

TruBlood
Prepared by Group 5
Imperial College London 2014

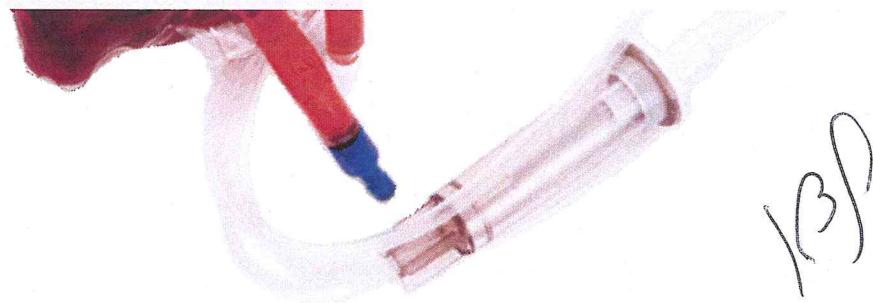
Without TruBlood, life is an empty vessel.

(S)



IMPERIAL
COLLEGE

TRUBLOOD



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EXECUTIVE SUMMARY

Introduction

Over the last decade, the demand for blood has increased, with a decrease in willing donors, who serve as the only current source of blood in the UK. We propose a solution to address this growing concern, initially concentrating on those with rare blood types.

Company description

Trublood proposes to make manufactured blood using a patented Bioreactor, and sell to it directly to the NHS Blood and Transplant Service (NHSBT). This blood will be used specifically for sufferers of rare blood types who currently depend on rare matched blood donors and expensive transfusions. Our aim is to yield widespread positive socioeconomic impact, reduce costs for the NHS and be a highly profitable business.

Industry analysis

In the UK, the Blood Bank and Transfusion Services industry is nationalised under NHSBT on a not-for-profit basis. The NHS currently has a maximum price of £120.09 that it is willing to pay for a unit of normal blood group product, and £3000 for a unit of rare blood group product.

Our patented technology has been proven to produce safe blood identical to that collected by blood banks but at a cheaper cost of £1200 per unit. If we are to produce a unit of blood for less than NHSBT's cost then the NHS will buy from us and mutual gains can be made.

Market analysis

The targeted niche represents 1% of the total UK blood transfusion market in terms of units transfused but due to the high costs of rare blood types this niche forms 13% of £290,000,000 market in terms of revenue.

Marketing plan

TruBlood is a Business to Business firm which aims to capture wealth for stakeholders by adopting a hybrid strategy whereby we provide a high-perceived buyer value but at a small price. We are concentrated in a market segment with lucrative profit margins and our ability to undercut the NHSBT's current supply creates a captive market, really transforming our technology into economic value.

Operations and development plan

Our business strategy is to maintain effective links with NHSBT, our main partner, in order to provide blood to those with rare blood types. Our long term vision is to break into the entire blood transfusion market, once solidifying the 1% of rare blood groups.

Financial projections and funding sought

TruBlood is in need of financing for up-scaling from proof-of-concept to commercialisation. We are seeking £700,000 in venture capital in return for 10% company equity and 10% royalties over a 5 year period. The annual rate of return on equity is 55% as the company reaches an estimated profit in year 5 of £7,545,000.



INTRODUCTION

TruBlood plans to operate in partnership with Imperial Innovations and The Incubator laboratories to manufacture mature red blood cells using our patented bioreactor. Our business model proposes to sell manufactured blood directly to the NHS Blood and Transplant Service (NHSBT). This blood will be used specifically for sufferers of rare blood types/disorders who need transfusion, which makes up 1% of the total UK blood transfusion market.

Background

In our life-time, over 25% of us will require blood at least once (NHS, 2014). Yet over the last decade, there has been a 20% drop in willing donors across the UK (BBC News, 2014) and only 4% of UK adults donate blood. The issue is further compounded by new research suggesting one third of donors go on to suffer adverse effects (Newman, 2004). Perhaps most critically, there is a real shortage of matching blood for some Black and Minority Ethnic populations with rare blood types.

Not only is the need great, but the cost is high. Government funded campaigns encourage donors to give blood, some of which is even wasted due to the short shelf life of 35 days (NHS, 2014). Additionally, the rising cost of blood safety (testing for HIV and Hepatitis C etc.) has reached an estimated \$1 Billion in the last decade in the USA alone (America's blood centers, 2009).

With the continual fall in willing donors, the increasing cost of safety combined with the unmet needs and very high costs of acquiring rare blood groups, there is potential for commercialisation of the bioreactor technology. This can yield widespread positive socioeconomic impact and be highly profitable.

Mission statement

To provide manufactured blood for all rare blood types across the UK.

Product and services

TruBlood is unique in providing financially competitive blood products through the utilisation of induced hemopoietic stem cells to produce Red Blood Cells (RBCs) ex-vivo, through a proven and patented method devised by Prof. Mantalaris et al, 2005.

TruBlood aims to deliver totally reliable and safe blood for patients with rare blood types, as this can be manufactured cheaper than the cost of collecting and processing donor blood for rare blood types. This represents a win-win for TruBlood, NHSBT and the public.

March 2014 the company conducted interviews with NHSBT Hospital Services division and Professor Mantalaris, a world expert on ex-vivo bone marrow bio-mimicry at Imperial College. It is felt that the product is best delivered through a partnership between TruBlood and NHSBT.

Current status

TruBlood was created in 2010 and has now been granted worldwide IP rights for its Red Blood Cell Bioreactor (Appendix). A prototype bioreactor capable of manufacturing mature red blood cells was created successfully in 2010, and has undergone up-scaling since. The company is poised to commence operations on Jan 2015.

Funding sought

TruBlood is seeking £700,000 in investment capital from an equity partner. Detailed financials are given below.

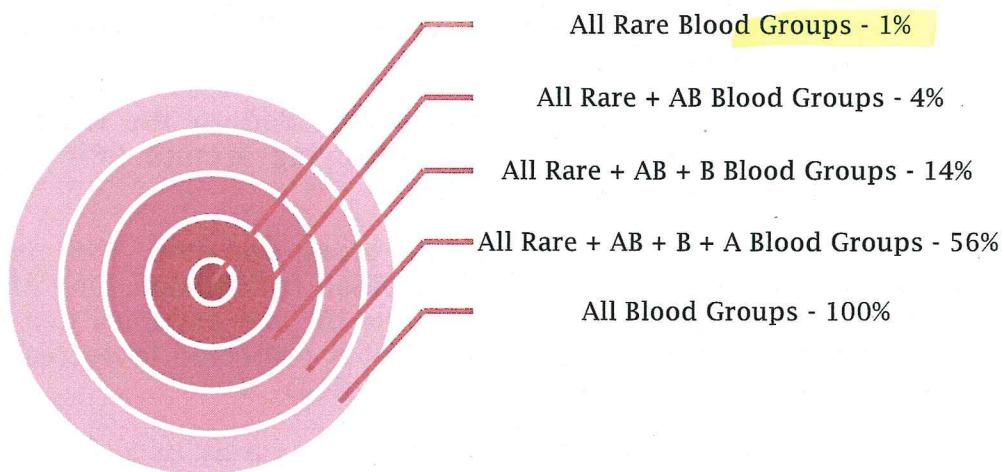
Legal status and ownership

TruBlood is a start-up assimilated at Imperial Innovations. It is currently owned by the members of its management team. See the "Management Team and Company Structure" section for further information.

