

FROM WORKBENCH TO CLINICAL PROOF OF CONCEPT: MIRRICON

Much work went into planning the company and proving the technology.

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About 4 years ago, we came together to explore the commercial possibilities of a technology that was being developed in Dublin. This technology, called Mirricon, involved using unique propositions to address the problems associated with IOL power calculation.



An initial research team, formed by the National Digital Research Center (NDRC) in Dublin, consisted of optical scientists from Professor Chris Dainty's group at the University of Galway, two surgeons (Dr. Cummings and Eugene Ng, MD), and computer scientists at NDRC. The team was led by the commercial project head and later CEO of ClearSight Innovations, Mr. Byrne.



The three of us agreed at that time to work together to investigate the technical aspects and commercial opportunities to move this technology forward. This article summarizes the 4-year journey that started with that agreement and led to a valuable and successful product.

FROM RESEARCH PROJECT TO COMPANY

Moving away from the initial research activity of the ClearSight project and into a commercial organization with a clear target to develop commercial technology involved a shift in the dynamics, processes, and aims of all involved.

This endeavor began with efforts on two distinct paths, discussed below.

Technical development. The first path concentrated on technical development with a focus on industry. This was crucial to ensure that all our work practices, development tools, and methodologies met industry standards. Without

this, it is likely any technical discussions with industry or institutional investors would come to an early end.

Commercial development. The other path was commercial. Market analysis is key at the outset of a startup: What problem are you trying to solve? Who are your potential customers? What is your unique value proposition?

Over a period of 2 years, we developed the ClearSight project on three key strands: clinical, technical, and commercial. The project was finely tuned in all of these areas and brought to the point of being investor-ready. We met with a wide range of venture capital firms before concluding on a financing deal that allowed us to spin out in early 2013 into a standalone company, ClearSight Innovations.

THE BUSINESS PLAN

Every business should have a plan developed around it. This is a living document that is constantly being referred to

AT A GLANCE

- The issue of IOL power calculation is talked about frequently and has multiple new papers, formulas, and technologies proposed to address it; however, it still remains a problem.
- The Mirricon technology involves using unique propositions to address the problems associated with IOL power calculation.
- ClearSight Innovations focused on delivering high-quality clinical data at an early stage of product development to prove the technical abilities of the Mirricon technology, before moving forward into industrial design and manufacturing.

and reiterated. It can act as a reference document and allow structured discussion among stakeholders.

There are many templates to assist with business planning. For instance, the basic guidelines outlined by William A. Sahlman are useful.¹ A business plan should consist of several aspects:

The opportunity. This includes a profile of the business itself—what it will sell and to whom, whether the business can grow and how fast, what its economics are, and who and what stands in the way of success.

The context. This is a big-picture view of factors that will inevitably change but cannot be controlled by the entrepreneur, such as the legal and regulatory environments and demographic changes.

The people. This is the team starting and running the venture as well as outside parties providing key services or important resources for it (eg, lawyers, accountants, suppliers, financial services).

The risk and reward. This is an assessment of everything that can go wrong and right and how the entrepreneurial team can respond.

Fundamental questions must also be answered as part of the business plan. How do we structure a business around our unique value proposition? Who are our customers? How do we reach them? How do we establish long-term relationships? What are our key processes and resources, and what kinds of key partners do we need? Finally, how can we build a valuable business around this framework with profitable earnings and reduced costs?

THE OPPORTUNITY

For the majority of patients—with the use of modern optical biometry equipment, informed formula choice, and IOL constant optimization—outcomes of more than 90% within ± 1.00 D and more than 60% within ± 0.50 D of target are achievable. However, reports of refractive predictability from cataract registries show that there is a gap between the published literature of distinguished experts and real-world outcomes, with the latter yielding only 85% within ± 1.00 D and 55% within ± 0.50 D.² Surgeons can improve their outcomes by retrospective data analysis to optimize their A-constants,³ but time and effort are required regularly, which can be challenging during daily clinical routine.

