TransTech Capital LLP

Investigating the potential for Intellectual Property commercialisation in Azerbaijan.

1 EXECUTIVE SUMMARY

TransTech Capital LLP ("TTC") with the support of Azerbaijan's Ministry of Communications and High Technologies has reviewed the current status of Intellectual Property (IP) commercialisation in Azerbaijan. The study's findings and recommendations are based upon meetings and discussions with a number of academic institutions i.e. the "Research Base" with whom TTC met, interviewed severally and consulted by telephone and e-mail over a four-month period.

TTC has considered these academic institutions readiness and potential to generate IP that could be commercialised, thereby contributing to Azerbaijan's economic growth. The review includes certain recommendations to accelerate IP innovation and commercialisation including suitable funding structures.

TTC identified significant underexploited Intellectual Property (IP) within Azerbaijan's Institutes (ANAS) and its Universities and Academies. However, the IP is currently not codified or protected to international standards. Historically, the impetus amongst Azerbaijan's academic institutions has been to publish research, not to consider its commercial potential. However, even with this impetus, the number of internationally recognised papers and level of citations from Azerbaijan is low compared to peer countries.
TTC found that in general, academic institutions recognise that Intellectual Property is a potential commercial asset that if correctly managed could make a significant fiscal contribution and help to reduce Azerbaijan's economic reliance on its hydrocarbon assets.

For IP innovation, entrepreneurship and commercialisation to flourish in Azerbaijan (alongside traditional academic research) TTC recommends that academic institutions focus on implementing:

1. Transparent, published regulations which enable institutions to create, develop, protect and use the IP generated within the institutional environment and to recognise and reward the inventors of the Intellectual Property.
2. Clearly defined processes and structures which inventors can rely upon and which will encourage them to come forward with their ideas and inventions. Reliable guidance for inventors on how to record their inventiveness and the steps toward commercialisation. Processes should cover the actions and responsibilities of all involved parties across the developmental, funding and ownership events from invention through to commercialisation and the distribution of financial return.
3. A culture which encourages enfranchisement and entrepreneurship and a willingness to subject inventions to technical and commercial investigation by potential domestic and international investors and industrial collaborators.
4. and making available a variety of funding types to support these changes:
    a. Funding to convert research into products and services. Given the current level of potential projects, it is estimated that an initial allocation of 1 million AZN per annum would be sufficient to 'pump-prime' this process. There are projects ready now which require funding to progress.
    b. Implementation of equity style funding for new and spin out businesses. TTC estimates that current demand is for 5 – 10 million AZN per annum and potential investments already exist.

Subject to the report's recommendations being carried out, TTC estimates 10 – 15 IP commercialisation opportunities being created per annum, in the short term, with numbers growing steadily year on year as successful role models are created.

KEY FINDINGS

1.1 Innovation

1.1.1 Current IP Commercialisation

The Intellectual Property TTC identified across the Research Base as having been commercialised is largely within Azerbaijan's National Academy of Sciences ("ANAS"), where a number of projects can be regarded as in advanced prototype stage. In these instances, product is being manufactured and distributed on a semi-commercial basis but with no commercial entity created in which a commercial team could be hired and remunerated to drive the commercial success of the activity.

1.1.2 Intellectual Property Ownership

There is significant non-commercialised IP within the University sector and ANAS. However, it is poorly codified and protected. In many of the ANAS institutes, the impetus has been to publish research, without considering its commercial value. Despite this, the number of internationally recognised papers and the level of citations received is low compared to peers (see Appendix 2).

It is worth noting that as a general rule, once IP has been disclosed by publication it will no longer be protectable by patent.

Ownership of IP in Azerbaijan's academic institutions presents a confused picture:

- Within ANAS all IP generated belongs directly to ANAS with the inventor having no ownership or participation.
- Universities however, appear to have no IP ownership clauses in their employment contracts with ownership of IP therefore residing with the academic and the University having no rights.

Normal international practice is for employment contracts to include a clause that the employer automatically owns the IP created by its employees in the course of their employment, unless the contract of employment specifies an arrangement to the contrary.

Employees of academic institutions will usually include professors, readers, lecturers, technicians, research staff, project officers, experimental officers, support staff and administrators. Students will not normally be employees unless, in addition to being registered students, they also have a contract of employment with the academic institution.

Whilst ANAS has a database of all projects being undertaken within its institutes, and tracks patent filings, the university sector does not appear to replicate this.

1.1.3 Intellectual Property Protection

In terms of the number of national patent applications per year, Azerbaijan compares quite well on a per capita basis with its peers although this has been steadily falling for a number of years. However, the number is significantly behind that which a developed nation with a strong industrial base would be producing. Very few of Azerbaijan's patent applications progress to international filings, which is a requirement for successful international commercialisation (Appendix 2).

