AQU@TEACH

OUTPUT 6:
ENTREPRENEURIAL SKILLS TEXTBOOK

AQU@TEACH:

Innovative educational techniques to promote learning among European students using aquaponics

Erasmus+

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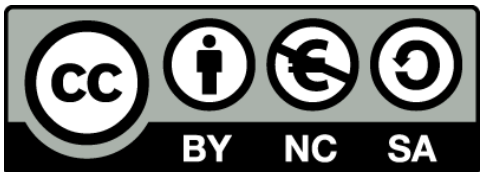

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1. INTRODUCTION

Aquaponics potentially offers entrepreneurs many possibilities for starting a business, including the commercial production of food and non-food products, consultancy services for the design and build of commercial farms, the supply of specialist equipment, and domestic systems for restaurants, schools and the general public. Commercial producers can sell plants and fish through a variety of direct and indirect markets. Direct markets include famers' markets, farm stalls, and community supported agriculture (CSA) schemes; indirect markets include grocery stores, restaurants, institutions, and wholesalers. Commercial producers can also diversify, by offering agritourism, training workshops, and the sale of specialist equipment. This chapter presents an overview of commercial aquaponics, in order to highlight some of the key issues that an entrepreneur should bear in mind before embarking on a new venture.

1.1 Aquaponics – is Europe market ready?

In 2015 the European Parliamentary Research Service included aquaponics in a report on ten technologies that could change our lives, alongside autonomous vehicles, graphene, 3D printing, massive open online courses (MOOCs), virtual currencies (Bitcoin), wearable technologies, drones, smart home technologies, and electricity storage (van Woensel *et al.* 2015). Aquaponics is therefore acknowledged as being at the cutting edge of technological innovations. But is it too cutting edge? Is there a viable market for it in Europe? One way to try to start to answer these questions is to use Gartner's Hype Cycle (Figure 1) which provides a graphic representation of the maturity and adoption of technologies and applications, and how they are potentially relevant to solving real business problems and exploiting new opportunities.

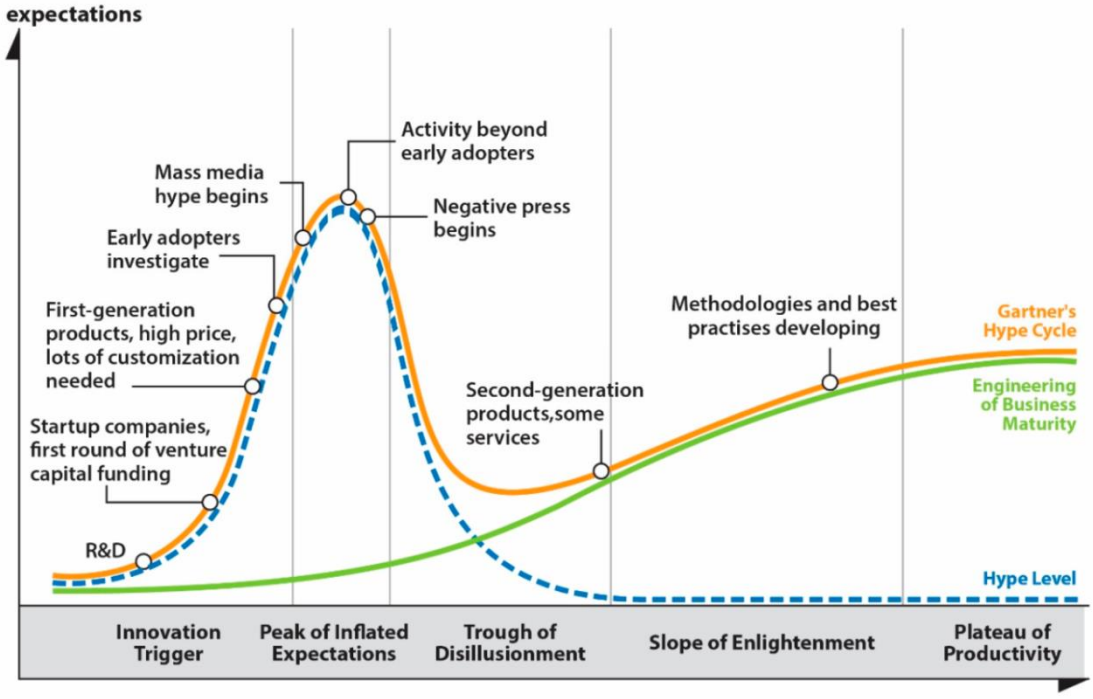

Figure 1: Gartner's Hype Cycle (Turnšek *et al.* 2020)

The Hype Cycle combines two theories of innovation adoption: the Hype Level Curve and the Engineering of Business Maturity Technology S-Curve. The bell-shaped Hype Level Curve explains a generally applicable path that a technology takes in terms of its expectations over time. The rapid upward trend at the beginning of the curve results from a sudden overly positive and irrational reaction to the introduction of a new technology, caused by the lure of novelty followed by social contagion, which in turn attracts the first media coverage. Decision makers follow the trend rather than carefully assessing the technology's potential themselves, and investors and adopting companies aim to capitalize on possible first-mover advantages. The curve culminates in a sharp peak, where high expectations are further boosted by media coverage. The overenthusiasm and over-hyped investments then result in commercial adoptions of first generation applications of the technology that fail to meet performance and/or revenue expectations. Public disappointment spreads and is again hyped by media, this time negatively, and the expectations suddenly ebb and collapse into a trough (Steinert & Liefer 2010).

