during development. The problem continued even in the middle of year 3. In the fall of year 7, these problems were still not solved and, as a consequence, it was decided to close down the firm.

The firm’s origin and early development

The invention

OptiSensor was founded as a result of an invention made by an inventor living in Stockholm. The invention — the optical touch key — was an outgrowth of work in the construction of an electrical circuit breaker with no moving parts.

Among other things, the invention was unique in that it could register light finger pressure while being insensitive to other external influences. It was therefore possible to construct a key that reacted to finger pressure but ignored other types of influences.

The inventor had received financial support from NUTEK to continue development of the invention. The money was also used to apply for patents in Sweden, Great Britain, France, Germany, and the USA. The strategy was to license the use of the optical key as a component in larger companies’ products. A few Swedish industrial firms were contacted but little interest was shown. At one point, discussions for a collaboration were conducted with one firm but, because of the unfavourable terms of the agreement, the inventor refrained from signing. For a time, the invention lay unused.

Two years before the firm was created, an invention competition, SwedeInnovation, was conducted by the development company NordInvent and some other large Swedish firms. The inventor submitted his invention which won first prize. The judging panel motivated their choice as follows:

The invention is of very high technical level and is based on advanced physical theories which demand complicated mathematical models. It has been successively developed over a longer period of time. The inventor has used the latest scientific developments in optics in an elegant and smart manner. The touch key has the unique characteristic of not being influenced by
electrical fields, pressure, heat, mechanical abrasions, chemicals, etc. The inventor has shown that the key can be made selective, that it is able to be operated only through skin contact. The key contains no moving parts and is well suited, for example, as a control switch. The other fields of application include the electronic industry, the engineering (manufacturing) industry, the petrochemical industry, the white goods sector, and the agricultural sector. Patents have been granted in a number of countries. The invention is expected to have large commercial use.

Because of the rules of the competition, NordInvent was able to acquire the rights to the winning invention. Six months later, a patent rights agreement between NordInvent and the inventor was therefore signed where the latter, for royalty considerations, transferred the rights of the invention to NordInvent.

The early development and founding of OptiSensor

NordInvent was extremely interested in continuing development of the optical key. Together with Electrolux, who was a member of the organising committee, and the inventor, a work group was formed to examine whether it was possible to commercialise the invention.

Their study showed that the optical key was applicable in many areas. Its basic construction opened new possibilities which, in combination with other techniques, were unique. To make it more marketable, however, it was expected that further construction work, laboratory tests, and market analyses would be necessary.

Early on, NordInvent proposed to start a firm for the development and exploitation of the invention. The intention was that NordInvent, who owned the rights to the invention, would make them available. In the spring of year 0, a plan was formed for the founding of a firm.

The idea was that at the beginning, NordInvent would make resources available such as offices, premises, telephones, secretarial help, and other administration services. The management of the firm was initially thought to be shared between NordInvent and the CEO. The intention was that the latter would gradually take over control of the business.

At the founding, NordInvent had collected a number of actors who could contribute important resources to the new business. The result was that a group of interested parties was formed. Besides Electrolux, ABB and four Swedish venture capital companies were also part of the group. In November of year 0, OptiKey (soon changed to OptiSensor) was founded. In connection with the founding, a CEO (Sven) was recruited from an electronics firm in Stockholm.

At the same time, some agreements were signed between the interested parties, agreements concerning the right to the development of the invention, the ownership, and the methods of financing. At least five agreements which should be commented were signed:

- The agreement between NordInvent and OptiSensor. Since NordInvent owned the right to the exploitation of the invention according to an earlier agreement, an exclusive license was granted OptiSensor at its founding.

- The syndicate agreement between the interested parties. At the founding, a syndicate agreement between NordInvent and those actors intending to contribute stockholder’s equity was signed. With this agreement, OptiSensor received 0.55 million SKr (US$75,000) in share-capital and 1.35 million SKr (US$185,000) in convertible bonds. The following became owners: NordInvent (25%), ABB (13.5%), S-bolag Tillväxt (13.5%), StartInvest (13.5%), Ventura (13.5%), VenTech (13.5%), and
Sven (7.5%). The owners would also be represented without cost on the firm’s board. Both the inventor and Electrolux were offered the opportunity to become partners, but they declined.