The spread of disciplines in which patent applications are being made is diverse, and are in areas which could form the basis for commercialisation (Appendix 2).

The current lack of international protection for IP is not in itself a barrier to beginning the exploitation of IP. There are two opportunities for Azerbaijan, which are not mutually exclusive, but can be pursued in parallel:

- National exploitation of IP to increase GDP by reduction of imports
- International exploitation of IP to stimulate exports.

IP which only has national protection can be used to displace imports, for example in the production of high efficacy fertilisers or automotive lubricants. A number of proposals for fertilisers have been seen, and could potentially be implemented for domestic use and export within the local region. However, better protection and a careful review of strategy to understand the economics of manufacture versus licencing could ultimately lead to expanded export potential.

1.2 Processes for Technology Transfer

"Technology Transfer" describes the process for formal transfer of rights from scientific research to another party in order to use and commercialise new discoveries and innovations resulting from that research. The rights may be Intellectual Property in the form of patents, utility models, copyright, industrial designs, domain names, trademarks, know-how or other forms of IP, depending on the product of the research (Appendix 3).

Although those Academic institutions TTC met in Azerbaijan aspire to having a Technology Transfer Office ("TTO"), most are only recently formed, and are at best nascent. The key processes which a TTO needs to deliver are mostly absent. A more detailed description of the Technology Transfer Process is included in Appendix 4.

No university TTC met appeared to have:

- a formal IP register or invention disclosure process tracking what IP is being generated within the University. Given their lack of ownership, this is perhaps unsurprising.
- any form of intellectual property policy, or invention disclosure procedure or form.
    - In order to protect the rights of all members of staff involved it is important for the institution to fully determine the facts relating to an invention, design or production of copyrightable material (including software and semi-conductor topography). An Invention Disclosure Form is intended to record the invention and be lodged with the body responsible within the institution as soon as practicable. The information in this form may be used to assist the institution's patent agents and is the basis of a statement of inventorship in respect of a patent (or other registration).

Although universities have identified projects they believe could be commercialised, due to a general lack of funding they are stalled at either the research or pre-prototype stage. Some example case studies of potential Spin Outs are included in Appendix 5.

ANAS has a database of all projects being undertaken within ANAS, which is maintained by the Innovation Department. They have analysed the 500 plus projects and identified 20 which they believe are commercialiseable. This is being done internally as part of ANAS activities. However, there is no visibility of market research, formal business planning or commercially motivated teams focussed on the success of the projects.

There is however strong interest from a number of staff within the Universities and ANAS to move projects forwards into the commercial sphere.

It should be emphasised, that there is no "one size fits all" model for IP commercialisation. Whilst the processes and steps required remain constant, how the organisation tasked with the process is structured and developed is specific to the country and organisation for which it is being developed, and the organisation will evolve over time as the processes become more established and mature.

1.3 Funding

There is a clear need for funding to move intellectual property through the technology transfer process, particularly in the University sector. ANAS appears to have some internal resources from within its grant, and has previously accessed resources from the Science Foundation of the State Oil Company of Azerbaijan (SOCAR) to advance its projects. Nevertheless this does not appear to be formal and transparent nor is it likely to be sufficient.

There is funding available from the ICT Fund but this is focussed on ICT Start-ups, rather than commercialisation of research, and the structure of the financial instrument is unattractive for developing a technology business from research through to spin out and commercialisation.

2 RECOMMENDATIONS

2.1 Innovation and Processes

Central to any IP commercialisation strategy is a clear understanding of:

- Who owns the IP?
  - At present this is unclear, and needs clarification
  - Ownership needs to be clear to institutions, academics and potential 3rd party investors and domestic and international industrial collaborators.

- What form of IP protection is required, depending on the commercialisation route
  - Currently applications for IP protection are limited, and what is in place will not provide defendable protection in the international marketplace

- Who will pay to develop the IP, and process patent applications

- Who benefits and by how much from any economics associated with success

Processes need to be established and strengthened with both ANAS and the University sector to address these IP issues.

Teams capable of executing technology transfer need to be trained-up to implement technology transfer processes.
Academics need to be made aware of the potential for gain from commercialisation, and the processes which they need to go through to begin the process.

