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COMMERCIALIZATION OF INVENTIONS AND RESEARCH RESULTS: MANAGING TECHNICAL AND COMMERCIAL DEVELOPMENTS TO OPTIMIZE OUTCOMES

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I. INTRODUCTION

Evidence world wide reveals that only a small proportion of inventions and research results ever become a commercial success, even though they may be a technical success. Approximately one success in one hundred is the figure generally quoted, where success is measured by a project's asset value, profitability and return on investment.

At Flinders Technologies, during the past eleven years, we have managed to beat these rather challenging odds.

The company's average internal rate of return has been 70% per annum. From 34 projects we've chosen to commercialize out of 350 opportunities, we have 3 major successes, 4 moderate successes and 7 new projects that show great promise. Thus, the ratio of "major successes : failures" is about 1 : 10. If we add in the moderate successes the ratio of "successes : failures" : is about 1 : 5. These results are for research projects and inventions that are commercially embryonic when we begin to manage them.

We have provided some $10million benefits to our share holder, have created some multi-million dollar Intellectual Property (IP) assets - which we treat prudently off balance sheet - and have formed valuable strategic relationships for research & development (R&D) and international business. We may have been fortunate, but I like to think there has been some logic and planning too.

In my address today, I would like to share with you some of the management strategies we have adopted in order to optimize both the chances for success and the outcomes from research commercialization. However, I do not want to suggest these are the only approaches; only that they have proven helpful to us.

The key management strategies have been as follows:

- A Commercially Focussed Technology Commercialization Company
- Formation of Alliances & Networks
- Careful Project Selection
- Thorough Evaluation of Commercial Potential
- Business Plans to Optimize Technical and Commercial Outcomes
- Project Portfolio Management: Innovation Investment and Funds Management

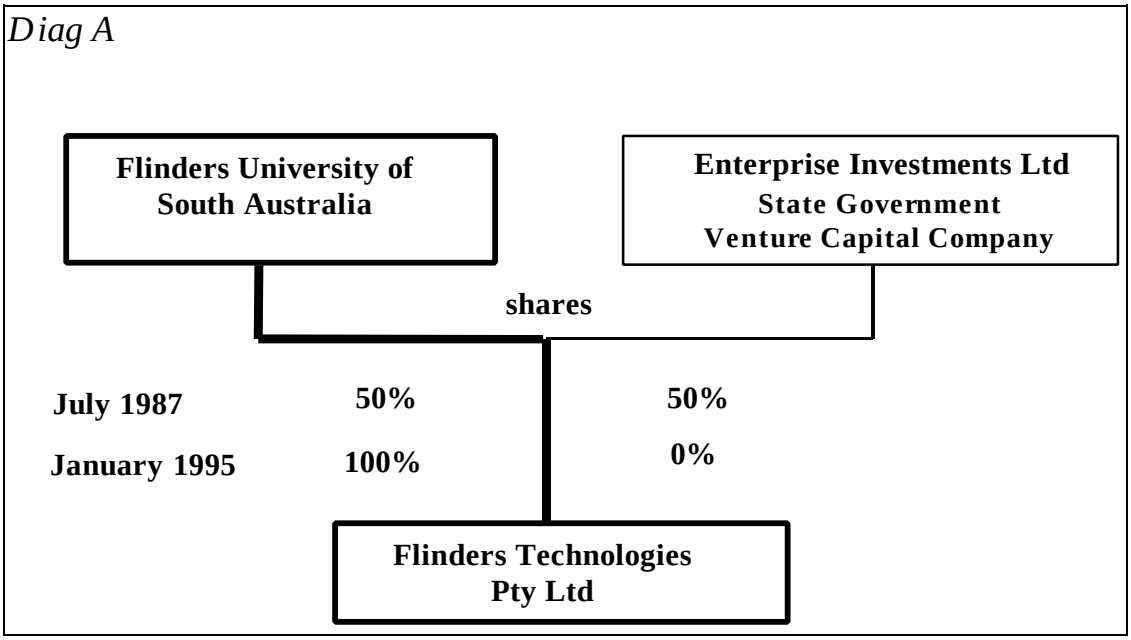
I will briefly discuss each of these elements in turn.