The Engineering of Business Maturity Technology S-Curve, on the other hand, is based on the notion that the performance or maturity of a technology develops only slowly in the beginning, since its fundamentals are poorly understood, and investments into pilots and early adoptions may result only in small performance gains. Depending on the technology, at some point its performance will take off until a plateau, defined by the technology's specific limits, is reached. The combination of the two curves forms the Hype Cycle. Its path can be divided into five distinct phases: Innovation Trigger, Peak of Inflated Expectations, Through of Disillusionment, Slope of Enlightenment, and Plateau of Productivity. These phases are characterized by distinct investment, product and market patterns that can be used to determine where an innovation lies on the Hype Cycle (Steinert & Liefer 2010).

An **Innovation Trigger** is anything that sets off a period of rapid development and growing interest, and it will be different for each innovation. It may be a product launch, a major improvement in price/performance, adoption by a respected organization, or simply a rush of media interest that socializes and legitimizes the concept. The most common indicator that an innovation is past the trigger but has not yet reached the Peak of Inflated Expectations is that it is available for purchase from just one or two commercial vendors funded by seed rounds of venture capital, it requires significant customization in order to work in an operational environment, the price is high relative to the cost of production and to the cost of related but more established products, and suppliers are not yet able to provide references or case studies (Fenn & Blosch 2018).

Indicators that a technology has reached the **Peak of Inflated Expectations** include the trade and business press running frequent stories about the innovation and how early adopters are using it, analysts speculating about its future impact and transformational power, a surge of suppliers (often 30 or more) offering variations on the innovation and who are able to provide one or two references of early adopters, and established companies buying one or two early leading suppliers in expensive, high-profile acquisitions toward the end of the peak. As the innovation slides into the **Trough of Disillusionment**, there is not always a drop in the overall adoption numbers. Instead, the anticipated rapid growth in adoption may simply be delayed, and what suppliers and investors expected to be a 'hockey stick' uptake remains a slow growth path. As a result, supplier consolidation and failure occur

because there is too little adoption growth to sustain so many similar products, and suppliers use the same few case studies and references of successful adopters (Fenn & Blosch 2018).

On the **Slope of Enlightenment**, early adopters who continue working with the technology begin to experience net benefits and regain motivation. With more investments, the contextual understanding of the technology grows, resulting in improved performance, and the curve starts to rise again. Suppliers of the innovation offer second- or third-generation products that require little customer support, new success stories and references start to proliferate, and press articles focus on the maturing capabilities and market dynamics of the suppliers. Finally, in the **Plateau of Productivity** stage, the technology is realistically valued and mainstream adoption of the technology surges. Clear leaders emerge from the many suppliers that joined the market on the Slope of Enlightenment, investment activities focus on acquisitions and initial public offerings, and the terminology connected with the innovation becomes part of everyday speech (e.g. Googling, texting, blogging). The time between the Peak of Inflated Expectations and the Plateau of Productivity has been termed the *time-to-value gap* which, depending on the technology, varies between two years and two decades. Some technologies, however, become obsolete before they reach the Plateau of Productivity, if they fail in the market or are overtaken by competing solutions (Fenn & Blosch 2018).

One of the problems with the Hype Cycle is that it is not quite clear how to measure hype. One method that has been used to gauge where aquaponics lies on the curve is to calculate the 'hype ratio', which is the search results for 'aquaponics' in Google divided by search results for 'aquaponics' in Google Scholar at a certain point in time. This provides an indication of the popularity of a subject in the public media in comparison with academic circles. Aquaponics has a hype ratio of over 1000, which is significantly higher than both hydroponics (over 100) and aquaculture (about 20). According to this method, aquaponics can be considered to be an 'emerging technology'[1] (Junge *et al.* 2017). Another method is to analyse Google Trends data which shows how frequently a given search term is entered into Google's search engine relative to the site's total search volume over a given period of time. From 2004 to 2019 the term 'aquaponics' peaked in 2012 before starting to descend, and this downward trend is still continuing (Turnšek *et al.* 2020).

Innovations may be at different positions on the curve in different industries or regions, depending on the pertinent macro-environmental factors (see section 1.2). The recirculating aquaculture research community in the US introduced the idea of aquaponics in the late 1970s, and the first commercial farms were developed there in the 1980s. Several more sprang up in the following decade, and the number has since continued to slowly increase. The most recent survey recorded 145 commercial producers in the US in 2013 (Love *et al.* 2015). Aquaponics has developed at a much slower rate in Europe (Villarroel *et al.* 2016), and while there are small prototype systems in most countries, and various commercial farms in development, there is still only a handful that are fully operational, while others have tried and failed along the way (see section 1.3). Early adopters necessarily have to go through the phase of trial and error, making it a highly risky endeavour. The small size of most of the farms is due to the high initial investment required coupled with the novelty

[1] Emerging technologies are technologies whose development, practical applications, or both are still largely unrealized, such that they are figuratively emerging into prominence from a background of nonexistence or obscurity

of the technology. Most investment costs are doubled when compared to the competing enterprises that engage only in aquaculture or horticulture. Because investors are reluctant to invest several million EUR in large-scale farms, small-scale pilot facilities are expected to provide a twofold proof-of-concept: technological and commercial. This leads to a 'chicken and egg' dilemma: large-scale farms are not built because investors require comprehensive proof of concept, and the small-scale farms are not able to provide this because they are simply too small. To become commercially viable, businesses need to either scale up to be competitive with conventional production (which amounts to producing hundreds of tons of fish and thousands of tons of vegetables each year), or they need to develop additional business models, such as an expanded product range, agritourism, consulting services, education, or specialist equipment (Turnšek *et al.* 2019; Turnšek *et al.* 2020).