2.2 Funding

There is a clear need and demand for funding at all stages of technology commercialisation. TTC has defined three styles of opportunity for generating new companies from academia, each of which has slightly different funding requirements:

New companies
- Could come from anywhere, probably student led probably mainly ICT
- Low initial funding requirement
- Need incubation space close to university
- Require specialised start-up funding

Spin Outs
- Science and academic led
- Need access to university facilities
- Probably 'Technopark' based, at least initially
- Require POC funding followed by (if successful) start-up equity funding

Privatisations
- Moving activity developed and currently run within ANAS out into the private sector
- Require larger funding packages
- Possibly based on High Tech Park, or an Industrial Park.

New companies flourish in environments where they feel 'comfortable', have access to amenities and most importantly can attract staff to work. The history and development of "technology clusters" shows that new companies flourish where staff are happy, rather than in what might appear to be the most appropriate locations. Therefore TTC would not recommend a prescriptive as to where new companies and spin outs might be based.

2.2.1 Proof of Concept ("POC") Funding

Although a vital part of the funding process, it is the most difficult area of funding from which to make commercial returns. Therefore it is normally provided by governments to prime the IP commercialisation process.

Proof of Concept funds are used to move IP from theoretical concept to practical exemplification.

- PoC projects are designed to prove the principle that an invention or discovery is capable of significant wealth creation
- They are NOT a spin-out company. They are pre-spin out projects. Project cash is managed by university accounts system

- The scope of a PoC project includes:-
  - Commercially relevant R&D
  - Product / specification development
  - Patent filing and exemplification
  - Seeking licenses to background IP
  - Market research
  - Regulatory review
  - Commercial planning

A useful data point is that the UMIP Premier Fund, the fund managed by MTI (TTC's parent company) which invests in Manchester University's POC activities invested £2.7 million in 31 POC investments in 5 years. This was into a well-established research base, with excellent TTO facilities and a well-informed academic base, but represents what can be achieved from a single university base.

The normal metrics TTC would consider for Proof of Concept and Seed Funds are:

- Financial aspirations: return of capital
- Evergreen funds recycling cash
- 25% of POCs transition into companies
- 30% of companies provide a degree of commercial return

There is currently sufficient high quality research available with ANAS and the University sector to produce up to 20 investable POC projects a year across Azerbaijan. This will grow in future years as academics become more aware of the potential to commercialise their research.

Whilst ultimately, each academic institution would have control of its own POC fund run by its own TTO, with the current standard of TTO provision, TTC recommends that an initial POC fund be established centrally with a capable independent TTO team administering it. TTC recommends that an initial fund size of 15 million AZN would be suitable. Details as to how this figure was reached are given in Table 4 Appendix 6.

An alternative would be to set an annual budget which could be adjusted to reflect changes to the level of potential POC projects coming forward.

2.2.2 New Companies and Spin Outs

Start Up funding is available in the form of loans from banks supported by the ICT Fund guarantee. This provides basic banking facilities for start-ups which is excellent, and an improvement over the positions in some jurisdictions. However, loan funding is rarely in the best interests of early stage companies for reasons which are discussed in Section 4.5 - Use of Financial Instruments.

The normal metrics TTC would consider for funds targeting investment in companies at this stage of development would be:

- 10 -12 year limited life funds
- Financial aspirations: commercial return (after costs) of 10 - 20% IRR.
- 70% of investments provide a commercial return

Demonstrating successful funds with these characteristics will attract private sector money into investing at this stage. A returns table illustrating what returns are required by each investment, and by the fund as a whole is included in Appendix 6.

Companies normally require a series of funding rounds, which grow in size as the company develops with the relative risk to company and investor changing at each funding round.
The later the stage of the company, then the lower the commercial risk of providing the funding (investor risk), but the number of providers and their willingness to invest decreases raising the possibility that the company may not be able to raise money and either stall or fail (company risk).

In developing markets, where investors have in the main not had exposure to venture capital it often remains difficult to engage investors in funding early stage ventures. There are a number of reasons for this:

- The size of the investments is too small for large corporates or very High Net Worth (HNW) individuals to consider.
- The concept of portfolio investing to cover risk is not fully understood, and making single investments tends to be perceived as too risky.
- Investors want to choose their own investments and therefore investing in funds is unattractive even though it offers portfolio spread.
- The apparent lack of liquidity and long holding periods connected to investing in early stage businesses deters investors.

In Turkey, HNW investors have a c. 2-3 year holding period in mind when investing. This focusses their interests on short term ICT (e.g. internet) style projects with the emphasis on speed of return rather than what maybe more in the economies interest i.e. hard-science based investments which generate significant returns over a longer time frame.

Although business plan competitions have begun to emerge in Azerbaijan, the prizes associated with winning them are not sufficient for the businesses to develop. In one instance a start-up business had been supported to enter numerous regional start-up competitions winning several of them. Around 100,000 AZN provided by the sponsoring

University had been spent entering the competitions, but the business had won 18,000 AZN in prizes and is unable to continue its commercial activities due to lack of funds.