The issue of IOL power calculation, therefore, is one that is talked about frequently and has multiple new papers, formulas, and technologies proposed to address it; however, it still remains a problem. Ultimately, patients want the best refractive outcomes possible, and there is a whole industry working to address the unmet medical needs around this. The value of the Mirricon technology became apparent when examined against this backdrop. Therefore, we concluded that the unique value proposition of Mirricon technology is straightforward:

- Results at the push of a button, requiring minimal technician training time and providing improved clinic throughput;
- Easy decision-making without great expertise and experience, delivering predictable outcomes, and excellent, consistent results; and
- Improved safety, by reducing the possibility of human error in IOL power calculation.

It should be noted that IOL power calculation is a multifaceted problem with a large set of variables that each must be controlled or measured accurately. Thus, improving only one of these variables—whether corneal power measurement, axial length measurement, or prediction of the postoperative lens position—provides only limited improvement. The key is to control and predict all such factors with high accuracy to achieve improved IOL power calculation.

THE CONTEXT

Besides the challenges of strong competitors who are active in a given market (in our case, optical biometry), there are other factors that cannot be controlled by entrepreneurs introducing a product into the global marketplace.

A startup must consider the value to be provided to its customers, how to reach those customers (sales), and how to build relationships with those customers. The question must be answered: Who is your customer? Is it (1) the patient, (2) a health care payer, (3) an individual clinician or hospital, (4) a distributor in a specific region, or (5) other companies offering complementary product (eg, IOLs) or otherwise depending on your product? It should also be noted that, in different regions, one will face the challenge of different sales or customer relation processes.

Based on these considerations, we recognized that our product could best be served by partnering with IOL companies. Thus, we reached out to many companies to discuss the opportunities associated with the Mirricon technology and the possibility of partnerships and to understand the market around IOL power calculation.

Most readers are aware of the legal and environmental challenges, costs, and timelines involved in bringing medical devices into a global market. From a regulatory perspective, optical diagnostic systems are relatively simple, as the risks associated with such devices can be well controlled. A more challenging question is related to how the clinical benefits of such a diagnostic device can be demonstrated by clinical data. Associated with clinical proof of concept is the fact that clinicians today look for clinical evidence that the proposed value propositions will be delivered by the technology in question. So, quite early in discussions with possible partners, we recognized that our hypothesis to bring IOL power calculation to the next level would require clinical proof.

The basic scientific approach of the Mirricon device addresses all challenges of IOL power calculation; however, the

THE VALUE PROPOSITION OF MIRRICON TECHNOLOGY



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only results we had available 4 years ago were based on theoretical calculations or on a limited number of eyes that were measured with a workbench prototype built by the ClearSight Research Project to achieve a technical proof of concept.

Therefore, ClearSight undertook to demonstrate the value of our technology based on a prospective clinical investigation that would statistically demonstrate a clinical proof of concept within the shortest possible time. The plan was to develop high value based on clinical data and by reducing potential risks of the technology (eg. getting reliable measurements for IOL power calculation in cataract eyes) as quickly as possible with the minimum resources required, using a minimum viable version of our product. This approach was, as much as possible, done in alignment with the principles of Lean startup models.⁴

The competitive ophthalmic market is sensitive regarding intellectual property. ClearSight technology was based on an initial patent application that was developed by Dr. Ng, who initiated the ClearSight project in 2008 together with Dr. Cummings. To create further value, we sought additional patent applications in key markets to cover the differentiators of our technology.

THE PEOPLE

Fundamental for every new venture is the leadership team and its ability to execute, manage the organization, and liaise with partners. The ClearSight team consisted of highly experienced commercial leadership represented by Mr. Byrne, who has built multiple companies over the

past 20 years and successfully exited them to larger organizations; clinical leadership of Chief Medical Officer Dr. Cummings, with a strong focus on the delivery of clinical value and usability; and guidance in technical execution from Chief Technical Officer Professor Mrochen and his team at IROC Science, mainly through orchestrating the multiple research and development teams working on hardware, software, and clinical studies. The team was completed by Doug Dowley, a representative of the NDRC with expertise in working with startups.