THE MARKET

Market Segmentation

For the purpose of the TruBlood business plan, the market has been segmented on blood group type, enabling us to target the rarest blood groups in the UK. (NHS Blood and Transplant Annual Report and Accounts, 2012) The market segmentation diagram is segmented on a need-basis (See Appendix), showing the growth potential of the blood donation industry, expanding to fill the blood group markets nationally.



Our initial target niche market is to cover all the rare blood groups in the UK. This constitutes 1% of the full UK blood market. This segment has been selected as prices we offer enable mutual gains for both the NHS and TruBlood, which ensures a smooth start-up.

We intend to cover this entire niche market in the UK within five years, and then look to expand into the remainder of the blood group market from the sixth year.

Target Market Selection and Size

Our customer will be NHS Blood and Transplant (NHSBT), supplying 200 NHS trusts across the UK. We have selected to target only the rare blood groups in the UK, and are looking to expand into 100% of this niche market within five years. There are over 200 rare blood types in the UK, including Sickle Cell and Colton (See Appendix) as well as AB negative blood group, totalling to cover 1% of the full UK blood market.

Market Trends

There is a continuous need for red blood cells (RBC) in the UK (Wells, A. et al. 2002), as the demand for this product is not decided by market preference, but by population health. Surgical operations alone, consume around 40.7% (Wells, A. et al. 2002), of all blood transfusions, with evidence for the constant demand for blood as over 1.8million people underwent a surgical procedure last year in England only (HSCIC, 2014). Audits have shown that around 60% (Wells, A. et al. 2002), of blood is

transfused in patients over 65 years, for both medical and surgical indications, and with the current ageing population (UK Parliament. 2014), demand trends will only look to increase in the future.

Future Projections

The NHSBT will remain in need of a blood supply, with a shorter, more efficient delivery of supplies, and that is where TruBlood will enter. Looking at future projections, it is safe to say that the market size will not be reduced, and there is potential for broadening our market, not only to cover the full blood group population in the UK, but also to expand geographically into the countries of the European Union, providing RBCs through the European Blood Alliance (EBA) to centralised EU blood banks (EDQM, 2008). This will also present us with vast opportunities for international expansion, as we would be in a stronger strategic position having already up-scaled our production.

THE COMPETITORS

Competitor Analysis

TruBlood aims to fulfil the needs of all rare blood groups in the UK, spanning the entirety of the UK market by the end of the 5th year.

The main direct competitors are the blood donations provided to the NHSBT by individuals through donation campaigns. Currently occupying around 98% of the current market share, it has a strong hold on the market.

Emerging competitors are from the category autologous blood donation. This means blood is taken from the same individual that needs the blood transfusion. One of the types is cell salvage; this method is currently used in the UK and occupies just less than 1% of the market. Currently it comes at great cost but is projected to decrease in costs in the coming years as its use increases. (Bernard, C. 2014)

The other type is autologous blood pre-donation which is very rarely used in the UK, this occupies a minuscule margin of the sector and costs for it are extremely high, thereby proving to be very difficult, especially in terms of logistics.

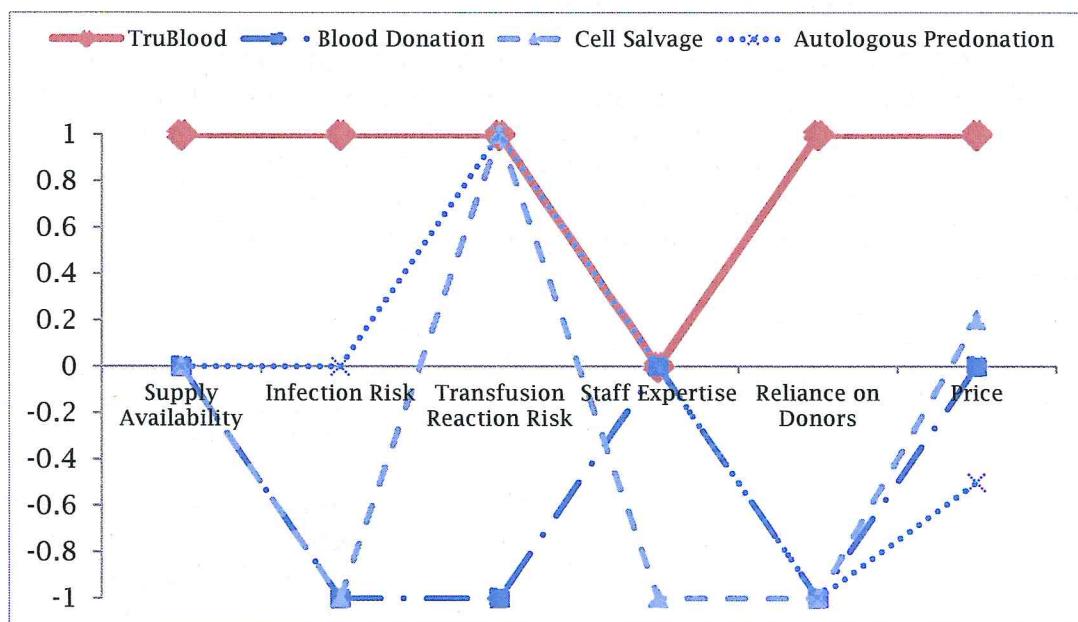
The main problem with autologous blood donation is that there may still be a shortage in supply to that which is needed by the individual, in which case the hospital will have to revert to donated blood from the NHSBT.

Type of Blood Supply	Current Market Share (%)	Cost/Unit (£/unit)
TruBlood	-----	1000
Blood Donation	98.72	3000
Cell Salvage	1.00 ⁱ	4000 ⁱⁱ
Autologous Predonation	0.28 ⁱⁱⁱ	6400 ^{iv}

The table above shows a comparison of the current market share.

Criteria	TruBlood	Blood Donation	Cell Salvage	Autologous Predonation
Supply availability	Advantage	Even	Even	Even
Infection risk	Advantage	Disadvantage	Disadvantage	Even
Transfusion reaction risk	Advantage	Disadvantage	Advantage	Advantage
Staff Expertise	Even	Even	Disadvantage	Even
Reliance on donors	Advantage	Disadvantage	Disadvantage	Disadvantage

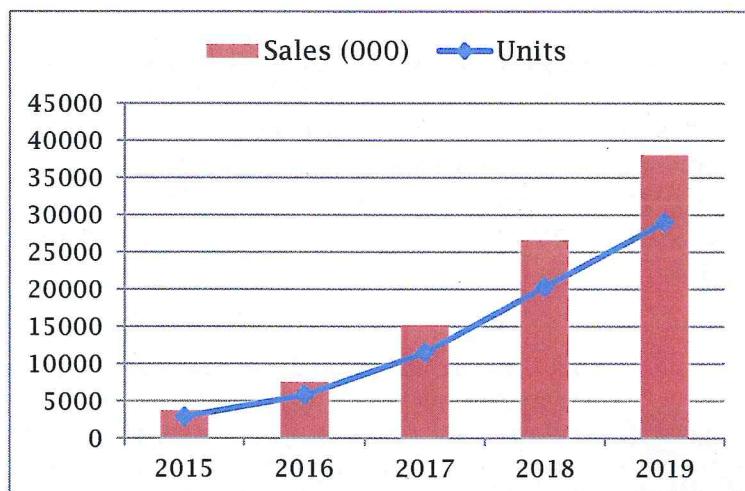
The diagram shows an illustration of the two above tables, conveying the different criteria for comparison.