Another start up business had been offered relatively modest funding from a private investor, but the pricing of that investment was such that management would have been left with minimal equity and have been demotivated from continuing the business.

If an Azerbaijan Venture Capital industry is to emerge and begin to demonstrate that the country is producing investment grade propositions capable of providing investors with commercial returns, then government pump-priming is probably required, not only to grow the initial businesses to a level that attracts third party investors, but also to establish best practice in terms of pricing and financial instrument selection and portfolio company support for the future.

Whilst initially this might be wholly government funding, in the longer term co-investment funds are often a good way of making most effective use of government funds, were government backed funds agree to invest pari-passu with private investors.

Subject to the report's recommendations being carried out, TTC estimates 10 – 15 IP commercialisation opportunities per annum being created in the short term with numbers growing steadily year on year as successful role models are created. This would require funding of the order of 75 million AZN over the next 10 years for the initial funding rounds.

This recommendation is for a fund which would help with the establishment of the new companies and start-ups, but additional funding will be required for further funding rounds. This is important to protect the position of the initial funder and minimise dilution. Developing 10 - 15 companies a year through to commercial success and profitability will require the availability of additional funding of around 35 million AZN per annum or an initial fund of around 200 million AZN. To seed the market, an initial fund might be provided by or corner stoned by the government, but the success of the initial fund will lead to private sector and international investors being willing to commit capital for future funds.

2.2.3 Privatisations

TransTech believes there are several projects currently running with ANAS which would grow more rapidly and be more commercially successful if they were transferred to the private sector. These include their activities in lubricants, Napthalan and potentially seismic monitoring.

None of these is currently ready for such a move, and considerable work will be required to establish the commercial business including preparation of the business plan and recruitment of commercial teams. However if run on a commercial basis, by teams remunerated on the success of the business, they will be significantly more successful.

Funding these de facto privatisations should probably be considered on a case by case basis.

2.3 Use of Financial Instruments

Funding for early stage companies should largely be based on the sale of their equity. This is important as it aligns the investor with the management team, and does not leverage the balance sheet making the business unattractive to future investors.

- Loans even with a 10 year maturity may well fall due before the company is ready to achieve a significant liquidity event which might enable the repayment of the loan.
- Using loans to fund a business where the loan is only likely to be repaid at exit misaligns the investor and the management team. The loan ranks ahead of the managements equity and therefore the exit expectations of the loan note holder and the management team are highly diverged.
- Having a highly leveraged balance sheet deters other funders who may be looking to invest in the company looking for equity style returns.
- Maturing loan notes may drive companies to seek premature exits.
- The returns from loans to start-up businesses which are successfully repaid will not be sufficient to compensate for the losses which will be made on unsuccessful loans, so the fund is unlikely to be self-sustaining and will require additional funding in the future. This will not demonstrate that funding start-ups can provide commercial attractive returns and attract other funders into the market.

In the event of a company sale, financial instruments are (usually) paid out in the following order:

- Accrued by unpaid interest on loans
- Loan Capital
- Preference shares
- Ordinary shares

This can lead to different investors receiving significantly different returns on a company sale, and therefore drive different behaviours. This is demonstrated in the example given below:

Investment Returns

Assume a company is created with 100 shares for management. It raises 1,000,000 AZN loan with a 5% compound interest rate and issues a further 100 shares for 1,000,000 AZN in equity with a 1x preference.

After 5years the company is sold.

Company Sale Price	2,000,000	4,000,000	5,000,000	10,000,000
Distribution to Lender	1,276,282	1,276,283	1,276,282	1,276,282
Distribution to Equity Investor	723,718	1,861,859	2,361,859	4,861,859
Distribution to Management	-	861,859	1,361,859	3,861,859
Lenders 5% Return	28%	28%	28%	28%
Equity Investor % return	-28%	86%	236%	486 %

There is a clear mismatch between the lenders returns and those earned by the equity investor

The above example makes it clear that inappropriate selection of financial instruments causes serious misalignment between management and investors, and even between investors. In the example, the loan provider is indifferent to exit price, provided that it exceeds 1.3 million AZN as they receive no upside on their return above that valuation.

It is possible to construct funds where one investor will subordinate their returns to other investors to encourage investment from the private sector, but discussion of this is probably beyond the scope of the current report.