The indicators of where an innovation lies on Gartner's Hype Cycle (Fenn & Blosch 2018) are difficult to apply in the case of aquaponics in Europe. A small handful of companies has been successful in securing investment from venture capital (VC) funds, and this might have been facilitated by speculation by the European Parliamentary Research Service analysts about the future impact and transformational power of aquaponics (van Woensel *et al.* 2015). Indeed, since 2015, two start-ups received VC funding before they received angel funding, and another received corporate funding before it received VC funding; both of these are highly anomalous funding trajectories (see Chapter 6). At the same time, a number of start-ups – commercial farms and suppliers of aquaponic systems – have failed over the past five years, and there is little evidence of any great rush to take their place.

The hype around aquaponics is inflamed by market forecast reports which make unsubstantiated claims about the technology, such as its comparative superiority in terms of productivity, growth time and potential for diversification in a commercial setting (Turnšek *et al.* 2019). For example, the *Aquaponics Market Forecast 2020-2025* report valued the global market size (for produce, system components and equipment) at around €522 million in 2018, with just under half of this being generated in the US, and forecast a compound annual growth rate (CAGR) of about 15% from 2019 to 2025; this would lead to a global market worth €1.4 billion (IndustryARC 2019). Value Market Research forecast that the global market will be worth €1.3 billion in 2024, €500.4 million of which will be generated in Europe (Value Market Research 2020). According to IndustryARC, the driver behind this forecast growth is the increasing rate of urbanisation and industrialisation, which will result in the loss of agricultural land and therefore favour a technology that produces eight times more food per acre compared with traditional agriculture (IndustryARC 2019). However, this assertion can be questioned. The comparatively high production rate is derived from the website of Nelson and Pade, a leading provider of commercial and domestic aquaponic systems, and is in itself unsubstantiated. The productivity of an aquaponic system is determined by so many variables – the type of crop, the amount of nutrients in the water, the amount of oxygen and carbon dioxide in the air, the amount of light and temperature, and so on. These are not elements specific to aquaponics per se, but are controlled by greenhouse management practices, such as fertigation, heating, artificial lighting, CO_2 generation, etc. In addition, higher production volumes can only be compared meaningfully if there is a clear reference to the input levels required to achieve this output. While the productivity per unit area might be higher compared to conventional agriculture, aquaponic systems might require more energy, capital and labour. Since these systems are not technically standardised,

data from any one system can only be considered as a case study, and should not be used as the basis for making generalisations about the technology as a whole (Turnšek *et al.* 2019).

Optimists will argue that the development of aquaponics will progress in the future to follow Gartner's Hype Cycle towards a Slope of Enlightenment and eventually establish itself as a mature technology. Pessimists, on the other hand, will argue that aquaponics is merely vacuous hype, with little chance of ever reaching the Plateau of Productivity (Turnšek *et al.* 2020). In truth, very little 'falls off' the Hype Cycle if innovations are tracked based on their capabilities, rather than specific ways of delivering the capabilities. Failure typically occurs where there are multiple ways to deliver the same capability or benefit. For example, broadband connectivity has made its way through the Hype Cycle over the past decade, but some of the techniques to deliver it (such as ISDN and broadband over power lines) have fallen off the Hype Cycle. Other techniques (cable modem and DSL) have reached maturity. The actual capabilities – broadband, speech recognition, biometrics and videoconferencing, for example – do not fall off the cycle. But specific techniques, protocols, operating systems, products and devices may be supplanted by alternatives (Fenn & Blosch 2018).

With this in mind, it is interesting to note that the global market for vertical farming was valued at €3.1 billion in 2018, and is forecast to grow at a staggering rate of 27% by 2026 to €19.22 billion (Global Market Insights 2019). While aquaponics is percentage-wise currently the smallest of the technologies involved – after hydroponics and aeroponics – and is forecast to remain so, the *unique capability* of aquaponics is that of producing fish *and* vegetables in the same vertical farming system. In the right place, this is where there are likely to be viable business opportunities.

1.2 PESTEL analysis

PESTEL analysis (formerly known as PEST analysis) is a tool used to analyse and monitor the macro-environmental factors that may have a profound impact on the profitability of a business, and it is especially useful when considering the viability of starting a new enterprise. It is often used in collaboration with other analytical business tools such as the SWOT analysis (see Chapter 4) and Porter's Five Forces (see Chapter 5) to give a clear understanding of a situation and related internal and external factors. PESTEL is an acronym that stands for Political, Economic, Social, Technological, Environmental and Legal factors.

1.2.1 Political factors

These factors are all about how and to what degree a government intervenes in the economy or a certain industry. This can include government policy, political stability or instability, corruption, foreign trade policy, tax policy, labour law, environmental law, and trade restrictions. These are all factors that need to be taken into account when assessing the attractiveness of a potential market.