Although numerous competitors can be found in field, the only true competitor is blood donations. The aim of TruBlood is to replace all forms of blood supply with TruBlood's manufactured RBCs but not to out-compete the NHSBT as an organisation, on the contrary TruBlood plans to provide NHSBT with a high quality blood supply, ensuring high levels of user safety, and provided at a much lower and convenient price than the competition.

Estimate of Annual Sales and Market Share

At the present time, TruBlood is able to product units at £1000 per unit and aims to sell them to the NHSBT for an average price of £1315. The following graph shows a five year projection for the unit and gross sale figures, expanded upon in the financing section.



The cost of production is expected to decrease due to up-scaling in production of RBCs. TruBlood will be looking to adopt value based pricing strategy in order to attain the highest profit margin achievable.

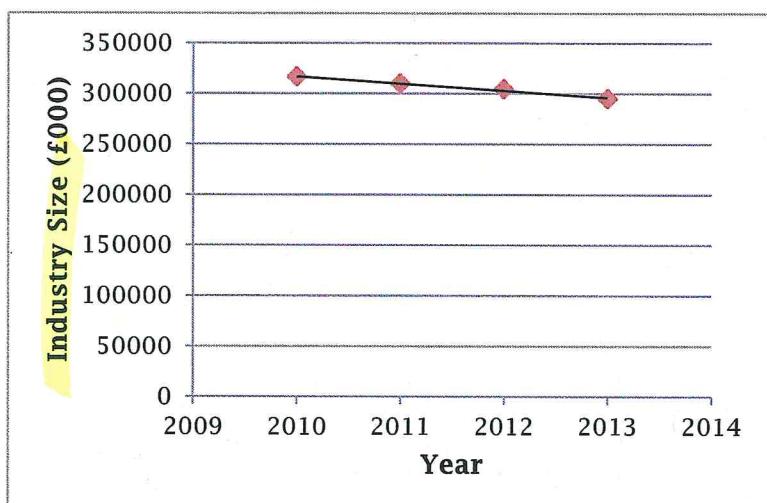
THE INDUSTRY

TruBlood is part of the Blood Bank and Transfusion Services industry (SIC code 85.14). (ONS, 2014) This industry includes companies that products for transfusion purposes.

TruBlood also participates in the Biotechnology industry (SIC code 73.10) (ONS, 2014), defined through the utilisation of enzymes and microorganisms for creation of bio-based products. (Europabio, 2014)

In the UK, the industry has essentially been nationalised under NHSBT, a Special Health Authority in England and Wales which supplies UK hospitals with the major components of blood, on a not-for-profit basis.

In 2013, the NHSBT revenue from RBC was £294,863,000, (NHSBT Annual Report & Accounts, 2012) essentially a proxy for the size of the UK blood bank industry. As shown below, the industry has seen a modest decline of 1.5% per year (NHSBT Annual Report and Accounts, 2012), over the past 4 years. However, NHSBT is a not-for-profit organisation and this decline merely reflects the decreasing cost of blood transfusions. Based on this trend the industry sales projection for next year is £290,440,000.

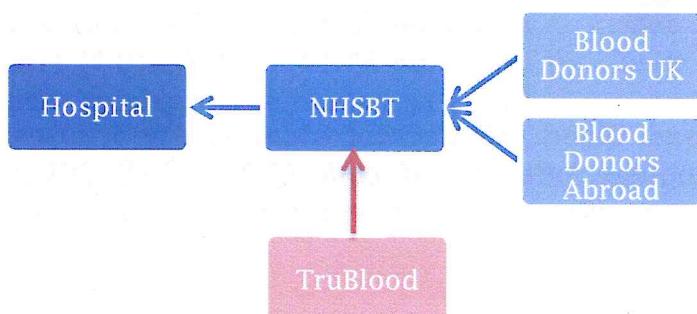


and become the industries primary producer. Whilst the industry is extremely concentrated with one primary producer (NHSBT) who is not-for-profit looking to produce blood as cheap as possible for the NHS and thus we don't expect NHSBT to react aggressively to our entry into the market. In fact NHSBT has a stated strategic objective 'to work in partnership with third sector organisations', hence very few barriers to entry are perceived.

THE PRODUCT

TruBlood, first developed in 2010, is a cutting edge bioreactor producing RBC of any type required, provided the correct input and conditions are met. TruBlood aims to produce all RBCs required for rare blood groups in the UK by the end of year 2019. The RBCs produced by the bioreactor have no extra components on their surface that can potentially produce allergies, and no risk of any infections transmitted to the patient. TruBlood aims to deliver to the NHS Blood Service in order to be distributed through their channels on to the UK Trusts.

Value of Product



At present, 8000 units of blood transfused by hospitals per day (Wales, N. 2014) (2.9 million annually), and although there is an overall larger supply of blood in stock (Wales, N. 2014), there are problems with the blood in stock.

One of the key issues is that the blood in stock has a very small limited supply for the rare blood

types in the UK with a 6% increase (BBC News, 2014) in demand year on year for these blood groups. Rare blood types in the UK account for 1% of the UK population. Currently, 14.2% of the population need a blood transfusion annually (Wallis, J. 2014), and over 25% of the population require a blood transfusion once in their lifetime (Wallis, J. 2014). Another issue is that the blood collected is costly due to need for blood donation campaigns as well as the expenses involved in blood collection and processing.

Due to increasing demand for blood, and the shortage of blood supply specific to these rare blood groups, it means the UK sometimes must look abroad to obtain blood for these individuals, as a method to ensure lives are saved. This comes at a premium cost to the NHS, reaching at times up to £3,000 (Email correspondence from Prof. Mantalaris) to include all the transport and delivery costs in obtaining blood from a different country. The NBSBT is aware of this shortage in rare blood supply, and the high costs too, hence has set aims to achieve a blood supply target of only 99.51% (National Blood Service Audit. 2000) to UK hospitals instead of the ideal 100%, hence we have chosen to target this population for TruBlood.

The TruBlood bioreactor produces RBCs pure of any potential sensitivity causing components, unlike normal blood (Annual Shot Report. 2013), thereby proving valuable in today's blood service sector as there needs to be no concerns with regards to patient reactions at transfusion.

Essentially, TruBlood eliminates the need for human donors, abolishing the need to depend on people through costly campaigns, removing the arduous process of shortlisting donors and attempting to find an appropriate blood match.

Technicalities of the Bioreactor

TruBlood has been fully developed and trialled to generate adequate amounts of red blood cells in order to move into the next stage of large scale RBC production.