- The agreement between NordInvent and Electrolux Mecatronik in Malmö. The agreement concerned, on the one hand, collaboration in the development of the optical key in a more general respect, on the other hand, a collaboration in the development of the adaptation of the optical key to Electrolux’ line of white goods. OptiSensor would also be able to buy production resources from Electrolux Mecatronik.

- The agreement between OptiSensor and ABB. In addition to the syndicate agreement signed with ABB at the founding, another agreement was reached a few months later. In the agreement, ABB would be allowed to evaluate and judge the use of the optical key for some of its products. If ABB was not able to find an application, they would have the right to revoke the agreement and sell back their shares at nominal value.

- Supplement to the previous year’s patent rights agreement. With the formation of OptiSensor, the situation that existed between the inventor and NordInvent at the time of the signing of the original patent rights agreement changed. Pressure came from the side of the inventor to adapt the agreement to the new situation. The negotiations that followed resulted in a supplementary agreement that increased the amount of royalty to be paid the inventor, who was also granted the right to participate in board meetings for the first three years.

Product ideas and products

Before OptiSensor was founded, the work group had devoted almost one year to developing ideas on how the invention could be exploited commercially. In the meantime, however, it was far from being a finished product. Much of the work in the beginning was therefore concerned with the continued development and documentation of the invention. This work was carried out mainly by Electrolux Mecatronik while OptiSensor tried to place (fit) the invention in different areas of commercial application.

The contacts between OptiSensor and Electrolux Mecatronik were frequent. The two sides often met or communicated with each other many times each week. The personnel assigned to the project at Electrolux Mecatronik varied, but, at the most, three people were engaged in the work. After six months of work, two product ideas had been developed in collaboration with Electrolux. The first was the so-called ITD key (Interactive Touch Display) which was a key panel with twelve pressure areas (points), a microprocessor, and its own electrical power supply unit.

The ITD key was a component designed to be built into other products and systems.

The key was thought to have a number of advantages, the main one being that it contained few moving parts and therefore was more durable compared with other keys currently on the market.

Another very important advantage was that it operated interactively. This allowed the user to form the key in the shape of symbols; the possible number of key functions were almost unlimited. All information would be given en clair, with or without simple symbols. In this manner, the key became self-instructing. Nothing similar was currently being marketed. The key was thought to have several areas of application, i.e. within process control systems, measuring instruments, medical apparatuses, and domestic appliances.
The second product idea was the so-called window key (panel), which was less complicated that the ITD key. The window key was an independent product that could be mounted on the inside of a window without the need of making holes or otherwise damaging the product. From the outside of a shop-window, for example, customers would be able to effect products (TVs, electronic games, videos, etc.) inside the shop-window via the key’s pressure points.

The product which was expected to be introduced first on the market was the window key. Even though the market for it was judged to be less than that for the ITD key, development in the beginning was centred on the window key. The opinion was that it was important to get a finished product out on the market as soon as possible and be able to show results at an early stage.

In the fall of year 1, the prototype of the window key was ready; it was tested at one of Stockholm’s larger toy stores during the Christmas season in November and December of the same year. On the whole, the key performed acceptably. Technical modifications were needed so that it would work better at colder temperatures. At very low temperatures, problems with the contact fluid occurred which resulted in the key coming loose from the shop-window.

Development work on the ITD key was conducted parallel with development of the window key.

It was expected that a prototype would be ready in the summer of year 2. The current development work at Electrolux Mecatronik to adapt the key to the white goods programme was expected to have progressed so far that a decision on whether the key could be used would be made in year 2. On the assumption that the decision would be positive, it was calculated that the ITD key would be a component in one or more of Electrolux’ white goods in year 3, at the earliest.

The evaluation of the key by ABB was just getting properly started. The plan was that the work would lead up to testing the key in some of ABB’s products in the first half of year 2.

In addition to the collaboration in product development with ABB and Electrolux, OptiSensor also had contacts with other industrial companies who had shown interest in the key. For a time, negotiations were conducted with Teli on a joint programme for the development and adaptation of the key to prescriber exchanges and telephones. The Ericsson concern showed an interest in testing the key in the area of fibre optics. The discussions with Teli and Ericsson, however, did not result in any collaboration.

New patents were sought for the product ideas that were developed. The existing patents covered France, Great Britain, Sweden, the USA, and Germany and applied only to the basic principles of the optical key. The inventor had the main responsibility for looking after and seeking patent rights.