Government policy and programs on food production are established in particular political, social, environmental and economic contexts. The policies affecting food systems in Europe – agriculture, trade, food safety, environment, development, research, education, fiscal and social policies, market regulation, competition, and many others – have developed in an ad hoc fashion over decades (De Schutter 2019). However, in recent years there has been a common agenda to strive to improve the

economic, social and environmental sustainability of both the methods by which food is produced, and the supply chains by which it is distributed. Aquaponics clearly has a role to play in the agendas of both Aquaculture 4.0 and Agriculture 4.0, which embrace the application of innovative and disruptive technologies in order to increase efficiency, productivity, and sustainability. The term 'Aquaculture 4.0' was introduced by the European Union in a Horizon 2020 Innovation call in 2017. In this call the focus was on the application of Industry 4.0 technologies, such as the Internet of Things and artificial intelligence, to the development of sustainable smart breeding programmes and feeding methods. The concept can be extended to fishery management strategies that require real-time monitoring of water quality, such as RAS and multi-trophic aquaculture (Dupont *et al.* 2018). Similarly, Agriculture 4.0, also called 'the fourth agricultural revolution', embraces the adoption of innovative and disruptive technologies – such as hydroponics and vertical farming – to ensure food security in the face of growing population size, increased urbanization, scarcity of natural resources, and climate change (De Clercq *et al.* 2018).

Governments have the power to foster a full ecosystem of technology companies, research centers, universities, and innovative start-ups working together to drive forward these agendas, and can enable the environment by offering financial incentives, regulatory flexibility, and providing infrastructure at an affordable price. However, currently aquaponics has no explicit political support, either at EU or at national level because, as a hybrid technology, it falls between the two stools of agriculture and aquaculture. At EU level, policy is dictated by two separate Directorates-General of the European Commission – Agriculture and Rural Development (DG AGRI), and Maritime Affairs and Fisheries (DG MARE), and by separate European Parliament Committees (AGRI and PECH). In the absence of an umbrella strategy cutting across these different policy areas, a number of synergies are missed, including aquaponics. This silo approach to the governance of food production is also found in the national ministries of some countries in Europe.

However, there are signs that things at EU level are starting to change or, at least, that efforts are being made to break down the institutional silos in order to foster innovation. In 2012 the European Commission launched five European Innovation Partnerships, one of which is dedicated to agricultural productivity and sustainability (EIP-AGRI). Their mandate is to help to pool expertise and resources by bringing together public and private sectors at EU, national, and regional levels, and to support the cooperation between research and innovation partners. A recent report on circular horticulture acknowledged the contribution that aquaponics could make, although it also flagged up the bottlenecks, including the need for demonstration of large-scale systems, the lack of experience in and tradition of aquaponic farming in Europe, and the importance of taking into account market/consumer needs regarding the choice of fish species, rather than focusing on species that are easy to cultivate in aquaponic systems (EIP-AGRI 2019).

Social innovations abound in food systems. Local food initiatives are increasingly circumventing conventional markets and supply chains. They include community-supported agriculture, farmers' markets, local food policies, urban food councils, and various types of urban agriculture. Cities and regions are emerging as major actors in these innovations, and new alliances are being formed between public entities, local entrepreneurs, and civil society groups. Yet there is a gap between policies developed at national and EU level and these social, often citizen-led innovations: rather

than encourage and reward local experimentation, top-down policies tend to homogenize, in the name of efficiency, gains from economies of scale and standardization, or undistorted competition (Dupont *et al.* 2018).

1.2.2 Economic factors

These are the determinants of a country's economic performance. Factors include economic growth, exchange rates, inflation rates, interest rates, disposable income of consumers, and unemployment rates. These factors may have a direct or indirect long-term impact on a company, since they affect the purchasing power of consumers and could possibly change supply and demand models. Consequently they also affect the way that companies price their products and services.

With regard to aquaponics, the main economic factors include labour costs, the price of land, rent costs, capital costs (equipment), operating costs (utility costs and resources), and economic instruments implemented by government such as subsidies and taxation. Intensive farming and marine fishing benefit from many years of institutionalisation, with corresponding support in the form of the Common Agriculture Policy and other subsidies. Aquaponics is disadvantaged since it is not classified as either of the above. Furthermore, since aquaponics is not classified as agriculture, obtaining insurance for the fish and the crop may be challenging, or may not even be possible, which increases the business risk. The labour costs of food production in the EU are relatively high, which means that it may not be possible to compete on price with products imported from parts of the world where labour costs are much lower (see case study 1.3.4 for an example), and many types of crop cannot be mechanised in aquaponic systems.

While aquaponics is often explicitly touted as a food production technology particularly suited for urban areas, the real estate cost is often underestimated, and there are significant differences between the price of land within the city limits and that outside. As an example, peri-urban real estate within the city limits of Dortmund, Germany, is 280-350 €/m^2, compared with 2-6 €/m^2 for agricultural land outside the city limits (Turnšek *et al.* 2019).

1.2.3 Social factors

Social factors are the demographic characteristics, norms, customs and values of the population within which the company operates. This includes population trends such as the population growth rate, age distribution, income distribution, career attitudes, health consciousness, lifestyle attitudes and cultural barriers. These factors are especially important for marketers when targeting certain customer segments, and can also give insight to the local workforce and its willingness to work under certain conditions. Social factors tend to operate at the national, regional and local level.