II. COMMERCIAL FOCUS

Flinders Technologies began in July 1987 as a 50/50 joint venture between Flinders University and Enterprise Investments Ltd, a venture capital company owned by the Government of South Australia. This initial structure and a financial base of minimal loan funds, put pressure on the company to become profitable as quickly as possible. A commercial focus and culture was developed which was beneficial financially – we became profitable in only two years. It should be noted though, that the joint venture structure and operations were not readily accepted by all sectors of the University and this presented some difficulties.

In January 1995, all the shares in Flinders Technologies were acquired by The Flinders University of South Australia (see *Diag A*). However, the Company is still commercially focussed and runs as an independent entity with its own Board of Directors and me as Managing Director.

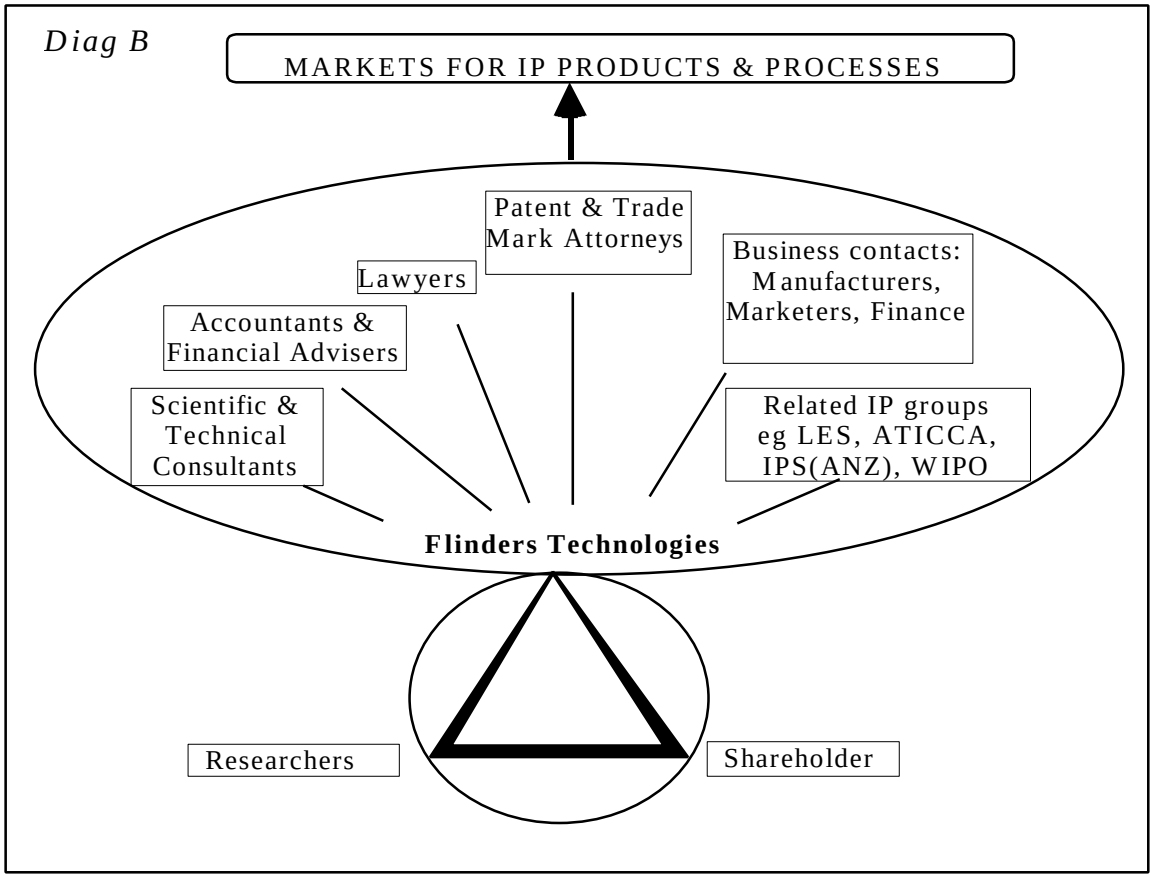
Diag A



Our commercialization strategies tended to be quite conservative initially because we encountered the stock-market crash of October '87, just after start-up. We invested in projects only after careful evaluation and business planning for development and commercialization and we tracked the performance of each project through a project-based accounting system. The drive to become self-supporting made us lean and hungry. We out-sourced (i.e. contracted out) much of the professional assistance needed and made strategic alliances. I will now discuss this further.

