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Tic Lens (Slovenia)

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TIC LENS

Introduction

Matjaz Milfelner was very excited about the challenges and opportunities he was facing in managing his joint venture. Having finished his Ph.D. in mechanical engineering, he had started working in a successful tool-shop in Celje, Slovenia when suddenly an unexpected opportunity arose. As Matjaz explained:

> *"I was working on several development projects and writing proposals for the company to receive some financial funds. All of a sudden I was entrusted into the position of Managing Director of this small company that deals with the development and application of two extremely sophisticated technologies. As the company is a joint venture I have several investors monitoring and watching me and they obviously require revenue from the company to justify their investment. I had no experience in managing companies or in marketing advanced technologies, but this was an exciting challenge!"*

Matjaz Milfelner took the job of managing a high-tech company in 2008. The company was a joint venture, established as a result of an industrial clustering program in Slovenia. It was a tough job and Matjaz had to prove that acquiring two expensive high technologies and putting them into operation was not an impossible assignment. Matjaz had to develop specific technology to a level that would be applicable to real-life projects and then he had to find industries that would acknowledge the potential benefits and huge possibilities that these new technologies offer. Matjaz believed that the world loved high-tech products, and advanced technologies are of huge market interest, so he was quite hopeful.

TCS and Clustering

The history of the company dated back to 2001, as the entire process of acquiring the technology took many years, when the Slovenian Ministry of Economy started its clustering policy as part of a national competitiveness programme. Recognising both the value of industrial clusters and the need for greater innovation and networking among Slovenian manufacturers, the Slovenian Ministry of Economy developed a systematic framework for developing industry clusters and funded the development of three industry cluster pilot projects for the Slovenian tooling, automotive and transportation industries. The clusters were part of a Slovenian programme of measures to promote entrepreneurship and competitiveness between 2002 and 2006. The Toolmakers Cluster of Slovenia was founded in 2001 as one of

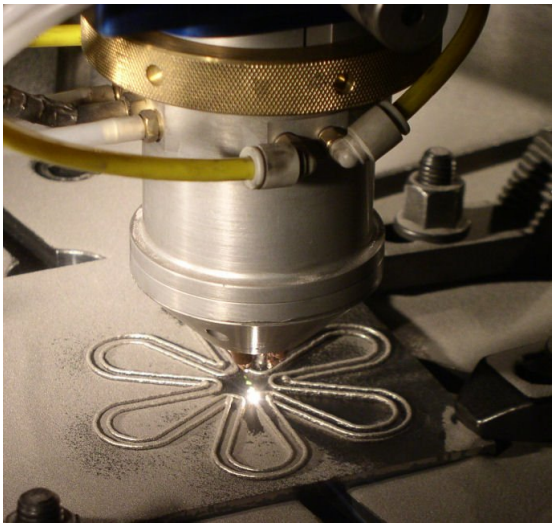
the three pilot cluster projects and it became one of the most successful examples of these governmental clustering activities. Its vision was to become a regional network of highly qualified and specialised firms and organisations as a development partner of the most advanced EU industries. There were around 20 tool-shops active in the cluster, two universities, several R&D institutes, supporting firms (consulting, information technology, human resource management and banks), several partner firms and a regional development agency. The target markets were the automotive industry, the aerospace industry and the household appliance industry. Soon after the formation of TCS, a specialised group of engineers from several different firms was established. They were working together on common technological issues and several complementary technologies were developed within this cooperation as the engineers exchanged their knowledge and experiences on particular technologies. TCS was also the first Slovenian cluster that strived to introduce an emergent technology that was new for all members in the cluster. This was a highly advanced laser technology called Lens.