2.4 Findings, Summary Table

	In House	In Collaboration	Capture & Collation	Selection	Initial Funding	Development
Key Questions	Is the academic sector creating good ideas?	Does it have strong links with industry to understand their issues?	Are there strong mechanisms to capture new IP?	Are there processes in place to screen ideas and select suitable "Proof of Principle" projects?	Can "Proof of Principle" projects be funded?	Are good ideas being turned into viable products and businesses?
Key Performance Indicators	Number of high quality academic publications Number of ideas being captured by an invention disclosure process	Number of industry funded programmes	Number of invention disclosures made	Percentage of all ideas generate that end up selected for "proof of principle" funding	Percentage of selected ideas that receive funding	Percentage of "proof of principle " projects that become Start Up companies
Current Status	Number of scientific papers appears low Interviews with ANAS institutes and universities shows there is significant "uncaptured" IP	Little or no evidence of working with industry	Only ANAS has any formal process in place to capture generated IP	Absent from University sector at present	No funding sources available. ANAS has used its own resource to develop its initiatives.	No spin out companies exist
Recommendations			Universities need to put in place processes to identify and capture arising IP	Teams with business skills are required to assess and select IP suitable for commercialisation Appropriate IP protection strategies need to be developed.	Proof of Principle funding needs to be put in place	Funding to allow start-ups to develop needs to be put in place.

Appendix 1

Research Base

Institution:

1. Azerbaijan State University of Economics
2. QAFQAZ
3. ADA
4. KHAZAR
5. Azerbaijan National Academy of Sciences
6. Azerbaijan National Academy of Sciences Institutes:
    - Institute of Geology and Geophysics
    - Chemical Sciences
    - Cybernetics Institute
    - Information Technologies Institute
    - Experimental Industrial Plant
7. Baku State University
8. Azerbaijan State Oil Academy
9. Azerbaijan Technical University

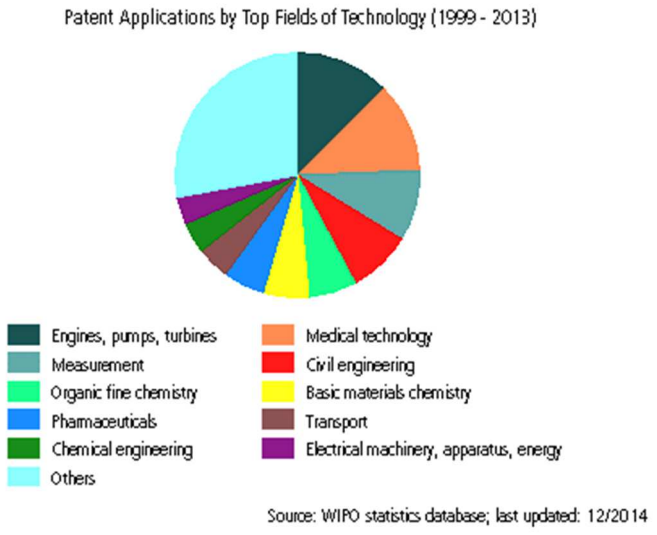
Appendix 2

Intellectual Property

Table 1. Comparison of Scientific Publications by County			
Scientific Publications by Country 1996 - 2013			
Country	Scientific Publications	Citations	Citations per Document
Hungary	124,265	1,416,878	12.71
Ukraine	122,263	539,896	4.65
Belarus	26,920	148,685	5.64
Georgia	8,759	67,334	8.7
Azerbaijan	8,296	25,625	3.48
Macedonia	6,643	37,143	7.44
SCImago Journal & Country Rank.			
Retrieved March 17, 2015, from http://www.scimagojr.com			

Table 2. Table Patent Filings by Country						
Country	Population (Millions)	2009	2010	2011	2012	2013
Sweden	9.6	2,649	2,549	2,341	2,436	2,495
Azerbaijan	9.5	281	271	205	144	156
Azerbaijan (progressed to international filing)		11	17	13	11	13
Percentage progressed to international filing		3.9%	6.3%	6.3%	7.6%	8.3%
Serbia	9.5	359	329	229	224	221
Belarus	9.3	1,926	1,933	1,871	1,871	1,634
Tajikistan	8.4	12	10	5	6	4
Kyrgyzstan	5.6	149	140	129	111	114
Georgia	4.3	474	362	398	372	333

Diagram 1: Patent Filings by Fields of Technology



Appendix 3

Summary of the main classes of IPR protection

Patent
A registered patent provides a time-defined (up to 20 years) geographically defined monopoly right to commercialise an invention or process. The basis of the permission to commercialise is that the invention's working is disclosed, patenting is not possible if there has been ANY prior disclosure of the invention not covered by a non-disclosure agreement.