III. FORMATION OF ALLIANCES & NETWORKS

Unless a technology commercialization organization is large, for example one associated with a major technology-based corporation, it is uneconomic to employ specialist professionals in-house to provide the expertise required. We have in-house professionals who are generalists with broad experience and expertise in technologies, project portfolio management, innovation fund management, legal and patent matters, marketing and international technology commercialization. However, we have established linkages with professional specialists such as patent attorneys, lawyers and technical experts, both locally and overseas. Moreover, we have built up contacts in some major companies throughout the world and this helps us reach key decision-makers when approaching companies with IP opportunities for licensing or other business arrangements (See Diag B).



Our networks extend backwards into sources for new projects, e.g. into research organizations, especially Flinders University and technology based SMEs, because a good flow of new opportunities for commercialization increases the chances of finding a potential success (i.e. quality deal-flow is a success factor).

Careful project selection is of paramount importance to avoid failure.

IV. CAREFUL PROJECT SELECTION – THE R&D CHECKLIST

Research results and inventions are often at an embryonic stage commercially when they come to our attention. Moreover, research is sometimes done more out of inquiry into new phenomena rather than with a market in mind. This is especially true for university research. Another way of expressing this is to say projects are based upon "technology push" rather than "market pull".

To achieve success in research commercialization, it is important from the outset to select projects that have the greatest potential, not only technically but also commercially.

General experience shows that only about 1 in 10 projects will make a profit and 1 in 100 will be a significant success although, as I have noted above, our results are somewhat better. The lead time before a new invention reaches the market can take several years (particularly for biotech projects although for IT projects the lead-time is usually shorter).

Given the lead time and related cost of commercial development, it is important to appraise carefully a project's commercial potential before committing time and resources to it.

Our starting point is a RESEARCH COMMERCIALIZATION CHECKLIST. This helps us inquire into key issues (such as ownership, IP position, market potential) and to identify potential weaknesses and fatal flaws that will disqualify the project from further evaluation. The Checklist is completed by the originator of the project. If the results are promising, we will undertake a detailed evaluation of the commercial potential.

V. EVALUATION OF COMMERCIAL POTENTIAL – THE PROJECT SCORE SHEET

We evaluate each project's potential by giving a score to the individual elements that normally contribute to success or failure. The total for a project enables ranking on merit against other projects. The absolute scores are compared with a data-base of previous failures and successes.

The Project Score Sheet has some 64 questions in three major categories.:

REVENUE POTENTIAL, LIKELIHOOD OF SUCCESS & PROJECT COST

Three examples of questions in each category are given in the table below.

Revenue Potential	**Likelihood of Success**	**Project Cost**
Market Characteristics	Market driven	IP Costs
IP 'monopoly'	Stage of development	R&D Investment
Competition	R&D team track-record	Project Management

In order to answers the (64) questions we carry out several detailed inquiries, for example:

1. Technical Audit

The technical audit compares the new discovery or development with existing products or processes and seeks to identify all the strengths and weaknesses and record their commercial significance. New technology developed because of a market need is more likely to be commercially relevant than technology that is clever but of limited practical use. Moreover, incremental improvements to known technology are generally easier to commercialize than new "breakthroughs". However, a breakthrough invention could have greater significance and market value, especially if it has general applicability.

We favour projects where it's possible easily and quickly to confirm both the principle of the technology and to add value through further technical developments.