Lens Technology

Lens was a technology that enabled layer manufacturing and had been in operation for approximately 20 years. These techniques directly fabricated, layer-by-layer, physical models from 3D solid models produced in CAD (computer-aided design). Lens was a laser fabrication technique developed at Sandia National Laboratory for producing components that were difficult or impossible to process through conventional metal forming techniques. It was one of the most promising technologies used to fabricate fully dense metal parts directly from CAD solid models. The process was similar to traditional laser-initiated rapid prototyping technologies such as stereolithography and selective laser sintering, in that layer additive techniques were used to fabricate physical parts directly from CAD data. By using the coordinated delivery of metal particles into a focused laser beam, a part was generated. The laser beam created a molten pool of metal on a substrate into which powder was injected. Concurrently, the substrate on which the deposition was occurring was moved under the beam/powder interaction zone to fabricate the desired cross-sectional geometry. Consecutive layers were additively deposited, thereby producing a three-dimensional part. This process exhibited enormous potential to revolutionise the way in which metal parts, such as complex prototypes, tooling, and small-lot production parts, were produced. The result was a complex, fully dense, near-net-shape part. Parts could be fabricated from stainless steel, nickel-based alloys, titanium, etc. Lens was a technology that was gaining in importance and was in the early stages of commercialisation. Its strength was in its ability to fabricate fully-dense metal

parts with good metallurgical properties at reasonable speeds. Much research was still being undertaken in American laboratories, but there were only three installations of Lens in Europe - the UK, France and Slovenia.

Figure One: Lens Technology in Action



The Acquiring Process

The idea for acquiring Lens technology in TCS was first spoken about in 2002. The TCS programme manager was approached by the American firm WorldTech that represented Optomec from New Mexico, a firm with responsibility for the commercialisation of Lens technology. The idea was presented to leading firm managers and other interested parties in Slovenia but while the majority of managers found the technology intriguing, they also showed some scepticism. Their biggest fear was their lack of knowledge about the high-tech Lens process and they also did not see the immediate use and benefits if it within the tool-making industry. At the beginning, people inside the industry never imagined the potential for the technology outside of the tool-making sector.

Based on some interest that was expressed at the first presentation (which was supported by the Ministry of Economics), WorldTech was asked to return to Slovenia in order to further explore the possibilities of introducing Lens. Following this visit, a Slovenian-based study group was formed to study the Lens technology and to help introduce the technology in Slovenia. In order to get better insights into the Lens technology's potential, six members of this group travelled to the New Mexico (USA) in 2002 and met with Optomec. During this visit they were able to see a demonstration of Lens machines, view product samples and evaluate the Lens technology. After the trip the group formed the consensus that Lens

technology was technically feasible and offered an opportunity to develop new capabilities and competitive advantages for TCS. A feasibility study was performed in 2003 and 2004 in order to analytically explore the potential for implementing the Lens technology in Slovenia. This in-depth study emphasised the suitability of this high technology and highlighted some potential application areas with a special focus on metal industry, tool making and automotive industry. Another important part of the study was detailed market research regarding users and buyers of products manufactured with Lens technology. It was also important to note that the surrounding regions of Slovenia, including Italy, France, Germany, Austria, Hungary, Croatia, Serbia and Greece, had also shown a lot of interest in Lens which was quite positive as Slovenia was not a sufficiently large enough market for the implementation of such sophisticated technology.

The next step was to establish a group of firms and other organisations that would eventually transfer the technology to TCS. The organisations and individuals that would participate in the transfer of this technology from the middle to the high-technology sector had to be established. Basically, there were two main issues that had to be addressed:

1. Which firms were interested in cooperating in R&D based on this new technology?
2. Who was ready to participate financially in order to acquire the technology?

This process took place from 2005 until 2007. The research among cluster managers revealed that there were no real barriers to cooperating in the field of new and emerging technologies. There was not much knowledge on these technologies among cluster members and therefore competitive positions were not threatened. The cluster managers agreed that:

> "*If the technology is as extremely sophisticated as Lens technology, no firm will engage in its development and use it on their own*".

The results of the Lens feasibility study were presented to interested parties, including R&D institutions in TCS and other partners. In 2005 a decision had to be made identifying the core group of organisations that would bring this technology to Slovenia as there were many firms interested in the use of this technology and joint development. Since the technology was very expensive, the biggest obstacle was financing the project. After a substantial amount time of was spent in negotiation, a small group of firms were identified that were ready to invest in the technology, and consequently took ownership over R&D activities. As one of cluster managers explained at the time:

> "*The core group of firms that will own the technology should not be too big. It is important to find firms that see direct benefits for themselves in acquiring the technology that could eventually become a key technology. There will be a critical*

mass of firms within a cluster that will be interested to use the technology later on for their own applications, so there is no fear of not finding customers. However, this technology is so versatile that we expect to establish several spin-offs within the cluster, where the technology will be used for specific purposes and have its own markets and buyers of products and services. If you want to acquire such a high-technology with so much technological and market ambiguity you have to be a risk taker. It is not about trust in cluster; the cooperation will undoubtedly occur later on, it is the question of immediate investment in technology."