Utility Model

Utility Models are very similar to patents, but usually has a shorter term (often 6 to 15 years) and less stringent patentability requirements.

Copyright
This time-limited (varies between 25 and 70 years according to the material) right arises automatically on the physical creation (not the idea) of software, original literary, dramatic, artistic or musical work, and in recorded (e.g. film) or published (e.g. layout) derivations. Use of the © mark and owner's name and date is the internationally recognised way of alerting the public to the copyright ownership but the protection (the right to preventing unauthorised copying) exists regardless.

Copyright may be assigned to a third party, but until that point or until a licence is agreed it remains the property of the creator, unless s/he creates the work 'in the course of his/her employment', in which case it is the property of the employer.

Moral rights
In addition, all European countries (including the UK) recognise an author's moral rights. There are four – paternity, integrity, false attribution and privacy. These rights relate to the reputation or standing of the creator in the eyes of fellow human beings. To infringe a moral right involves denigrating or harming the author's reputation. The right of paternity has to be asserted in writing: it is the right to be identified as the author of the work. The right of integrity means the copyright owner has the right to object to derogatory treatment of his/her work. Basically, this means changing it in any way without permission. Moral rights can be waived: by this, the author chooses not to exercise the rights – or they can be bequeathed. They cannot be assigned.

Performing rights
Creators of copyright works have the right to protect the physical form in which those works are created – words on the page, pigment on a canvas, or the clay or metal of a sculpture. Performers such as actors, musicians and dancers also enjoy protection of their performance, especially when recorded on film, video, tape, CD, or in other form. Performing rights may affect the multimedia elements of online courseware, as well as the creator's copyright in the material itself.

Database Right
This time-limited (15 years) right arises without registration to protect the compilers of non-original information from losing the benefit of their work through unauthorised copying or re-use.

Industrial Designs
There is automatic time-limited protection (the right to prevent unauthorised copying) for unregistered designs, provided authorship can be proved. This design right covers functional shape or configuration.

Domain Names
Registering a domain name for Internet use gives a right to use the domain name typically for a period of two years. Owners of trade marks can have established rights to domain names.

Trade Marks
Registering a trademark gives a monopoly right for the use of graphically distinct trading identification signs. Unregistered trademarks have some protection through court actions against "passing off" (piracy), provided that their use has not lapsed for a period of 5 years.

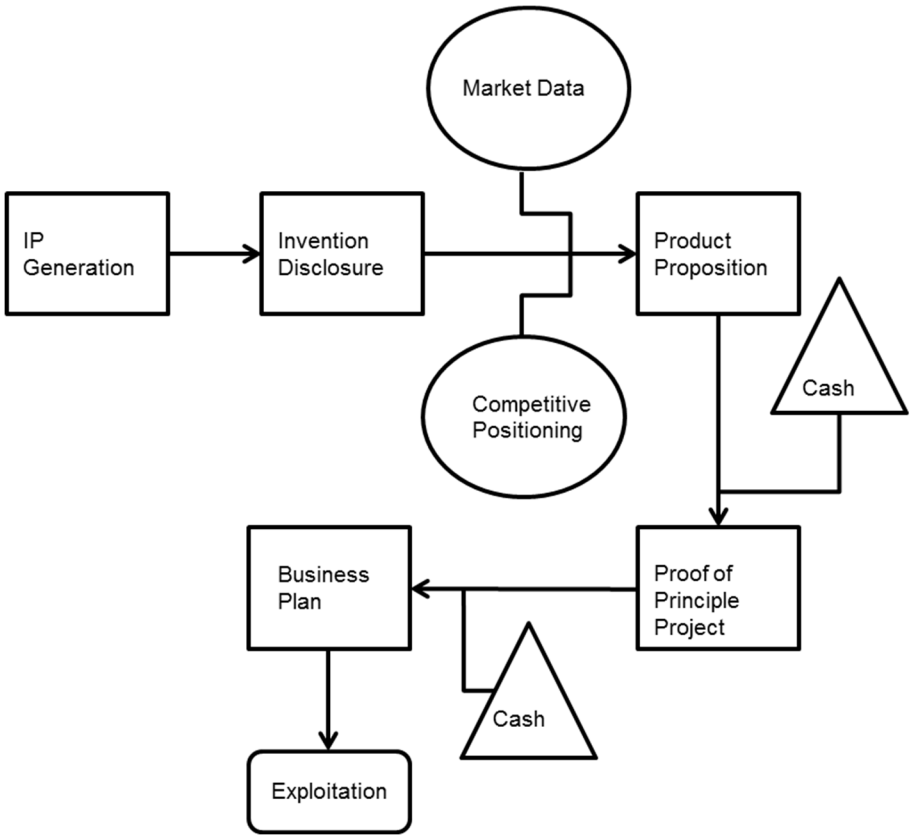
Appendix 4

Technology Transfer Processes

"Technology transfer" describes the process for formal transfer of rights from scientific research to another party in order to use and commercialize new discoveries and innovations resulting from that research. The rights may be intellectual property (IP) in the form of patents, copyright, or other forms of IP, depending on the product of the research.