The blood reactor requires a very small amount of stem cells, as well as a concoction of molecular growth and proliferation factors, under the appropriate bioreactor conditions to generate fully mature RBCs and an aside of further stem cells, thereby economically self-sustaining its production cycle.

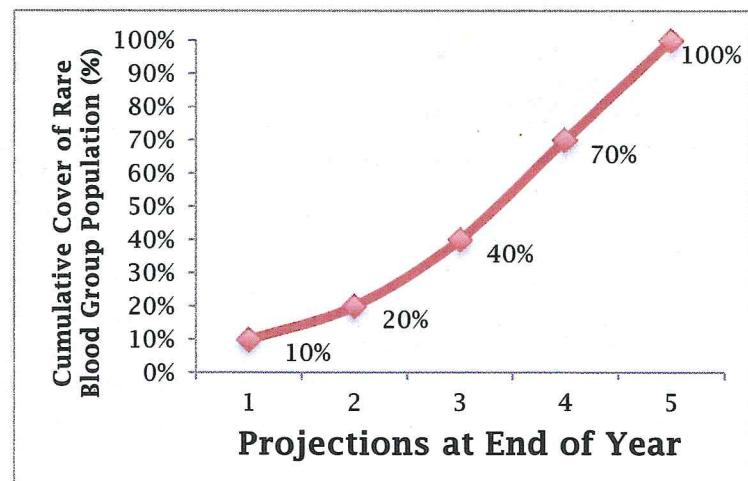
Protection

The product does not infringe on any existing intellectual property and is PCT patent protected, allowing us to sell the innovation and the rights associated with it, should we wish.

Introducing TruBlood to the market provides a strong first-mover advantage as no other product has come close to large scale production such of this bioreactor; essentially becoming leaders in this technology sector. Essentially there are two opportunities to capture: the technological opportunity, and the need-based opportunity.

Product Projections

As shown in the graph, TruBlood production aims to be incremental, starting with small units to cover 10% of the population, in order to ensure



high quality, and then increasing to cover the full rare blood group market by the end of year 5.

BUSINESS MODEL AND COMMERCIALISATION

Overall Marketing Strategy

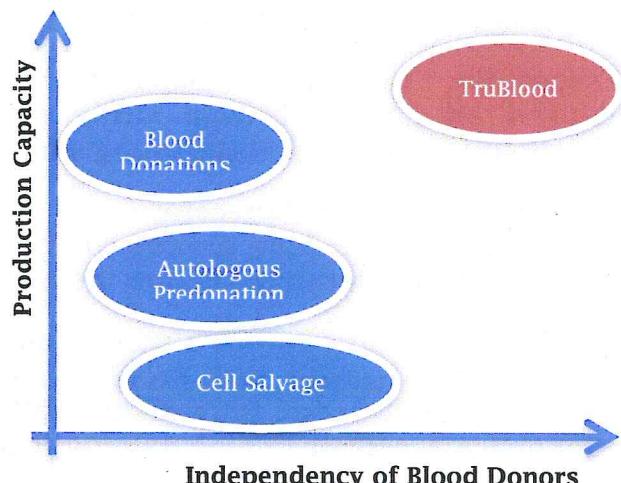
TruBlood overall aim is to produce all RBC required for rare blood groups in the UK by the end of 2019. We appreciate that achieving may include logistical difficulties and so the decision has been made to try and exploit NHSBT's pre-existing distribution channels, storing and delivering blood to NHS hospitals. Essentially, we are selling blood directly to NHSBT rather than to hospitals or patients.

As a consequence of this our marketing strategy is unique and targeted at NHSBT. As a partner in achieving our stated aim, we plan to create due diligence with NHSBT, by educating TruBlood staff at every level on the importance of upholding strong ethical principles and working in fair and open manner with all our stakeholders.

This will also help us achieve the second part of our marketing strategy which is to assure the public on the safety of our blood. As NHSBT is a public company, this is of paramount importance. We aim to do this at a primary care level through leaflets and posters informing patients that we can now create rare blood type RBC meaning we won't ever run low on those blood types again and that there's no longer any risk of the blood carrying an infection.

Points of Differentiation

Our cutting edge patented technology means that we are the first and only firm in the UK to be able to produce RBCs without the need for any blood donors and at virtually any quantity required, putting an end to shortages. By cutting out blood donors, our blood is also the safest with no risk of transferring blood borne infections.



Pricing Strategy

Price/unit (£)	1315
Cost/unit (£)	1000
Mark-up	31.5%
Gross margin	24% +
Taxes	20%

TruBlood is implementing a policy of value-based pricing as it takes account for the customer (NHSBT). This pricing strategy is ordinarily based on an assumption of the consumers' willingness to pay, however in this instance there is the added advantage of NHSBT having stated that its maximum willingness to pay for rare blood is £3000. As NHSBT will only adopt our product if we offer a cost saving, we plan to price our good based on the primary criteria of current

costs for NHSBT.

Given the importance of building trust with NHSBT and the public at large we plan to ensure sizeable surpluses for both producer and consumer and are targeting an initial gross margin of 24%. This figure will increase as our capacity expands and our costs decrease. Whilst this may seem like a modest gross margin for a tech industry, the blood bank industry has previously seen zero gross margins and ensuring a reputation for honest pricing and good business will outweigh any losses in the long term as lucrative opportunities to produce blood for the whole UK market are likely to

arise. From year 3, TruBlood will be able to produce units at £1000 per unit and so, based on the above strategy, we aim to sell them to the NHSBT for an average price of £1315.

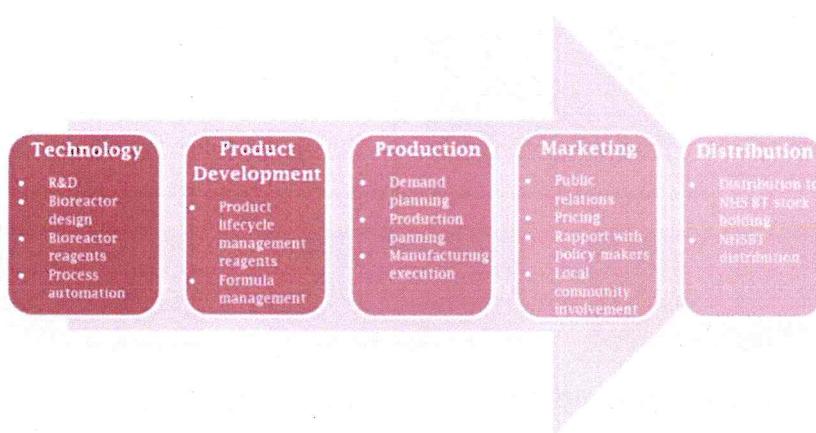
Promotion Mix

Fundamental to TruBlood is public relations as we will be working with public organisations in providing a healthcare service. Therefore we will exploit all media outlets in order to convey an image of a cutting edge biotech company that's working with the NHS to produce massive cost savings for taxpayers. We will also target medical and industry press as well as working to build relations with policy makers. TruBlood will constantly aid local blood bank communities in their endeavours to distribute RBC. TruBlood long term vision is to do away with the need for (and risks associated with) blood donation and blood shortages, which is a remarkable breakthrough in itself, and so we plan to create a buzz and sense of anticipation about our offerings.