The initial idea was that several tool shops, a Regional Development Agency, two universities and one institute would form a consortium to establish a joint venture in the field of laser technologies. The R&D institutions did not participate financially but just contributed their expertise in the R&D activities of the new technology. In the end, only two companies (tool shops) and a Regional Development Agency agreed to acquire the technology and to invest financial funds. This Lens group applied for financial help from the Ministry of Economics and in 2006 they obtained funding. The government and Regional Development Agency decided to help with the transfer of Lens technology from USA to Slovenia and so in 2008 the technology was installed in Slovenia. The machine was called LENS 850-R.

Figure Two: Lens and the Laser Cladding Machine in TIC LENS

But the LENS technology was not the only technology installed in the company as the partners also invested in another interesting technology called laser cladding. Laser cladding was a unique advanced metal manufacturing technique that offered the ability to create fully dense metal features and components directly from a computer solid model. Laser cladding systems were used to cost-effectively fabricate, enhance and repair high-performance metal components in state-of-the-art materials such as titanium, stainless steel, and inconel

materials. These two machines now had to generate revenues that would repay the substantial investments made by the consortium in bringing them to Slovenia.

Establishing Business Ideas and a Business Plan

The company's first business plan was prepared in late 2006 as part of an application for the funding of the technology. As explained by one of the partners, the basic business idea was:

> "*Tool shops were small and medium sized companies, suppliers to extremely sophisticated industries, such as the automotive industry and the household appliances industry. Keeping their position in these supply chains was an extremely demanding task. Original equipment manufacturers (OEMs) looked for flexible companies that were not just suppliers, but also R&D partners, as they had to keep up with the latest technology trends in order to be competitive. Investing in advanced technology required a lot of money and finance was always a problem for SMEs. Furthermore, there was a lack of knowledge in these smaller environments, so the basic business idea was to join financial sources, knowledge and experience, and to share the inherent risks.*"

The business plan had to have all of the necessary ingredients and it took time for them to gather all of the required information needed such as:

1. Basic data about the company;
2. Introduction of management and founders;
3. Introduction of the organisation's areas of work;
4. A brief strategy of the company;
5. Market analysis;
6. Investment analysis, cost-benefit analysis, etc.

The business plan was prepared just before the official founding of the company in 2008. AS part of writing the business plan, a market analysis was also performed for the Lens and laser cladding technology. The Lens technology met the needs of the tool and automotive industry for the production of unique products (functional prototypes) of complicated shapes from different materials, repairs of elements, production of gradient materials, repairs and renewals of products. The main customers were the largest tool making and automotive companies in Slovenia. The market was extensive, with significant potential in many of the primary manufacturing industries. The list of applications spanned the entire product life-cycle, from concept and design, through production and on into field service. The technologies could also be used in manufacturing companies in the following industries:

Automotive

During the product development phase in the automotive industry, technologies could be employed to rapidly produce fully functional prototypes. Additionally, in specialty high-margin applications such as automotive industry, Lens technology was applied as a low-volume manufacturing system. For high-volume end products, laser cladding was used to more efficiently produce and maintain production tooling, such as plastic injection moulds or metal die casts for cars. Finally, in the end product after-market, laser cladding delivered unique repair and overhaul capabilities that served to extend product lifecycles and reduce downtime.

Tool-making

A conventional mould-making methodology required as many as seven to ten separate steps to complete production grade tooling. Each individual step contributed both time and cost to the overall process. In comparison, a laser additive approach helped users create tools and consequently reduced the time involved, which can often translate to less overall cost. An additional benefit of laser technologies was its unique ability to repair damaged tools that might normally be discarded as waste. This was also highly applicable in the defence industry.