The market and marketing

A market survey was conducted parallel with product development. Sven had the main responsibility for this. In the spring of year 2, it was planned to hire a salesman who would be responsible for the marketing of the window key.

The primary target groups for the window key were thought to be banks, chain stores, and retail distributors of interactive VCR systems. The introduction of the window key was planned for the spring of year 2, and in the same year, it was optimistically projected that 1000 window keys would be sold in Sweden and Scandinavia with sporadic sales to Europe.
The ITD key was thought to have a considerably larger marketing potential than the window key.

The primary interest was in manufacturers of keyboards and key systems but not companies manufacturing keyboards for typewriters and personal computers, for example.

The market was judged to be very large (several billion kronor) and the yearly growth 15-20 per cent. Since OptiSensor’s ITD key was based on new principles, it expected that the market would first react sluggishly and that sales in the beginning would be in small series. The sales volume for year 2 was projected to be 50-100 keyboards. As with the window keys, the initial marketing activities for the keyboard would focus on the Swedish and Scandinavian markets.

The competition on the market was heavy, and both national and international producers of different types of keys had entered the market. In Sweden alone, the number of competitors was estimated to be over fifty. But, since the market demanded specific solutions for different applications—those keys available on the market had low resistance to external wear and the demand for user-friendly constructions had increased—OptiSensor was thought to have a competitive edge.

At the turn of the year 1/2, OptiSensor had made no sales.

Financing

In December of year 1, OptiSensor received 2 million SKr (US$274,000) in share capital from the previous owners and had an overdraft facility on their checking account of 50 thousand SKr (US$6,800) at Göta bank.

The firm’s development from January of year 2 to May of year 4

Product ideas and products

The continued work on development of the window key was primarily aimed at correcting those problems which had occurred in testing and developing some peripheral devices. Several tests were made and new, unexpected problems appeared.

It turned out that a large number of the customer’s shop-windows had double-paned glass, on which the window keys did not work as there was an airspace between the panes of glass. Another problem was that installation of the window key was too complicated, even for relatively technically-oriented customer groups such as radio and TV dealers. This meant that OptiSensor had to invest greater amounts of resources than expected in instructing customers in mounting the key.

Another important factor was that the window key could not function alone but had to communicate with other devices at every use; supplemental work was therefore necessary. First, two types of relay boxes for improving the key’s control characteristics when displayed in a shop-window (e.g. steering toys, lamps, tape recorders, and slide presentations) were developed. Together with Philips, a so-called laser vision with advanced picture and sound technique for use in shops and at trade fairs, etc. was developed.

In order to be able to use the window key with personal computers, it was necessary to develop a special computer program. Such a program was developed in collaboration with a customer and the computer company Arbìt.
During this time, the ITD key underwent an intensive period of development and a prototype was tested in the spring of year 2 at a newspaper publisher where it was used to count approved and rejected newspaper copies. The key performed satisfactorily other than that the resolution on the display was somewhat unclear.

At about the same time, a software program with six so-called format groups (user instructions) was developed in collaboration with ABB. Later on in year 2, the ITD key was judged to be conceptually ready for ABBs programme of products, and in the spring of year 3, the previous agreement was extended for three years.

In the meantime, problems occurred in the collaboration with ABB; the person at ABB in charge of co-ordinating work with OptiSensor was transferred to England in the fall of year 3. From that time point on, the collaboration was successively phased out. ABB reprioritized their activities and all collaboration stopped in the spring of year 4.

The collaboration with Electrolux continued, and the work to adapt the ITD key to their white goods programme was judged to be positive. In year 3, the previous agreement where Electrolux retained the exclusive right to use the key in their white goods programme was extended for three years. The indications were that the key would be used in the next generation of white goods.

New patents were sought as new applications were generated from the original optical key principle. In May of year 4, OptiSensor’s technique was protected by strong patents in most industrial countries. Surveillance and application for patent rights continued to be carried out by the inventor.

Market and marketing

A great deal of effort was put into marketing the window key. The hiring of a salesman, planned since year 1, occurred in the spring of year 2, and he became responsible for the introduction of the window key. Potential customers were contacted and visited and offers were sent out.