Distribution

An agreement has been put in place for our blood products to be produced in our Imperial College labs and transported directly (with no intermediaries) to NHSBT Stock Holding unit in Brentwood. From there NHSBT has agreed to utilise its infrastructure already in place to distribute the blood components to the NHS Hospitals on our behalf.

The Business Model

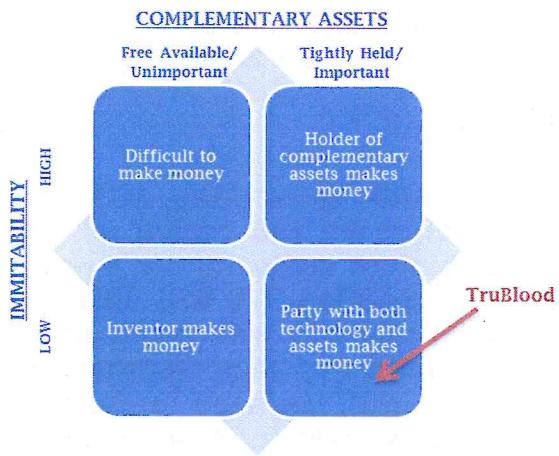


TruBlood is a Business to Business firm which aims to capture wealth for stakeholders by adopting a hybrid strategy whereby we provide a high perceived buyer value but at a small price. Our patented and differentiated value proposition is revolutionary, which combined without collaboration with the industries sole buyer (NHSBT) places us in an

unprecedented position. We are concentrated in a market segment with lucrative profit margins and our ability to undercut the NHSBT creates a captive market, really transforming our technology into economic value.

TruBlood can cover the first four phases of the value chain but is centred around the technology phase. The success of our business lies with this technology that allows for indefinite quantities of pathogen-free RBCs to be produced - which creates the customer value and will generate us revenue. We have protected this value with our patent, which stands as barrier to entry for any new potential competitors.

The value chain shows the other key players to be NHSBT, Imperial Innovations and the public. In particular NHSBT has high bargaining power as it controls the downstream distribution of our product and this is where a large proportion of our complementary assets lie. However NHSBT is not-for-profit and has a stated aim to



collaborate rather than compete with novel firms and we have consolidated this with amicable relations thus far.

TruBlood therefore has some degree of control over important complementary assets and a difficult to imitate product (due to our patent) allowing for an 'ideas factory' to develop. We can therefore be said to be in a strong competitive position in our value chain with great opportunity for both technology and assets to realise profits. The primary challenge is that in order to reach our customer, we must attract those in the value

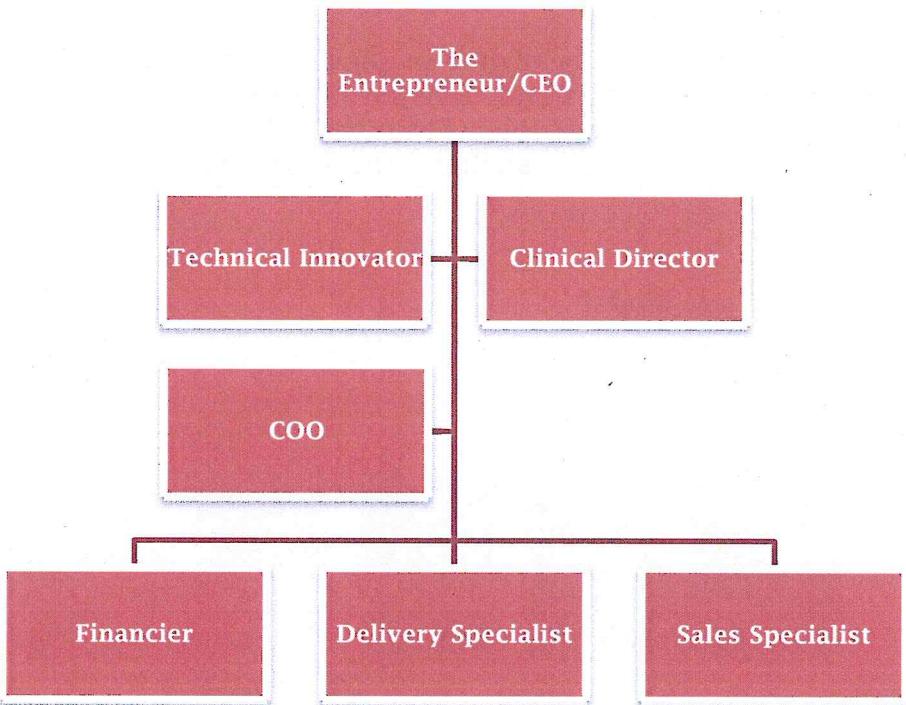
chain who control complementary assets, however measures have me to taken to minimise these risks.

OPERATIONS

Management Team and Company Structure

The five-member team has a history of success working together with each well versed with one another's strengths. A blend of both clinical and non-clinical backgrounds provides an optimum synergy of skills and experience. As the business hits targeted projections, the team hopes to expand operations to multiple production facilities.

Duly, a clinical director and chief operations officer will be hired in addition to our five core members. (See Appendix)



Operations Plan and Product Design and Development Plan

OPERATIONS MODEL AND PROCEDURES

TruBlood is providing a revolutionary unique service by being the first company that provides a viable alternative to donated blood. As such, careful consideration must be taken to ensure its safety and reliability.

The biggest challenge in operations is storage of TruBlood, especially due to constraints in terms of shelf-life (7 weeks) (Flegel et al., 2014). TruBlood will need to liaise with NHSBT in order to gauge supply and demand at any given time. TruBlood's smaller target market of rare blood types will allow easier management of the production scale.

Our inventory will be stored safely in our hired laboratory in the Incubator at Imperial College Innovations. Inputs will be sourced from affiliated companies such as Sigma Aldrich, VWR International Limited and Fisher Scientific. NHSBT will place orders using their own forecasting to predict demand and will pay in advance for orders. Final blood components must meet the defined specifications and comply with regulations (Murphy et al., 2001). Effective and constant communication with NHSBT and our initial targeted Trust (Imperial College Healthcare Trust) is vital to a successful launch.