2. Market Assessment

This examines market potential (location of markets, volume, value, competitors, possible allies) and growth over time. A project should have ideally a large financial "up-side"; that is to say, a market potential for products of several million dollars per year. This is necessary to compensate for the expense and risk of developing a project (I can elaborate on this issue in question-time if requested). We seek information on the following:

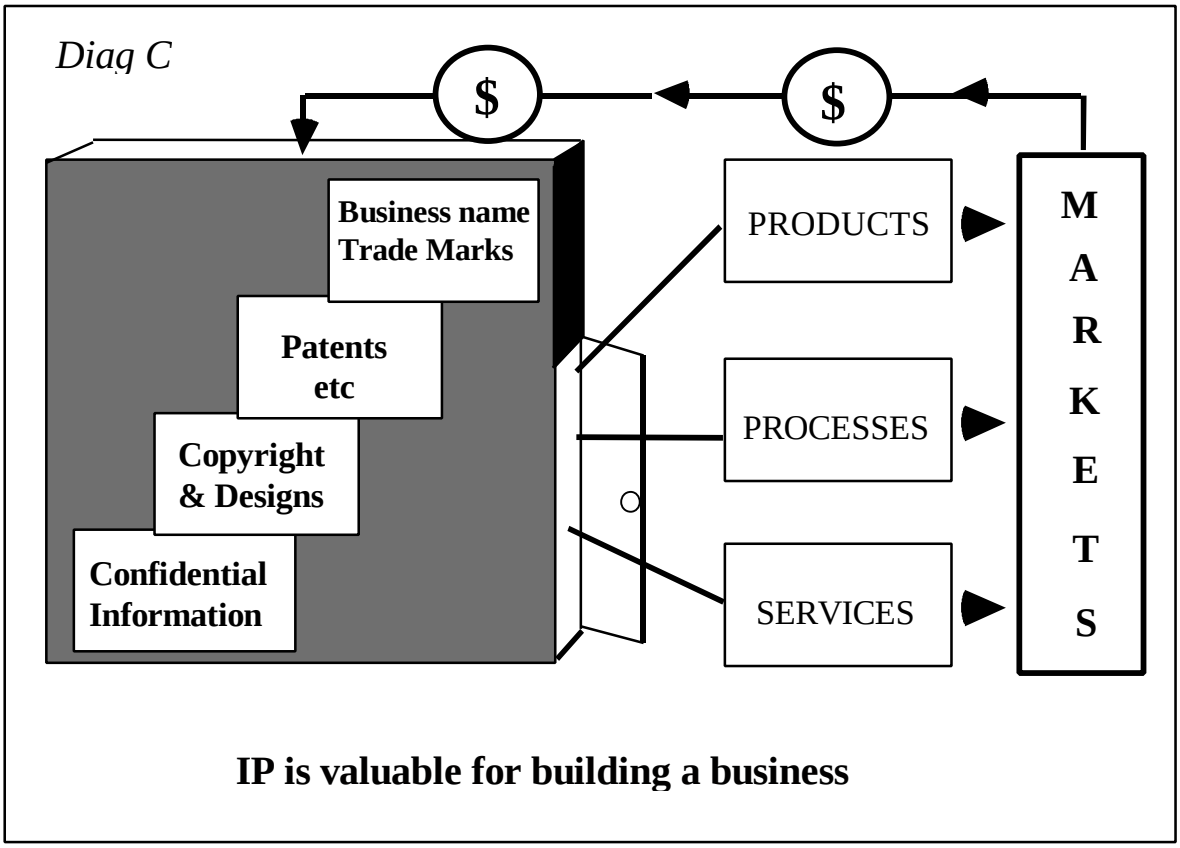
- diversity of products or processes to which the technology is applicable;
- location of markets;
- $ value of individual markets;
- market size as global sales ($ p.a., sales volume p.a. & growth);
- competitive products (price per unit & sales volume – if available);
- competitive firms and researchers;

- potential allies.

3. Intellectual Property Audit

Intellectual Property (IP) is a foundation for business. Typically, IP begins as a new idea or discovery that is confidential information. The confidential information is usually written down and copyright IP is created. Then, tests are done and perhaps a patentable invention is made, resulting in more IP.

These elements of IP individually or collectively can constitute a basis for building a business that may develop additional valuable IP as Trade Marks, Business name and reputation. Through its operations the business will create further confidential information and the cycle of innovation continues (see Diag C).