Aquaponics should be well placed to take advantage of an increasing social desire for locally-sourced food which is driven by a number of factors, including environmental concerns and the anonymity of the agro-industrial offering. Aquaponic produce should be anything but anonymous – it offers a unique opportunity to tell an innovative story around how it was farmed. However, one has to bear in mind that the story may not appeal to everyone, and the viability of commercial aquaponic farms in Europe depends on public perception of their produce, and the associated social acceptance among other key stakeholder groups – wholesalers, retailers, caterers, etc. Commercial production

that does not involve all these groups runs the risk of non-acceptance of the produce. For some stakeholders plants and/or fish produced in aquaponic systems are innovative and interesting, while for others the technology is not acceptable. The few surveys that have been conducted in Europe to date indicate that the technology is still unfamiliar to many of these stakeholders, and there is public scepticism about consuming plants that have been in contact with the fish water due to misguided food safety fears, and concern about the welfare of fish raised in tanks (Miličić *et al.* 2017). The acceptance of aquaponic produce seems to vary in different countries. For example, in a survey of residents in Berlin the majority said that they would not buy aquaponic produce (Specht *et al.* 2016), while in Romania the majority of those surveyed said that they would buy fish raised in aquaponic units, due to its perceived health benefits and freshness (Zugravu *et al.* 2016). This would suggest that there are strong cultural differences in the perception of aquaponics, which highlights the importance of conducting willingness-to-pay surveys in order to assess the local demand for the produce.

1.2.4 Technological factors

These pertain to innovations in technology that may affect the operation of the industry and the market either favourably or unfavourably – national R&D incentives, the level of innovation and automation, the pace of technological change, and the amount of technological awareness that a market possesses. These factors may influence decisions about whether to enter or not enter certain industries, to launch or not launch certain products, or to outsource production activities abroad. By knowing what is going on technology-wise, you may be able to prevent your company from spending a lot of money on developing a technology that would become obsolete very soon due to disruptive technological changes elsewhere.

The application of Industry 4.0 technologies in order to automate, enhance and optimize aquaponic systems has the potential to make significant increases in the efficiency – and therefore economic viability – of commercial aquaponics farms. The Internet of Things (IoT) – a network of physical devices that communicate between themselves via a cloud server, without the need for any human intervention – can be used to continuously monitor and analyze the whole system (parameters such as room temperature, humidity, water temperature, pH, etc.). IoT platforms have embedded sensors connected with physical objects which are controlled by a central processing unit. The sensors can also communicate with the user through a network, thereby allowing corrective actions to be taken remotely. The real-time data collected from the sensors is then stored and can be analysed in order to maximize yield, reduce risk, and eliminate the need for manual intervention (Butt *et al.* 2019). IoT platforms specific to aquaponics systems are still in development, and are likely to have a significant impact when they become commercially available.

Advances in genetic engineering and consequent developments in GMO (genetically modified organisms) in traditional horticulture and aquaculture may either decrease the competitivity of aquaponic produce or, alternatively, increase demand, depending on societal acceptance.

1.2.5 Environmental factors

These have come to the forefront only relatively recently, due to the increasing scarcity of raw materials, and pollution and carbon footprint targets set by governments. Environmental factors include ecological and environmental aspects such as weather, climate, environmental offsets, and climate change, which are especially likely to affect an industry such as agriculture. Furthermore, growing awareness of the potential impacts of climate change is affecting how companies operate and the products they offer. This has led to many companies getting more and more involved in practices such as corporate social responsibility (CSR) and sustainability.

Aquaponics is currently well placed in terms of environmental factors: over-fishing in the sea, water scarcity and soil/water degradation caused by intensive farming, the use of antibiotics in aquaculture, and pesticides and herbicides in field production, should all favour a food production technology that neither contributes to nor exacerbates these problems. Controlled-environment agricultural technologies, such as aquaponics, are likely to become more important in the future due to climate change, while the phenomenon of 'food kilometres' – the carbon footprint of food production and distribution – plays to the strengths of local production of food using aquaponics, especially within cities. A symbiotic relationship can be created between a farm and its host building by coupling the flows of the agricultural process – heat, water, Co_2 – with those of the building in order to close the waste, resource, and energy loops.

1.2.6 Legal factors

Although these factors may have some overlap with the political factors, they include more specific laws such as discrimination laws, antitrust laws, employment laws, consumer protection laws, copyright and patent laws, and health and safety laws. It is clear that companies need to know what is and what is not legal in order to trade successfully and ethically. If an organisation trades globally this becomes especially tricky, since each country has its own set of rules and regulations. In addition, you need to be aware of any potential changes in legislation and the impact it may have on your business in the future.

Rules and regulations at local, national and EU level all have to be considered, as each one affects a different part of a business – local for planning permission, national for veterinary control and which plant and fish species which may be produced, and EU for general policy on agriculture and fisheries. To date no specific food safety rules apply for aquaponic produce, and there are no harmonized legal regulations at EU level relating to aquaponic food production. The only country that has issued regulations specific to aquaponics is the UK. In some European countries, such as France, Hungary and Switzerland, recirculating aquaculture systems are regulated by governmental bodies responsible for fisheries and aquaculture, while hydroponics is regulated by agriculture bodies. Licence registrations, permits, and authorisations for sales therefore have to be obtained from different administrative bodies. In other countries, such as Belgium, aquaculture and greenhouse cultivation are both considered to be agricultural activities (Hoevenaars *et al.* 2018; Joly *et al.* 2015).