Aerospace

Aerospace represented one of the major applications for Lens. The aerospace industry was rapidly adopting newer alloys (such as a Titanium alloys) for parts which needed a very high strength-to-weight ratio, as well as resistance to fatigue, heat, and corrosion. Because titanium was so hard and difficult to machine, machining the part can tie-up an expensive CNC machining centre for hundreds of hours and wear out large numbers of cutting tools. However, laser forming could save 20-30 percent of the cost of the part by eliminating material waste and the need for consumable cutting tools.

Establishing a New Company – Tic Lens

During the acquisition process the investors agreed that they would establish a new company that would be in charge of further developing both technologies. All three investors in the technology were also stakeholders of the company. The first tool shop had a 56 percent share, the other tool shop 18 percent and the Regional Development Agency had 26 percent (the two tool shops were not direct competitors). The establishment process began in January 2008 and the company was finally established in July 2008 (Tic Lens basically meant Technological

Centre for Lens Technology). A new Managing Director was appointed and the company only had four employees. Besides being Managing Director, Dr. Matjaz Milfelner also worked as a researcher in the company as this was an applicative R&D (the basic/generic R&D was still in the hands of the American partners). The second employee was a commercialist, who also worked as a sales manager. The third and fourth employees were machine programmers and machine operators who also performed some R&D work.

Tic Lens was the first company in Slovenia which offered and developed solutions for a wide range of metal fabrication and repair applications with state-of-the-art laser technologies for all industrial areas. The core business of the company was the R&D of laser cladding applications and solutions for a wide range of metal fabrication and repair applications with the state-of-the-art Lens technology for all industrial areas. The primary work was based on the laser deposition rapid prototyping technologies for metal parts and laser hardening of metal parts. The Lens technology was used for the needs of the tool and automotive industry for the production of unique products (functional prototypes) of complicated shapes from different materials, repairs of elements, production of gradient materials, repairs and renewals of products. The laser cladding technology brought new extensions to the production of prototypes, special elements, coatings and repair of elements in small batch production. This played a very important role in tool making and other industries. The company specialised in the two services, laser hardening and laser engineering net shaping of material, and they wanted to offer this expertise to local industry. With this in mind, they hoped to be a catalyst for the creation of new advanced technology services and products, new jobs and higher added value products. The vision of Tic Lens therefore was to obtain a competitive advantage with the Lens technology over other service providers of surface laser hardening and cladding for manufacturers of finished products, initially for the tool and automotive industry and later for the aerospace and other industries.

About the New Managing Director

Matjaz Milfelner was a doctor of science in mechanical engineering and had defended his Diploma thesis, Masters thesis and Doctoral dissertation thesis at the Faculty of Mechanical Engineering in the University of Maribor. During his postgraduate phase he was a Research Fellow, sponsored by the Slovenian government. His research area was production technologies, such as high-speed milling and others. Soon after completing his Ph.D. he enrolled in another national research programme where the Slovenian government partly financed the salary of highly educated experts that were employed in specific companies. He

started to work as a researcher and project manager in a tool shop that later became the main investor in Lens technology. Matjaz never went through any formal training in the field of business sciences, the only exceptions being project management workshops. Nevertheless, he proved himself a very good project manager and at the age of 35 he suddenly became the Managing Director of the newly established Tic Lens Company.

Current Activities and Projects

Matjaz quickly set about establishing a customer base for laser cladding technology and the initial customers were mostly based in Slovenia. His company provided services to manufacturing companies in different industries (tool shops, machine building companies, etc.), with these services including the maintenance and repair of worn out tools, gears, axes etc. Laser cladding technology was perfect for these services as it prolonged the life-cycle of products. The only large and established customer outside of Slovenia came from Austria. However, as no customers had yet been found for the Lens technology, all of the company's initial efforts in that area were oriented towards R&D work. They acquired different materials (powders) and they were manufacturing and testing different prototypes which enabled them to build a database of material, processing and technology parameters. The company required additional funds to finance its R&D phase of technology development and several project proposals had been submitted within different funding schemes in Slovenia and with the EU. Some projects had already been approved and Matjaz found this funding to be extremely useful in helping the company with developing and marketing the technology. The company was also cooperating with several R&D institutions in Slovenia (Faculty of Mechanical Engineering in Ljubljana and in Maribor, Faculty of Medicine in Ljubljana) and they had found R&D partners in Austria and Germany, with the most important partner coming from Dresden, Germany (the famous Fraunhofer Institute). The company had also became a partner within a technological centre for the aerospace industry that had recently been established in Slovenia. Matjaz hoped that this centre would provide a good opportunity to penetrate demanding industries such as aerospace. Unfortunately, the company was not yet generating profits so it had become ever more critical to secure funding in this development phase of the company. The company had received some funding from the founding tool shops, funds from domestic and international R&D projects, and from the Slovene Enterprise Fund that covered part of the salaries for the R&D workers, but it was a constant struggle to keep the company financially afloat.