Therefore, it is important to assess:

- the IP elements in the project (whether there is for example confidential information, copyright, a patentable invention and so on);
- who owns the proprietary rights in the project;
- if the rights can be transferred to the Technology Commercialization Company (eg Flinders Technologies);
- whether there have been any disclosures;
- how the rights can be protected;
- whether additional valuable IP can be created;
- whether there could be infringement of third party rights;

- the potential cost of IP protection and management.

4. Further Development Required

Inventions and early stage research can rarely be commercialized without further investigation and development, for example to demonstrate technical feasibility or to build a pre-production prototype. The requirements for this are calculated in terms of time, the resources needed, and costs. An estimate of the unit cost of the finished product or cost of introducing a new process is also needed to help work out the potential economic benefits of commercialization.

5. Regulatory issues

Most countries have regulations and laws governing the conduct of business. These can impact upon the development and launch of a new product or process. For example, before a new medicine can be released, typically it must satisfy efficacy and safety requirements and be passed for use by a government department of health. This is a fairly obvious example. The point is, it is prudent to check what government regulations, if any, are relevant to the project. Compliance with such laws can be time consuming and costly and must be factored into the strategy for commercialization.

6. Financial Requirements

Research commercialization can only proceed through further investment. This could be by company like ours, by an outside financier, manufacturer or marketer or by some other means. In developing a commercial strategy, it is important to establish the financial requirements for a project both in terms of dollar value, the kind of investor required to take the project forward and exit strategies for investors. The characteristics of potential investors should be defined in terms of their capabilities, financial strengths and likely commitment to the project. Those meeting the requirements can then be further evaluated.

7. The R&D Team

An assessment should be made of a researcher's potential to work well with others and to achieve goals in a timely fashion. Researchers are not usually experienced in managing IP, commercial law, finance, the development of a commercial product, manufacturing and marketing. However, these business activities will be important for adding value to a technology and its overall commercial success. It is a golden rule that if you have to choose between a great project with a mediocre R&D team, and mediocre project with a great R&D team, THE PROJECT WITH THE GREAT R&D TEAM IS THE BEST CHOICE.

In our experience, a simple indication of how easy it will be to work with a particular research team is to see how they respond to a request to complete the R&D check-list.

I will now turn to the part of my paper that addresses optimizing the potential of research commercialization.

VI. BUSINESS PLANS TO OPTIMIZE TECHNICAL AND COMMERCIAL OUTCOMES

Having decided which projects to pursue, the next task is to create business plans for "managing-up" the projects with good prospects in order to optimize their value and the financial returns.

As a general rule, the greater value that can be added before involving third parties, the greater the rewards to the Technology Commercialization Company. This can require the Company to provide financial support for R&D as well as supporting costs of IP protection and project management, often over several years. In other words, the Company must be prepared to accept some risk in order to optimize the benefits. Therefore, a Technology Commercialization Company should:

1. Add Value to the Project

There are two important elements :

- TECHNICAL VALUE ADDING: e.g. this can be achieved by making further technical developments, particularly those which meet a market demand, and

- COMMERCIAL VALUE ADDING: e.g. through protection of IP, understanding the market, knowledge of investors and competitors, evaluating the merits of possible commercial arrangements and, importantly, preparation of an attractive investment prospectus.

2. Reduce Apparent Risk for Investors

This can be done for example by:

- verifying the scientific and technical viability of the project (in-house and by using third parties) and,
- commercial diligence e.g. by undertaking patent searches, obtaining written independent assessments of the technical and IP strength, market potential and feasibility of any proposed developments.

3. Harmonize Technical and Commercial Strategies

Having a productive relationship between researchers and their research commercialization colleagues is very important. Here are some practical suggestions to achieve this, for managers of Research Commercialization Companies:

- HAVE REGULAR MEETINGS WITH RESEARCH WORKERS. These should seek agreement on the technical and commercial goals and review progress;

- SECURE IPR AND AVOID PREMATURE DISCLOSURE**.** Keep comprehensive dated records of the research and communications related to it. Do not provide valuable information to third parties without adequate protection. Use appropriate Confidential Disclosure Agreements (CDAs) and "Supply of Materials Agreements" (SMAs) when giving proprietary information and/or materials to others;