Operations flow diagram:

Business Location

TruBlood is proposing to operate a single facility initially, based in the Incubator at Imperial College. The location is considered to be ideal because of:

1. Central London Location
2. Connection with Imperial College Trust
3. Facilities already available, cheaper to hire lab than purchase
4. Proximity to eminent scientists and experts in technology

Facilities and Equipment

Provided by the Incubator at Imperial College, consisting of Bioreactor, inputs and lab facilities

Operations Strategy and Plans

Our business strategy is to maintain effective links with NHSBT, our main partner, in order to provide blood to those with rare blood types. Our operations strategy aligns with this via the efficient production of viable blood. Quality control will be made a priority in order to ensure maximum safety of the transfusion recipient. As such the blood must be free from haemolysis, stored at a suitable temperature and must be the correct blood group. (Goldsmith, 1975)

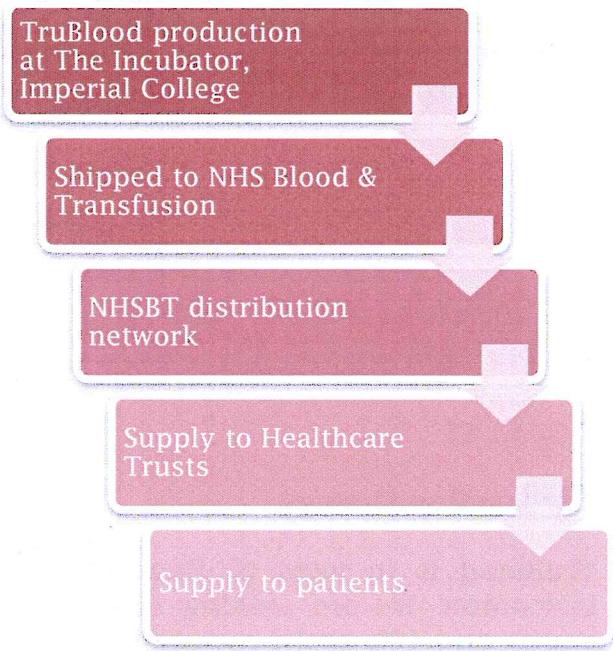
A fundamental bottleneck is a lack of quantitative information with respect to cellular behaviour in culture whilst running the Bioreactor which slows down productivity. (Prof. Mantalaris) This is hoped to be addressed by year 3 via the implementation of a new monitoring modality.

PRODUCT DESIGN AND DEVELOPMENT

Development Status and Tasks

The TruBlood Bioreactor is currently at Level 3 of development, as described by Rich and Gumpert, ready to be introduced to the market (Rich and Gumpert, 1985). Post acquirement of funding from Venture Capitalists, money will thus be used to upscale and commercialise TruBlood.

Risk Management (See Appendix)



<u>Milestone</u>	<u>Completed milestones</u>	<u>Milestones to be completed</u>
	Fully developed 'Bioreactor'	Placing first order and shipping to the UK
	Demonstrated proof-of-principle	Test sales in 1 st year
	Secured patent	1 year scale up
	Available for commercialisation	Year 3 - Expansion via hiring of two new core staff
		Year 4 - Purchase of new Bioreactor
		Full operation

FINANCES

Our Funding Strategy

TruBlood is in need of financing for up-scaling from proof-of-concept to commercialisation. We are seeking £700,000 in venture capital in return for 10% company equity and 10% profit royalty for a 5 year period. The annual rate of return on equity is 55%.

Sources and Use of funds Statement

Source of Funds	£
Source	Amount
Venture Capital	700,000
Use of funds	
Item	Cost
RBC Bioreactor	500,000
Cash (working capital and reserve to cover first year losses)	200,000

Assumptions (See Appendix)

Projections

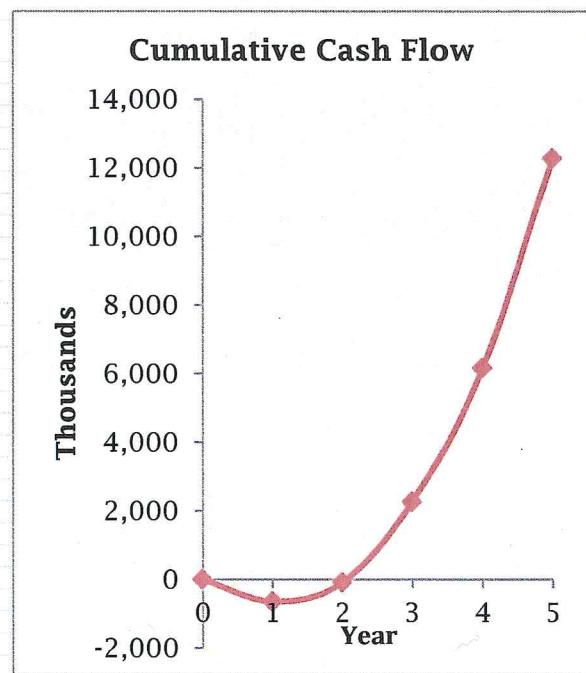
TruBlood is forecasted to generate total revenues of £38,135,000 in Year 5 with a net pre-tax profit for the full financial year of £7,546,000.

Pro Forma Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5
Units	2,900	5,800	11,600	20,300	29,000
Gross Sales (Returned Goods and Discounts)	3,813,500	7,627,000	15,254,000	26,694,500	38,135,000
Net Sales	3,813,500	7,627,000	15,254,000	26,694,500	38,135,000
(Cost of goods sold)	3,480,000	6,380,000	11,600,000	20,300,000	29,000,000
Gross Profit	333,500	1,247,000	3,654,000	6,394,500	9,135,000
Expenses - General and Administrative					
Marketing	10,000	20,000	20,000	20,000	20,000
Salaries	321,000	346,000	483,000	723,000	1,099,000
Rent	30,000	30,000	30,000	50,000	50,000
Electricity	5,000	10,000	17,000	25,000	35,000
Storage	8,000	10,000	14,000	15,000	20,000
Distribution	6,000	12,000	15,000	22,000	40,000
Administration	5,000	10,000	15,000	30,000	70,000
IT Systems	40,000	20,000	20,000	20,000	25,000
Insurance	42,000	60,000	70,000	90,000	100,000
Legal	10,000	30,000	30,000	30,000	30,000
Depreciation (10%)	-	50,000	50,000	50,000	100,000
Total expenses	477,000	598,000	764,000	1,075,000	1,589,000
Net Profit	-	143,500	649,000	2,890,000	5,319,500
					7,546,000

Pro-Forma Cash Flow

Cashflow	Year 1	Year 2	Year 3	Year 4	Year 5
	£	£	£	£	£
Receipts					
Units of blood sold	2,900	5,800	11,600	20,300	29,000
Weighted avg. selling price	1,315	1,315	1,315	1,315	1,315
Total Receipts	3,813,500	7,627,000	15,254,000	26,694,500	38,135,000
Payments					
Cost of blood production	3,480,000	6,380,000	11,600,000	20,300,000	29,000,000
RBC Bioreactor Investment	500,000	-	-	500,000	-
Distribution	6,000	12,000	15,000	22,000	40,000
Storage	8,000	10,000	14,000	15,000	20,000
Administration	5,000	10,000	15,000	30,000	70,000
IT Systems	40,000	20,000	20,000	20,000	25,000
Electricity	5,000	10,000	17,000	25,000	35,000
Marketing	10,000	20,000	20,000	20,000	20,000
Insurance	42,000	60,000	70,000	90,000	100,000
Legal	10,000	30,000	30,000	30,000	30,000
Rent	30,000	30,000	30,000	50,000	50,000
Salaries	321,000	346,000	483,000	723,000	1,099,000
Total Payments	4,457,000	6,928,000	12,314,000	21,825,000	30,489,000
Net Cash Flow	- 643,500	699,000	2,940,000	4,869,500	7,646,000
Earnings after tax	- 643,500	559,200	2,352,000	3,895,600	6,116,800
Cumulative Cash Flow	- 643,500	- 84,300	2,267,700	6,163,300	12,280,100



Break-Even Analysis

Time taken to breakeven = 1 year 202 days

Time to break even units = 6116 units.