Problems with Advanced Technologies

Matjaz imagined that advanced technologies with huge potential would be easy to market but over the first two years business had not blossomed or flourished. Although the feasibility study had identified a large number of possibilities in which to use both new technologies in different industries, the reality was somehow different. Potential buyers were not showing as much enthusiasm to use the new technologies as was found in the feasibility study and the majority of sales were services based on laser cladding technology even though the laser cladding technology was no comparison to the breakthrough technology of Lens. While some customers were already familiar with Lens technology, many still do not see its potential. The problem was that information about new technologies was not spreading around as quickly as it should and so Matjaz had problems with marketing his technologies. He also recognised that he lacked the resources (people), time, funds and marketing knowledge to undertake a mass marketing campaign to educate the market. He tried contacting potential customers over the phone, explaining the potential of the technology, but most of them did not recognise such potential. He even offered free demonstrations in his company but this brought little reward. The downside of laser cladding technology was the slightly higher prices charged for the services compared to other more conventional technologies. Some customers did not see that repairing their tools was still cheaper than buying new ones and they just did not trust the technology.

But Lens technology was an even bigger problem as this technology was completely new for the Slovenian, even for the European market. It was expensive since it was very sophisticated and enabled the manufacturing of products that were extremely complex. The biggest problem was that the technology was still in its development phase and a lot of testing with different materials and processing parameters had yet to be undertaken. The majority of work with the Lens machine was still focused on R&D, and while this technology was ready for specific services, the only thing missing was customers with sophisticated needs to use the technology. Again, potential customers, identified in a feasibility study, suddenly disappeared and similar to the situation with laser cladding technology, Matjaz lacked the necessary resources to educate the market. Furthermore, the economic crisis that was sweeping across Europe was not helping as companies became less inclined to engage in breakthrough R&D projects. Matjaz admitted that:

> "*You have to know your potential customers in detail. You have to be aware of their problems or you have to make them present their problems. After analysing these*

problems, you could offer them some specific solutions with Lens and laser cladding technology, but companies usually want short-term solutions that do not cost much."

The automotive, aerospace, defence and other industries were closed to outsiders, and it was extremely difficult to penetrate them being a small high-tech company. A company needed extra certificates, sufficient resources, good references, a strong governmental support and marketing strategy just to get an appointment. This is not easy for a small company.

Strategy and Future of the Company

Matjaz was determined to follow through with this business, and wanted to turn the advanced technologies into a profitable business. The strategy of the company still was to find customers with sophisticated needs in the European automotive, aerospace and defence industries and he intended to undertake personal business visits to several manufacturing companies in the near future. A further important area of interest was medicine as some initial activities and tests had already taken place. Lens technology was used to produce a special modern medical implant and generally medical implant products had to satisfy strict requirements regarding materials, machining technologies and their functionality. They were regulated and classified in order to ensure safety and effectiveness in the patient. A favourite biomaterial used for biomedical applications was the titanium alloy Ti6Al4V due to its characteristics of immunity to corrosion, biocompatibility, shear strength, density and osteointegration. These implants had specific shapes and sizes, and could be very complex to produce. Because Lens technology was an excellent option to produce the medical implants, especially from titanium alloys, the company was seeking new partners in Israel and it was preparing to obtain needed certificates to enter the medicine products manufacturers market. Another market niche it was targeting was the aircraft industry, where some initial contacts were already established with a Turkish company. Matjaz knew he had a lot of work ahead of him but he was determined to develop and long-term effective strategy for his company, with a strong customer-base. He just needed to prioritise his markets and the actions that he should take if he was to achieve his goal.