This process includes:

- Funded research
- Invention disclosure
- Patents
- Licensing
- New start-up ventures



In general, the technology transfer process has four phases:

1. The tech transfer office has a relationship with faculty and researchers and monitors their ongoing research. The tech transfer office may also provide some links to commercial partners to fund ongoing research.

2. Once the researcher files an invention disclosure with the institution in accordance with the intellectual property policy, the technology transfer office evaluates the strength of the opportunity from an intellectual property and commercial perspective. If there is support for the innovation's potential, the tech transfer office will pursue a patent application.

3. Once a patent application is filed, the tech transfer group will begin to actively pursue commercial partners for potential license agreements or other forms of alliances.
4. Fee, royalties or milestone payments emerging from the successful commercialization of innovations from an institution constitute financial returns for the technology transfer office.

Appendix 5

CASE STUDIES

Case Study 1 Qafqaz University - Hydrogen Generation

Proposition

Novel flow through hydrogen generator. Significantly cheaper than existing systems. Can be tailored to produce flammable but not explosive levels of hydrogen.

Current Status

Laboratory prototype exists, but has not been fully tested. The gas mixture produced needs to be fully characterised to optimise production parameters. Over 200 membranes have been tested. The University doesn't have the facilities to continue development as specialist equipment is required.

Likely Commercialisation Route

Depending on the range of applications identified where the technology has competitive advantage, it can either be spun out into a company, or the technology can be licenced to an international company who can lead the exploitation.

Requirements

1 year and a budget of 100,000 AZN to buy the calorimeter and complete the testing.

TransTech Opinion -This is a classic example of a "Proof of Principle" project which requires relatively modest investment to determine viability.

Case Study 2: Khazar University - Methane Clathrate Modelling

Proposition

Methane Clarates are often formed in gas pipelines, and represent significant operational problems. Theoretical modelling allows process conditions to be adjusted to prevent formation. However, significant deposits (10^{15} to 10^{17} cubic metres) exist in ocean sediments and represent an as yet untapped energy reserve as it is not yet clear how they could be harvested. The modelling could be extended to investigate ways of extracting the gas.

Current Status

Models exist, but require additional work to consider the harvesting aspect

Likely Commercialisation Route

The models would be licenced to multinational energy companies interested in Methane Clathrate extraction

Requirements

Not yet quantified, but likely to be less than 100,000 AZN

TransTech Opinion - This is a high profile opportunity which could lead to licencing revenue, as well as consulting contracts from energy companies. A relatively modest investment could lead to a significant increase in the University's international profile.

Case Study 3: ANAS - Oil Recovery polymers

Proposition

Enhanced polymers for recovery of oil from water surfaces, where the oil can be recovered and the polymers reused. 1kg of polymer can collect 20 kg of oil.

Current Status

Polymers have been synthesised in small scale, but require scale up for larger production

Likely Commercialisation Route

A spin out company could be formed to sell the polymers internationally.

Requirements

Not yet quantified, but likely to require less than 1,000,000 AZN to reach production. Detailed market analysis required

TransTech Opinion - If these polymers are superior to current technologies, they could easily gain an international market.

Case Study 4 ANAS - Fertiliser Manufacture

Proposition

Low cost fertiliser production with much lower dosing requirements than super phosphate

Current Status

Significant field trials have been undertaken

Likely Commercialisation Route

A production plant in Azerbaijan could supply the local market and surrounding countries. The technology could also be licenced to manufacturers in other geographies where it does make sense to try and ship product.

Requirements

Not yet quantified, but likely to require less than 1,000,000 AZN to reach production.

TransTech Opinion - An interesting mix of displacing imports, gaining local exports, but gaining a much wider international presence by licencing. Whilst current imports of fertilisers are relatively low at around $25 million, domestic production could significantly increase availability.

Case Study 5 ANAS - Lubricants

Proposition

ANAS has developed a range of greases and lubricants with advanced properties which could address larger international markets. They also have the only facility in Azerbaijan to manufacture automotive oils.