(See Appendix)

Net Working Capital Needed

Rounded to £200,000 net working capital (See Appendix)

Ratio Analysis

Profitability	Year 1	Year 2	Year 3	Year 4	Year 5
Gross profit margin	8.75%	16.35%	23.95%	23.95%	23.95%
Net profit margin	-3.76%	8.51%	18.95%	19.93%	19.92%

Valuation & Discounting

Cashflow (£)	Discount Factor (3%*)	Net Present Value (£)
- 643,500	0.9709	- 624,774
559,200	0.9426	527,102
2,352,000	0.9151	2,152,315
3,895,600	0.8885	3,461,241
6,116,800	0.8626	5,276,352
Total		10,792,235

*Discount Factor - we have taken a 3 year average of average interest rates (Swanlowpark, 2014) in UK savings accounts and rounded up to 3% to discount the Net cash flows after tax.

Sensitivity Analysis

We conducted a sensitivity analysis using a sales volume reduction method. As can be seen in the table below, our pessimistic sales volume is our realistic (projected) sales volume less 40%. Optimistic is sales volume + 40%.

Projection	Sales Vol Years 1-5	Market Share Year 5 (Of total UK Blood market)	Net Profit Year 5 (£)	Company Valuation Y5 (Industry P/E = 10.3)*	Equity (%) offered in exchange for Venture Capital
Pessimistic	-40%	0.6% (17,400u)	3,992,000	41,117,600	16%
Realistic	Projected	1% (29,000u)	7,646,000	78,753,800	10%
Optimistic	+40%	1.4% (40,600u)	11,300,000	116,390,000	6%

* The industry P/E was calculated as an average of comparable but different blood product companies (mainly plasma) including Hemacare, Plasma Resources UK and Synthace.

Example calculation of Percentage Ownership (Equity):

Predicted Venture Capital realisation multiple = $(1+55\%)^5 = 8.95$

Thus Capital Return = $700 * 8.95 = 6,265,000$

PO = £6,265,000 / £ 41,117,600 * 100 = 15.24% (rounded to 16%)

Exit Strategy

As mentioned the expected rate of return is predicted to be 55% per annum. If the investor wishes to exit after 5 years, multiple options are feasible:

1. Management buy-out, involving the founding members.
2. Trade sale/take-over by a larger multinational industry player, the likes of Grifols S.A. or Bain Capital (Majority stakeholder in Plasma Resources UK)
3. If actual sales and revenues follow an optimistic path, an IPO could be possible, although this is not perceived to be the most likely route.

APPENDIX

Appendix A

Patented

Bioreactor (Blanco et al. (2012))

WO 2012069841 A1

Publication number	WO2012069841 A1
Publication type	Application
Application number	PCT/GB2011/052316
Publication date	31 May 2012
Filing date	24 Nov 2011
Priority date	24 Nov 2010
Also published as	<u>CN103328625A, EP2652119A1</u>
Inventors	Maria Teresa Mortera Blanco, Andrew Guy Livingston, Hugo Miguel Magalhaes Macedo, Athanasios Mantalaris, Nicki Panoskaltsis
Applicant	Imperial Innovations Ltd.

Appendix B

Customer Segmentation Criteria

FACTOR	CUSTOMER MARKET
What are the characteristics of the customer?	Patients with rare blood groups (1% of the population)
How will customers purchase the product?	Through the NHST Blood and Transfusion service
What are the customer specific needs and preferences?	To cover the rare blood group sector in the UK

Appendix C

Rare Blood Groups UK

Blood Group	Percentage of UK Population (%)
AB Negative	1
Sickle Cell	0.016
Colton	0.2
Kell	0.01
All Other Rare	N/A

(Blood UK)

Appendix D

Team title and description

Job Title	Description
Entrepreneur/CEO Marius Larsen	Responsible for strategy formulation and the overall success of the company <ul style="list-style-type: none"> • <i>Serial entrepreneur, CEO of Contego Stormproof Umbrellas and voted most connected business student at Imperial College Business School. A visionary, complex problem solving skills</i>
Financier Neil Shah	Responsible for raising capital and for the financial management of the company <ul style="list-style-type: none"> • <i>Extensive experience working in the Financial Industry, notably the Bank of England. Critical thinker with fine attention to detail</i>
Delivery Specialist	Responsible for acquisition and installation of new

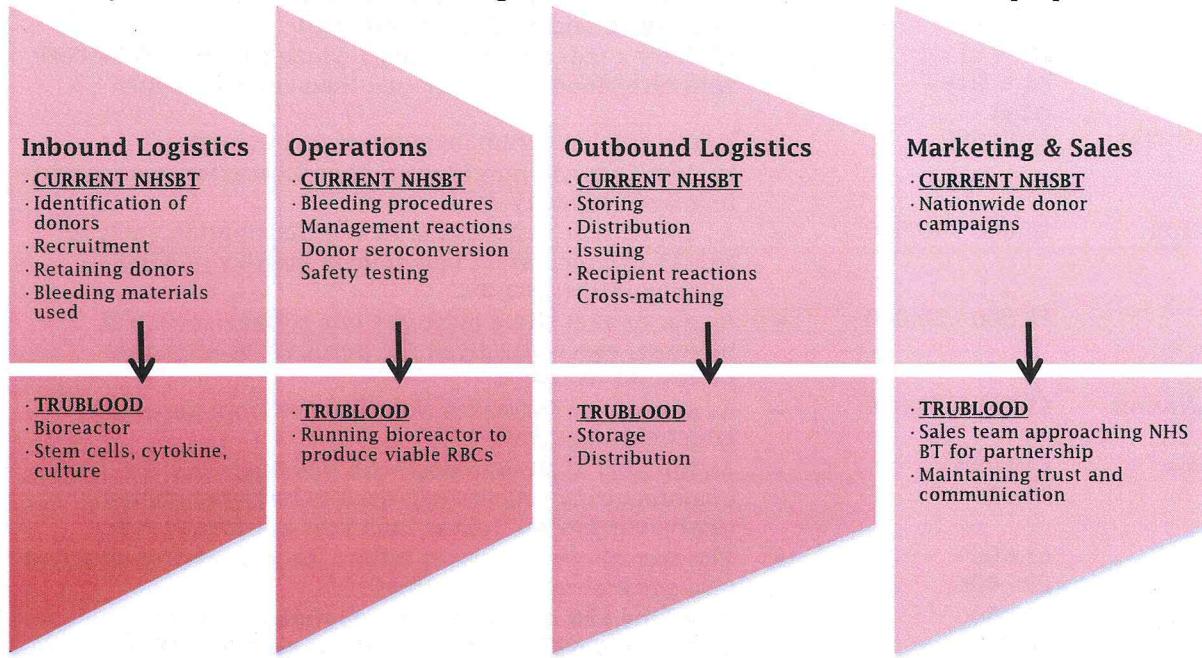
Sharika Anjum	equipment, as well as distribution of TruBlood
	<ul style="list-style-type: none"> • Several previous managerial roles and graduate of Imperial Business School. Extensive networking and strategic partnership skills
Technical Innovator Riham Rabee	Responsible for further development and commercialisation of TruBlood
	<ul style="list-style-type: none"> • Graduate of Imperial College School of Medicine, experience in both business and medical sector, forward thinker
Sales Specialist Muhammad Najim	Responsible for sales, strategic market planning, market research programmes and partnership growth
	<ul style="list-style-type: none"> • Highly successful marketing graduate with experience working in a plethora of industries. Brings fresh insight and passion to the team
Clinical Director	Responsible for supervision of laboratory with overall feedback to management team on clinical policies and procedures, ethics and other regulatory affairs
	<ul style="list-style-type: none"> • To be hired
Chief Operating Officer	Responsible for the day-to-day operations of the company, ensuring production quotas are met to achieve budgeted results.
	<ul style="list-style-type: none"> • To be hired