Advertising brochures were printed, announcements were made in the trade press, and exhibitions were mounted at trade fairs. The window key sold slowly. It was soon concluded that it was difficult to manage marketing by themselves and retail distributors were sought. Late in year 2 an agreement was reached with Owell, one of IBMs largest retail distributors with twelve regional offices in Sweden. Sales through Owell were slow, and, at the same time, Owell developed economical problems which resulted in the cancellation of the agreement. Other retail distributors were sought, but interest was low, primarily because the window key was difficult to sell. Existing contacts gave no results.

OptiSensor was therefore forced to try and sell the window key on their own, but they were not particularly successful. Sales were very slow, except for one order in the fall of year 3 from Luxor for 75 keys.

In the fall of year 2, the ITD key was introduced at the Component trade fair that year in Göteborg. Interest was large. A follow-up programme was undertaken to solidify the contacts made during the fair. Even though the key had generated a great deal of interest, it soon became clear that it was difficult to get customers to buy.

Only a few bought and almost all consignments of the ITD key were some type of sample for evaluation in the customer’s prototype. The most important customer was FFV Aerotech, who bought the ITD key on a few occasions (during years 3-4), but the quantities were minor.
In order to achieve more effective marketing and sales, retail distributors for the ITD key were sought. In the fall of year 3, a retail distributing agreement was signed with Nordqvist & Berg who, through the terms of the contract, were given the exclusive right to market the ITD key in Sweden. Nordqvist & Berg were thought to be a strong retail distributing outlet in the Swedish and Scandinavian markets.

In spite of the relatively extensive marketing and a large number of customer contacts, billing (invoicing) was considerably less than budgeted. The number of window keys sold in year 2 and 3 was 36 (budget 1000) and 125 (budget 1300) respectively, and the firm’s turnover was 0.12 million SKr (US$16,000). The ITD key fared no better. In year 2 and year 3, 5 (budget 15) and 20 (budget 300) were sold respectively, and the firm turned over 0.5 million SKr (US$68,000). The agreements signed with Electrolux and ABB, in spite of the efforts of OptiSensor, had still not led to any commercial applications which produced any income from royalties. The retail distributing agreement with Nordqvist & Berg had not resulted in any income from sales either.

In the spring of year 4, a consultant was hired to conduct a thorough market research for the ITD tangent. A number of experts and possible users were interviewed. One of the most important results was that a large market potential existed in industrial automation.

The firm also had some contact with foreign partners during this period, among others, the German companies COS and Miele. Contacts were also made in Japan through the Swedish company Inventure. Use of the ITD key in touch screens at railway stations was discussed with the French railway company. These foreign contacts, however, gave no commercial results.

Financing

OptiSensor was twice given additional stockholder’s equity. Changes also occurred in the ownership structure. In the spring of year 3, 1.35 million SKr (US$185,000) in share-capital was contributed by NordInvent, S-bolag Tillväxt, and StartInvest. Ventura and VenTech sold their shares to NordInvent. ABB remained a partner but did not contribute any new capital at this time. Sven left the firm at the time of the emission and the new CEO (Lars) took over his shares.

In the spring of year 4, another new emission took place where OptiSensor was given 5 million SKr (US$685,000) in share-capital by the 4th AP fund, who thereby became a 20 per cent partner in the firm. It should also be mentioned that the 4th AP fund had previously been a partner in NordInvent and was familiar with the development of OptiSensor.

Göta Bank raised the overdraft facilities of OptiSensor’s checking account first to 0.5 million SKr (US$68,000) and then, in year 4, to 1.0 million SKr (US$137,000).

Organisation

During the entire period, OptiSensor’s organisation structure was very simple, which can be explained by the fact that the firm never had more than three employees. NordInvent determined the design and structure of the firm. The thought was that OptiSensor would have a limited number of employees and that resources such as product development and production would be acquired from partners outside of the firm.

The CEO employed primarily took care of marketing and administration of the resources available from members of the board. He collaborated with NordInvent, who acted as a sounding board and
had contacts with ABB and, above all, Electrolux Mecatronik. In year 2 he also had help of the salesperson hired to market the window key.

Sven resigned in the spring of year 3, and until Lars was recruited, there was a void surrounding the position of the CEO. Lars, however, resigned in the spring of year 4.