- BEWARE OF COMPROMISING IP RIGHTS. Third party CDAs and SMAs should be reviewed carefully. "Grants" which a research institution may wish to accept may actually be contracts under which third parties claim ownership in IP created. Terms for a research institution's collaborative activities with outside groups should be agreed and understood by all those involved, if there are potential IP consequences. Only senior executives of an institution and the Technology Commercialization Company should have authority to bind these entities in contracts and "informal" collaborative arrangements should be avoided. Also, it is often overlooked that, unless there is an agreement to the contrary, consultants are normally the owners of the IP they create (at least that is the law in Australia);

- ENSURE THERE IS AN IP POLICY. This should provide incentives and rewards for 'inventors' and be understood by all concerned**.**

4. Optimize Deal Structures, Management and Negotiations

Deal structuring and management and skilful negotiations are vitally important components in the commercialization of research. Negotiations may also provide an opportunity for the acquisition of funds for further R&D. The structure of deals and negotiations are subjects in their own right. Time does not permit me to give a detailed review but relevant technology commercialization structures and mechanisms include : technology start-ups and joint ventures, exclusive and non-exclusive licenses, franchises and assignments, capital raising, innovation investment and funds management. I will briefly discuss this last example in my final comment on key management strategies.

VII. PROJECT PORTFOLIO MANAGEMENT: INNOVATION INVESTMENT AND FUNDS MANAGEMENT

So far, I have addressed mainly the management and commercial development of individual projects and optimizing project outcomes. However, we know that even with the best efforts to pick winners, a high proportion of projects will fail either technically or commercially or in the case of SMEs through poor management.

In order to succeed overall therefore, a Technology Commercialization Company must manage its risk by investing in and managing a portfolio of projects. Out of the portfolio

should emerge a few significant projects to offset the failures and make profitable returns overall for the Company.

In summary, the benefits of seed investments in a portfolio of technology projects are :

- Investment risk is spread across the portfolio rather than focused on a single project at a time;
- More projects are dealt with in a shorter time;
- Likely successes and failures are identified earlier;
- Likely successes can be supported with more confidence in 2nd & 3rd round funding : failures can be abandoned quickly;
- The portfolio manager can apply experience across a range of projects to the benefit of each project and the portfolio overall;
- The boom-bust financial cycle is smoothed out when financial returns from successes come on stream.

Flinders Technologies has over the years, made seed capital investments in projects and through successful transactions and retained earnings, built a modest fund for continuing investments in new technologies.

There are other advantages in having an innovation investment fund and seed capital investments. These are illustrated in *Diags D* and *E*.

Diag D shows that a lack of seed and start-up capital leaves a funding gap between research that is early stage and high risk commercially (e.g. research after 2 years which often has arisen out of support through government) and research developed to a point (e.g. after 6 to 10 years) where the risk is lower and investment is more attractive to the technology corporates and venture capitalists.

A consequence of insufficient innovation funds, is that most R&D projects at an early stage will never ever be commercialized because they never receive the capital necessary to reduce investment risk to a point attractive to the technology corporates, venture capitalists and eventually financial markets and institutions.

On the other hand, as seen from *Diag E*, the effect of innovation funds providing seed and start-up capital is to :

- Speed the reduction of risk;
- Create value-added projects for down-stream investments, i.e. a deal flow from early stage R&D to marketable products and processes;
- Stimulate investment growth in technologies;
- Accelerate innovation and enterprise growth;
- Create new job markets in high-tech firms.

Managers of innovation investment funds should be skilled and comfortable operating at the high-risk end of the R&D-commercialization spectrum. They must be capable of relating to and providing regular support to the management of technology based SMEs and R&D teams, which often lack expertise in IP management, law, finance, accounting, marketing and general business.

VIII. CONCLUSION

I have commented on the practical aspects of identifying and evaluating IP and research with commercial potential and have discussed management strategies for optimizing outcomes. To sustain a high level of success, it is desirable to have innovation funds for seed or start-up investments and to manage not only individual projects but a portfolio as a whole. You will appreciate that in effect, our Company functions like an Innovation Center. Innovation Centers in various forms have been set-up in countries around the World to promote commercially promising inventions and innovation and I will be discussing this in my next presention at this Seminar.

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