Appendix E

Risk	Risk Size	Why?	Mitigation Strategy
Product	Very Low	<ul style="list-style-type: none"> • Demonstrated highly successful proof-of-concept • Production process is controlled • Input prices have remained relatively stable over the past 10 years 	<ul style="list-style-type: none"> • Ensure as 'first entrant' reputation is maintained via existing networks
Technology	Moderate	<ul style="list-style-type: none"> • Technology is proven and IP rights are protected. • Fast moving technological environment, with new entrants developing blood products. 	<ul style="list-style-type: none"> • Renew patent • Promote new brand as 'the first entrant'
Market	Very Low	<ul style="list-style-type: none"> • The need for blood will always exist, and in particular Black and Minority Ethnic groups continue to rely on very rare blood types. 	<ul style="list-style-type: none"> •
Operational	Low	<ul style="list-style-type: none"> • Simple production process & distribution will be primarily handled externally by NHSBT 	<ul style="list-style-type: none"> • Maintain relations with NHSBT
Financial	Moderate	<ul style="list-style-type: none"> • Required rate of return of investors may change 	<ul style="list-style-type: none"> • Ensure projected revenues are met
Legal	Very Low	<ul style="list-style-type: none"> • Patented IP 	<ul style="list-style-type: none"> • Renew patent
Reputational	Very Low	<ul style="list-style-type: none"> • Product has been clinically proven and B2B sales through NHSBT limit public exposure 	<ul style="list-style-type: none"> • Maintain relations with NHSBT

Appendix F - VALUE CHAIN ANALYSIS

→ Primary Activities: Value chain showing differences between current NHSBT and proposed TRUBLOOD



Appendix G - Breakeven Analysis

Breakeven = fixed costs divided by the per-unit contribution (selling price - variable cost).

$$BE = \frac{FC}{SP - VC}$$

However, the estimated contribution per unit varies from Year 1 to Year 2, as do the fixed costs and the company is projected to make a loss in its first year. Thus the BE is given as follows, by adding first year's deficit to the Year 2 fixed costs that must be recouped by sales' contributions:

$$FCY1 = (£4,457,000 - £500,000) - £3,480,000 = £477,000$$

$$FCY2 = £6,928,000 - £6,380,000 = £548,000$$

$$BE = \frac{(FCY1 - 2900u \times (\£1315 - \£1200)) + FCY2}{(\£1315 - \£1100)} + Y1 u$$

$$BE = \frac{\£143,500 + \£548,000}{(\£1,315 - \£1,100)} = 2900u + 3216u = 6116u$$

Time taken to breakeven is computed based on linear sales rates for each year:
(Y1: 2900u/2900u = 1 year) + (Y2: 3216u/5800u = .555 year = 6.67 months = 202 days)
= 1 year 202 days

Appendix G

Based on Y1 projections, we calculate the average monthly NWCN and multiply by the number of months until break even. This will mean Time Till Out of Cash = Time till Breakeven.

$$\frac{\frac{(\text{Total payments less reactor investment}) - \text{Total receipts}}{12 \text{ months}} \times 16.67}{\frac{(\£4,457,000 - \£500,000) - \£3,813,500}{12 \text{ months}}} \times 16.67 \text{ months} = \£199,345 = \text{Rounded to } \£200,000$$

Appendix H

Assumption	Justification
Projected Profit Margin	24%

- Calculated based on cost and price from year 3 onwards as our production costs stabilise

Expected Unit Price	£1,315	<ul style="list-style-type: none"> Calculated as a weighted average selling price given our sales mix of 4 products, using the value based pricing strategy adopted
Expected Unit Cost	£1,000	<ul style="list-style-type: none"> Our cost stabilises at £1,000 in year 3 given our process will be mapped and made more efficient
Market Share in Year 5	100% of UK Rare Blood types	<ul style="list-style-type: none"> We have a patented technology which will provide NHSBT with rare blood at a lower cost than current supply
RBC Bioreactor	£500,000	<ul style="list-style-type: none"> Figure obtained from Inventor of technology In Year 4 we will purchase another bioreactor to cope with increased capacity
Distribution	£6,000 - 40,000	<ul style="list-style-type: none"> As our market share increases our distribution costs to NHSBT will increase. Costs remain low due to NHSBT's existing infrastructure.
Storage	£8,000 - 20,000	<ul style="list-style-type: none"> As our market share increases our storage costs will increase, especially given the purchase of a second Bioreactor in Year 4
Administration	£5,000 - 70,000	<ul style="list-style-type: none"> As production increases we will move from part-time administration staff
IT Systems	£40,000 - 25,000	<ul style="list-style-type: none"> An initial IT System to deal with inventory and the manufacturing process will need to be implemented. Improvements will follow each year at a steady rate.
Electricity	£5,000 - £35,000	<ul style="list-style-type: none"> The annual cost increases reflect the projected production changes and reactor run-time.
Marketing	£10,000 - 20,000	<ul style="list-style-type: none"> Given the B2B nature of our operation and direct partnership with NHSBT, we do not need as a large marketing budget as a B2C company.
Legal	£10,000 - 30,000	<ul style="list-style-type: none"> As we increase our market share, we envisage incurring legal costs for defending our patents and IP.
Rent	£30,000 - 50,000	<ul style="list-style-type: none"> The step up by £20,000 is due to the required increase in space for the second bioreactor in year 4
Salaries	£321,000 - 1,099,000	<ul style="list-style-type: none"> As our market share increases, we will hire two core new staff in addition to production staff. These include a Clinical Director and a Chief Operations Officer
Sales Rate		<ul style="list-style-type: none"> Linear as blood demand is not seasonal

Appendix I - Milestones

Milestones to be completed	Assumption to be tested	
Placing first order and shipping to the UK	Expected unit cost Distribution Storage Administration IT Systems	£1000 £6,000 £8,000 £5,000 £40,000
Test sales in 1 st year	Expected unit price Projected profit margin Distribution Marketing Sales rate	£1,315 24% £6,000 - £40,000 £10,000 - £20,000
1 year scale up	Administration IT Systems Salaries	£5,000 - £70,000 £40,000 - £25,000
Year 3 - Expansion via hiring of two new core staff	Salaries	£321,000 - £1,099,000
Year 4 - Purchase of new Bioreactor	RBC Bioreactor	£500,000
Full operation	Rare blood groups market share in Year 5	100%

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