Different countries have different regulations regarding non-native fish species. For example, in the UK it is permissible to raise tilapia, subject to the issue of a permit; in Germany is it also permissible, but the solid and liquid waste needs to be specially treated before it is released into municipal waste

water systems; in Portugal and France tilapia is not a permitted species (Hoevenaars *et al.* 2018; Joly *et al.* 2015). Different countries also have different regulations for growing certain crop species. As a high value crop, medicinal cannabis would make a good choice for a commercial venture. In a few countries, such as Malta, Greece, Spain, Portugal, Denmark and the Netherlands, it is legal to grow it commercially, subject to being granted a license, but in most other countries it is currently illegal.

The EU organic regulatory regime does not have any standards or regulations for certifying aquaponic produce as organic, due to the fact that, as noted previously, aquaponics is not officially recognised as a food production technology. However, the separate regulations which currently apply to horticulture and aquaculture both exclude the possibility of such certification being achieved. According to the European Commission, organic plant production is based on nourishing plants primarily through a soil ecosystem, so hydroponic cultivation is not allowed, while recirculating technologies are prohibited in organic aquaculture (Kledal *et al.* 2019).

In most countries in Europe there is no idependent category for urban agriculture in municipal planning zones, as agriculture has traditionally been regarded as a rural activity by urban planners. It therefore falls between different policy areas, which can make it difficult to get permission to set up an aquaponic farm in an urban location. A few cities, such as Paris, have taken the first step to adapt local codes to promote urban agriculture, including aquaponics.

1.2.7 Summary

This section has provided a brief overview of some of the macro-environmental factors which operate at various scales – global, EU, national, regional, and local – and how they relate to commercial aquaponic farming, both now and potentially in the future. It will be apparent that the six factors are not silos – on the contrary, they are inextricably interconnected. While the environmental and social factors generally push towards the viability of commercial aquaponics, especially in urban contexts, the political and legal factors currently tend to pull against it. For example, political factors – such as the lack of a common EU food policy that embraces both horticulture and aquaculture – influences the legal factors – such as the absence of standards or regulations for certifying aquaponic produce as organic. Since organic produce generally realises higher market prices than non-organic produce, the lack of certification for aquaponics means that it may be hard to compete (but see case study 1.3.1 for an exception to this).

1.3 Case studies

The following case studies briefly tell the stories of the first commercial aquaponic farms in Europe, and the lessons that can be learnt from them.

1.3.1 ECF Farmsystems

ECF Farmsystems was founded in 2012 and started building its 1800 m^2 prototype aquaponic farm in Berlin in 2014; production started in 2015. The 1000m^2 plant production area was initially used to grow a wide variety of crops, but the farm struggled to establish a local direct marketing channel for limited quantities of each of them. In order to generate the large production volumes needed to penetrate the market via large distribution channels such as supermarket chains, the business model

was revised. The farm now only grows basil, which is marketed as 'Hauptstadtbasilikum' (capital city basil) and sold as a potted herb via a single retailer at over 250 supermarkets in the city, while the fish (red tilapia) is marketed as 'Hauptstadtbarsch' (capital city perch) and mainly sold to local supermarkets, with a smaller portion going to local restaurants. Local branding is therefore put at the forefront of the strategy for marketing the produce, and in fact the basil generates higher sales than non-local organically labelled basil, despite its slightly higher price. ECF also offers farm tours for schools, universities and other interested groups. The farm was seen as a proof-of-concept, and the company has now leveraged this know-how to set up a second stream of revenue derived from designing and building turnkey aquaponic farms for third parties. ECF modulates its revenue in this business either by generating a one-time engineering sale, or by negotiating a share of the profits of these farms (Figeac 2017; Turnšek *et al.* 2019).

1.3.2 NerBreen

At 6000 m^2, NerBreen in Spain is currently the largest aquaponic farm in Europe. It started production in 2016, by which time the team had already accumulated five years' experience with a 500 m^2 pilot. The farm is mainly focused on the aquaculture side of production, with 70% of the revenue generated from sales of up to 70 tonnes of tilapia per year. The fish is sold in supermarkets and local markets, and 50,000 portions of tilapia are sold to school kitchens each month. The 3000 m^2 of plant units is used to grow garlic, strawberries, and four different types of lettuce in winter, while in the summer they replace the garlic with cherry tomatoes and peppers. The focus is on quality and variety rather than quantity, in order to achieve a higher market price for the produce, and the decison to grow garlic and cherry tomatoes was dictated by the lack of competition for these products. The vegetables are sold at supermarkets and markets with well-designed packaging and leaflets which explain the sustainability benefits of aquaponics. In order to overcome the negative perception of Spanish consumers towards tilapia, much of which is imported from intensive aquaculture farms in China where it is not raised in healthy conditions or fed a high quality feed, and is therefore considered to be low-quality, NerBreen focus their marketing on local production using the best quality water and feed, which results in a high quality fish product (Turnšek *et al.* 2019).