Owners and management

NordInvent was the most important and most dominating actor during the entire period of development—even more dominating that the CEOs—because it was NordInvent who had founded OptiSensor, had organised and structured the business activities, had established relations with important actors, was chairman of the firm's board, and was the largest owner. In NordInvent there were people competent in business management and marketing but with little experience of firm start-ups and, especially, technology-based firm start-ups.

There were at least two driving forces that caused NordInvent to get involved with OptiSensor: the one was to earn money by developing products based on the principles of the invention, the other was to test the model they had for developing inventions by starting a firm. NordInvent was convinced that the model they used was superior to all others. Because of the importance of the invention and the relationships built up, success was expected to be certain. With time, NordInvent felt more and more pressed to succeed, which is why they stubbornly stuck to their original model in spite of commercial failures.

The CEOs all had different backgrounds and characteristics, but the common denominator was that they were ambitious and growth-oriented. Sven came from Stockholm but still had his family in the Göteborg area. By taking the job with OptiSensor, he no longer had to commute, one of the reasons he applied for the position. He came from an electronics firm and therefore had experience of an environment similar to the one at OptiSensor. He had an upper secondary engineering degree and was knowledgeable in both technology and marketing. Colleagues described him as a businesslike, flexible, creative, and outgoing person.

Sven had a clear conception of how the business activities in OptiSensor should be run which often made relations with NordInvent rocky. Above all, he felt NordInvent interfered too much with the business. In the end, the co-operation failed, and he left the company.

Lars had a B. S. in Economics and came from Mölnlycke company where he had worked with the marketing of consumer products. He was not happy in a large city milieu and was interested in working in a smaller company. This, in combination with a large technical interest, made the work at OptiSensor attractive.

Relations with NordInvent were better in this case, primarily because Lars had previously had contact with people at NordInvent before his employment. He had the same outgoing personality as Sven but completely lacked experience of small businesses and the marketing of technically advanced products. This was why the situation did not do him justice and the main reason why he left OptiSensor a year later.

The inventor was important since he was responsible for the invention, had the necessary technical competence (a B.S. in engineering), and was a member of the board. What interested the inventor was the possibility of making money on his invention, not by starting his own company, but by selling the
rights to the key and in that way receiving an income from the royalties. In the beginning, he was very involved and anxious to be a part of any future commercial successes.

In the cases of ABB and Electrolux Mecatronik, both were involved in the founding, represented on the board, and important collaboration partners. They mainly contributed technical expertise. The driving forces behind their involvement was their curiosity about the technical characteristics of the optical touch key and the possibility of using it in their products. Electrolux Mecatronik was the more important of the two and the one most closely tied to OptiSensor.

The Venture capital company and the 4th AP fund were the most important actors, above all, in their role as financiers. They were represented on the board and contributed knowledge of business economics and experience of industry and commerce.

**What happened in the firm from May of year 4 to the fall of year 7?**

A new CEO who only worked part-time in the company was recruited. The problems in OptiSensor continued. Sales deviated greatly from the budget and only a few window keys and ITD keys were sold.

Nordqvist & Berg, on whom large expectations had been placed, had great difficulties selling any ITD keys. After a time, Incentive (the main owner of Nordqvist & Berg) decided to merge Nordqvist & Berg with another firm. Reductions were made and the ITD key was removed from the line of products. OptiSensor then had no retail distribution for the ITD key.

In the spring of year 5, economical problems occurred in Electrolux which caused turbulence in Electrolux Mecatronik. The person in Electrolux Mecatronik responsible for holding contact with OptiSensor resigned. At the same time, Electrolux replaced the entire management at Electrolux Mecatronik. Collaboration with OptiSensor no longer had any basis and was soon dropped.

The third CEO (Sören) had begun to develop a new application for the optical key during his time at OptiSensor. “Guided Waves” was the name of the new concept and a prototype was ready in the late fall of year 5. A lot of work was put into development and market surveys. NordInvent actively sought financing from NUTEK and the Regional Development Fund but were turned down.

A conflict between NordInvent and Sören developed over how the work on the project should continue; this led to his leaving OptiSensor at the end of year 5.

One of the main people in NordInvent took the post of CEO in the firm. In year 6, a gradual reduction in the activities of OptiSensor was begun. No further external financing could be found. A few ITD keys were sold to old customers, but these incomes could not support the firm. The new CEO was transferred to other duties in NordInvent. OptiSensor was closed down in the fall of year 7.