Current Status

A production plant exists at the ANAS Experimental plant and product is being supplied to Russian customers. No international certification of the products exists, and it is not being supplied to the wider international market

Likely Commercialisation Route

A sales and marketing company could be formed, tasked with assessing the international market opportunities, facilitating the appropriate certification and testing and with responsibility for overseas sales. ANAS can retain manufacture within their current facility.

Requirements

Not yet quantified, but likely to require less than 500,000 AZN to reach expanded sales and international accreditation.

TransTech Opinion - Whilst it is difficult to judge without additional work, ANAS believe their lubricants have super performance in specialised situations to other products on the market. This would position them as premium products and would give them an international market. The domestic production of Automotive oils would be a significant step in displacing imports. Azerbaijan currently imports over $120 million of refined oil products and lubricants.

Appendix 6

Fund Structures and Returns

Table 3 Indicative Cash return requirements by year to generate commercial IRRs.

YEARS							
Cash Multiple	2	4	5	6	7	8	10
1	0%	0%	0%	0%	0%	0%	0%
2	41%	19%	15%	12%	10%	9%	7%
3	73%	32%	25%	20%	17%	15%	12%
5	**124%**	50%	38%	31%	26%	22%	17%
7	165%	63%	48%	38%	32%	28%	21%
10	216%	**78%**	58%	47%	39%	33%	26%

Green – portfolio return after costs
Red – Portfolio Returns before costs
Black – individual investment returns

Table 4 Fund Types and Size

	Proof of Concept	New	Spin out	Privatisation
When	Now	Now	1 – 2 years	Now
Main Target	NAS / Universities	Universities	All	NAS
Type of Funds	Multiple	Single (but might have several targeting different tech. areas)	Multiple	Single
Control	Devolved	Central	Devolved	Central
Investment Size (AZN)	50 – 100	100 – 500	250 – 1000	2000
Annual investment numbers	20	10	5	1
Total Number of Investments	200	100	50	
Fund Size (million AZN)	15	50	25	

Authors of the Report:

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David is an experienced venture capitalist having led or participated in over 40 primary transactions and realised numerous exits through trade sale or flotation. With a combined honours degree in Biophysics and Genetics, David joined Arthur D. Little's Cambridge Consultants Limited in 1985, ultimately leading CCL's natural sciences team to provide strategic consultancy and "hands on" product and process development to both SME and multinational companies across a variety of industries. David joined the YFM Group as a Venture Capital Investment Manager where in addition to direct investment activity David consulted with a number of other fund managers, providing either technical due diligence support, or serving on their investment committees.

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Simon is an experienced corporate financier who is expert at the commercial development of non-quoted technology companies and has been instrumental in raising $300million for 46 such companies at varying stages of their development from spinout to pre-flotation and IPO. Simon previously worked as a Director in corporate finance of the specialist European investment bank Beeson Gregory. Whilst at Beeson Gregory, Simon formed its private equity franchise and its private investor network. Simon brings considerable investment banking and venture capital networks and experience of the processes and participants involved in the financing of nascent technologies from spin-out to IPO/trade sale.

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Richard is Managing Partner, Chair of the Investment Committee & CFO of MTI Ventures. MTI has been investing since 1983. MTI is a leader in the field of technology venture capital. Headquartered in the UK, and with a US office in Boston, its portfolio of investments includes global technology companies in the Clean Tech & Materials and Medical sectors. MTI focuses on early stage companies, in particular those associated with, or spun-out from, Universities. Richard focuses on operations, transaction structuring and compliance for the firm.

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Mahmut has a lifetime of relationships across Turkey and several years' experience in business development, general, financial, risk and operations at a senior level in international trade and investments and project management. Mahmut set-up Universal Trade and Investment Associates following a decade at the pre-eminent Turkish financial industrial commercial conglomerate called Sabanci Group. Prior to this, Mahmut had 10 years' diverse insurance and risk management experience working for www.marsh.com Turkey dealing with business development, setting-up the country operation of and achieving growth and margins targets through business development and customer service excellence.

About TransTechCapital LLP ("TTC")

TTC is a venture capital advisory and investment firm and part of the award winning MTI Partners technology investment group, which has been investing in the technology commercialisation sector since 1983 (www.mtifirms.com)

In the course of its advisory and investment activities, Team members have invested in and nurtured over 100 technology businesses. TTC's advisory team has considerable experience of Intellectual Property commercialisation which includes 'Proof of Concept' project processing and funding, technology transfer, technology research, development, due-diligence, investment and exits. In the course of its investment activities, the Team has worked with many of the world's leading universities Technology Transfer Offices.

TTC is focussed on transferring its technology commercialisation, due-diligence and venture funding expertise to academic institutions and corporations in Azerbaijan in its pursuit of non-oil based GDP growth.

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