1.3.3 UrbanFarmers

UF002 De Schilde, an aquaponic farm sun by Swiss start-up UrbanFarmers (UF) in The Hague, Netherlands, was operational from 2015 to 2018. Having previously gained experience with a 260m^2 rooftop aquaponic farm in Basel, Switzerland, their business model was to sell local fish and vegetables to restaurants and caterers. Tomatoes, cucumbers, bell peppers and leafy greens were grown in the 1200 m^2 rooftop greenhouse, and tilapia were raised in 120m^3 of fish tanks on the top floor of the six storey former Philips building. However, the produce could not be priced competitively enough, and their customers soon reverted to their previous, cheaper suppliers. This required UF to change their sales channel, from business-to-business (B2B) to business-to-consumer (B2C). At the same time they diversified their business model to include tours of the greenhouse, training, renting office space, on-site direct sales, and catering. Tomatoes and other fruiting crops are produced on a vast scale in the Dutch countryside and are available in supermarkets at very competitive prices. With tomatoes retailing at €2/kilo, UF chose to offer theirs for €6.5-8/kilo, but the sale of high-priced produce was mismatched with the location of the farm, which was in one of the poorest neighbourhoods in the city, and they struggled to make sufficient sales. The Hague is by

the sea, and consequently there is a strong market for marine fish which made it difficult to sell the tilapia. The annual target turnover was €500,000, but this was never achieved, and even as turnover was growing, so too were the losses. The company had six full-time employees, and while the workforce related to production and sales was adequately matched, there were too many employees relating to general management and events. A further problem came from within the company itself. While the team had looked strong – an expert in aquaponics, a business developer, and an operations manager, there were disagreements even before the construction of the greenhouse had been completed, and within a couple of months of opening almost everyone from the initial team had left the company. UrbanFarmers AG in Switzerland went bankrupt, and since it was a shareholder in UF this further contributed to weakening the company, which itself went bankrupt a few months later (Ancion *et al.* 2019).

1.3.4 Ponika

Ponika in Slovenia set out to sell fresh-cut herbs grown in their 400 m^2 greenhouse in an attempt to fill a niche market. Data from US aquaponic farms showed that herbs grew well in aquaponic systems, and could get a good market price. After trialling several varieties, they narrowed their focus to chives, basil and mint, which had grown well and for which there was a large and frequent enough demand. The fact that the farm was located in a rural part of the country excluded the possibility of direct sales, so the produce was sold to distributors who supplied restaurants. The intention to start selling to large-scale retail chains, which would have generated higher margins, was abandoned because the contracts included financial penalties if the farm could not fulfil the orders. In fact, the herbs did not grow as well as anticipated, and the system was too small to be able to achieve the uninterrupted production required by the distributors. In addition to these problems, the labour costs needed to cut, screen and package the produce were very high. Since Ponika was the only supplier of fresh-cut herbs in the country, the distributors were happy to take their produce over imported produce, but only if the prices were equal to the market price of the international competitors. Since much of the fresh-cut herbs sold on the European market is grown in north Africa, where labour costs are much lower, the company could not compete on price, even when transportation costs were factored in, and Ponika stopped production after only two years (Turnšek *et al.* 2019).

1.3.5 GrowUp Urban Farms

In the UK, GrowUp Urban Farms tried to combine aquaponics with vertical growing technologies to produce year-round harvests of salads and herbs for the local market. The company was founded in 2013, and with the help of a crowdfunding campaign they set up a prototype farm in a shipping container in London. From 2015 they operated 'Unit 84' in an industrial warehouse. The 762m^2 of stacked horizontal beds could produce more than 20,000 kg of herbs and salads (enough for 200,000 salad bags) and 4000 kg of fish each year, and this was sold directly to local stores and restaurants, and to home delivery services. However, the unit closed down in 2017, since the comparatively small volume of produce did not make the business profitable, and the company is currently looking to raise investment in order to start a larger farm.

1.4 Conclusions

This chapter has provided an overview of the some of the key issues that an entrepreneur should bear in mind before setting up a commercial aquaponic farm. The main takeways are:

- market foreacsts for the growth of aquaponics in Europe are promising, but these may not be reliable
- innovative technologies typically fail where there are multiple ways to deliver the same capability or benefit. While coupled aquaponic systems cannot compete with hydroponics in terms of yield, due to the operational compromises needed to find a balance between optimum parameters for healthy plants and fish, they have the *unique capability* of producing fish *and* plants in the same system and, in a vertical farm, can produce high yields of both per unit area. In the right context, this opportunity should be exploited;
- it is essential to understand how the viability of a business will be impacted by the macro-environmental factors – political, economic, social, technological, environmental, and legal – which operate at various scales – global, EU, national, regional, and local;
- small aquaponic farms may struggle to be financially viable, since they cannot use economies of scale to reduce unit costs[2];
- in order to generate the large production volumes needed to penetrate the market via large distribution channels such as supermarket chains, commercial production should focus on a monoculture or a very limited number of crops that need similar growth conditions;
- if there is a gap in the market, there may be good reasons why it has not been filled;
- the products and services need to be matched with the needs of the customers.

The following chapters present the basic building blocks for setting up a new business, with a focus on the tools that can facilitate the process.

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[2] The price incurred by a company to produce, store and sell one unit of a particular product

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2. LEAN START-UP METHODOLOGY

2.1 Introduction

Lean start-up is a collection of tools and techniques that can be employed by entrepreneurs to build their ventures faster and at lower cost. It is based on the idea that entrepreneurs should make explicit their assumptions about how their venture works and how the market works. These explicit assumptions can then be put to empirical tests in the real world, in order to validate or invalidate them, and thereby get a better understanding of how a new venture can really work. In what is called the 'build–measure–learn loop' (Figure 2), which is modeled after the learning cycle, entrepreneurs research the success factors of their venture by testing their assumptions. Lean start-up is not only used as an approach that is applied by more and more entrepreneurs worldwide (Blank 2013), but it has also become a framework for entrepreneurship education (Blank & Engel 2013).