In addition to the in-house team, we realized a critical element for creating clinical proof is the independence of the principal investigator and study site. Thus, we decided to work with Gerard Kervick, FRCOphth, as the principal investigator, whose ability to enroll large numbers of eyes at the Mater Private Hospital in Cork, Ireland, would allow the study to be completed within the planned timelines. We also decided to partner with a large engineering company that was able to scale manpower for optical and mechanical engineering and firmware development within a short time frame.

Other elements of the company were kept internal, as the functions they were performing represented key know-how and were deemed mission-critical.

For us, it was important to bring our team together mindful of a balance of speed and efficiency coupled with excellence and the ability to deliver a high-quality solution. In choosing this team, one of our main criteria was their experience and know-how in the field. In our opinion, this is essential for any

startup in the ophthalmic space for investment, credibility, and, most important, for developing solutions that will withstand analysis and scrutiny.

THE RISK AND REWARD

A lot can be said about the risks of high-tech startups. Ultimately, up to 90% of startups fail.⁵⁻⁷ In our opinion, the team involved in a startup should always be mindful of this risk.

The reasons for failure are multiple.⁵ Fundamentally, one can reduce the level of risk quickly by looking at key challenges and addressing them early. In the case of ClearSight, we identified and addressed three challenges.

Lack of market need. This is probably the main risk for all startups. To mitigate this risk, from the outset, we started conversations with cataract surgeons, key opinion leaders, industry representatives, ophthalmic center managers, and ophthalmic technicians. Basically, we were establishing a good understanding of how an improved ocular biometer would change the world of cataract surgery in terms of clinical outcomes and financial success for service providers and clinicians.

Ensuring agility and delivering value rapidly in a competitive market. Aside from the classical market entry barriers, we looked at the ocular biometer industry and identified a weakness in the way clinical studies are conducted and published. All discussions are around regression-based formulas, but the technologies used to feed such regression analyses are not questioned. Therefore, we focused on delivering high-quality clinical data at an early stage of product development to prove the technical abilities of the Mirricon technology, before moving forward into industrial design and manufacturing.

Creating value through clinical data is one way to demonstrate a benefit for patients and surgeons. It can further generate market protection because other competitors would need at least the same amount of time to demonstrate that their technology is equal or superior.

Change of focus from researchers to entrepreneurs. One of the big challenges of moving from university research into a commercial organization is the different aims these organizations have. The role of the universities in research should be the quest for fundamental understanding, either in use-inspired research, as exemplified by Pasteur, or in pure basic research, such as that of Bohr.⁸

Researchers must be attracted by the interesting and exciting elements associated with research activity in itself. When technology comes to the point where the quest is no longer for fundamental understanding, but more for pure applied research with a clear intent of use, the technology should move out of the university and into an organization that has a clear commercialization mission, such as an incubator or startup. Team members of a commercial organization must focus on efficiency and effectiveness to develop a product, which is different from the environment researchers experience in academia.

CONCLUSION

Throughout this process, our team was driven by a common motivation for our technology to succeed clinically and commercially. However, at the end of this journey, one might ask, "What reward did the ClearSight team get out of this, what are the possible entries to market, and what are the exit scenarios?"

In sum, we were able to achieve quite a bit:

- Successful building out of our business plan and delivering against same;
- The ability to offer an IOL power calculation method without the need for formulas;
- A statistically robust clinical proof of concept that also demonstrates the future abilities of the Mirricon technology;
- Creation of value with excellent clinical data, superb technical achievements, and novel intellectual property;
- Sale of the Mirricon technology to a larger company, ensuring that our scientific, technical, and clinical achievements will find their way into the global cataract market; and
- An excellent financial return against capital investment.

Additionally, all team members learned a lot during this journey and can add a great experience to their personal profiles, and we formed some great friendships. ■

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