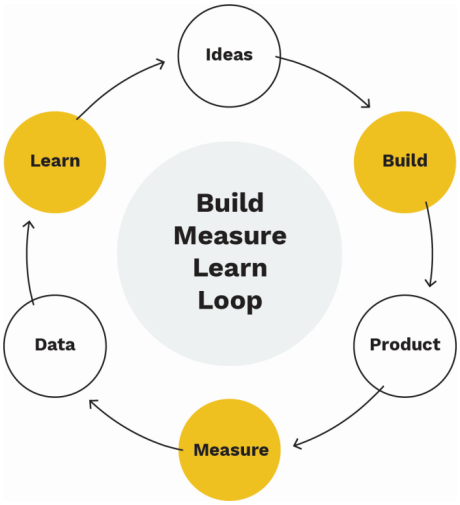

Figure 2: The build–measure–learn loop (after Ries 2011)

2.2 What is a start-up?

Start-ups are new organizations created by entrepreneurs to launch new products or services. The term 'start-up' has no official definition, but commonly draws on three criteria (Steigertahl *et al.* 2018):

- **Age**: younger than five/ten years, depending on the sector
- **Innovation**: in product, service or business model
- **Aim to scale**: intention to grow the number of employees and/or markets operated in

All start-ups are SMEs (small and medium-sized enterprises), which are companies with fewer than 250 employees and a turnover of less than €50 million, but not all SMEs are start-ups, due to their differences in set-up and vision. A start-up owner's intent is to scale and to grow into a large, disruptive company that has a significant impact on the existing market and may even be intent on creating new markets. The SME owner's intent, on the other hand, is to run their own business and secure a financially sustainable place in a local market. Typically, a small business – such as a local

deli, coffee shop, plumber, or electrician – brings in a relatively small amount of sales, enters a local or regional market, and has a small number of employees. These businesses are not disrupting an industry, but they are attempting to be profitable within it. So while SMEs are driven by making a profit and creating a business offering stable long-term value, start-ups are focused on top-end revenue volume and growth potential (Hecht 2017).

According to the *EU Startup Monitor Report*, the average start-up founder is male, has a university degree, and is 35 years old at the time of founding the business. This goes against the stereotype of a youngster in a garage, and rather emphasizes how well-equipped most founders actually are, with competencies acquired through a university education, practical knowledge, and experience. It further illustrates that the start-up environment is increasingly sophisticated. In the EU most start-ups generate the majority of their revenue through Business-to-Business (B2B) activity, and most founders operate in teams of 2 to 3 people (Steigertahl *et al.* 2018).

2.3 Lean start-up methodology

According to the traditional method of starting a new business, an entrepreneur would create a *business plan*, pitch it to investors, assemble a team, introduce a product, and start selling it. A business plan is a static document that describes the size of an opportunity, the problem to be solved, and the solution that the new venture will provide. Typically it includes a five-year forecast for income, profits, and cash flow. A business plan is therefore essentially a research exercise written in isolation at a desk before an entrepreneur has even begun to build a product. Once an entrepreneur with a convincing business plan obtains money from investors, they begin developing the product in a similarly insular fashion, investing thousands of man-hours to get it ready for launch with little, if any, customer input. Only after building and launching the product does the entrepreneur get substantial feedback from customers, in the form of sales figures. And too often, after months or even years of development, entrepreneurs learn the hard way that customers do not need or want most of the product's features. 75% of start-ups fail (Blank 2013).

Entrepreneur Eric Ries coined the term 'lean start-up' to describe the principles of hypothesis-driven entrepreneurship which maximises, per unit of resources expended, the amount of information gained from resolving uncertainty about the viability of their proposed business (Ries 2011). In this context, 'lean' is often interpreted as keeping costs to a bare minimum and relying on the founders' personal resources. Rather, lean start-ups espouse the same objective as companies that embrace lean manufacturing principles: avoiding waste and optimising resource spending. A lean start-up may eventually invest enormous amounts of capital in customer acquisition or operational infrastructure, but only after its *business model* has been validated through fast and frugal tests. The lean definition of a start-up is therefore *a temporary organization designed to search for a repeatable and scalable business model* (Blank 2013; Eisenmann *et al.* 2013).

The lean start-up methodology, which rejects long-term planning and embraces experimentation and iterative learning, has attracted much attention from entrepreneurs, practitioners and academics. A growing number of prominent entrepreneurship programmes (e.g. Stanford University, Harvard Business School, Berkeley, Columbia University) have begun to favour the use of the lean start-up

methodology over business planning approaches (Blank 2013). As a cyclical process it is grounded in three main sets of activities (Blank 2013; Blank & Dorf 2012; Eisenmann *et al.* 2013):

1) lean start-ups map their business idea visually as a series of falsifiable hypotheses in a framework called a *business model canvas.* Essentially, this is a diagram of how a company creates value for itself and its customers. These hypotheses are then tested using a series of 'minimum viable products' (MVPs), which are versions of the product with the smallest set of features built by using the minimum amount of time and resources. Based on test feedback, entrepreneurs must then decide whether to *persevere* with their business model, *pivot* by changing some elements of the model while retaining others, or *perish* by abandoning the venture.

2) lean start-ups use *customer development* to test their hypotheses. They go out and ask potential users, purchasers, and partners for feedback on all elements of the business model, including product features, pricing, distribution channels, and affordable customer acquisition strategies. The emphasis is on nimbleness and speed: start-ups rapidly assemble minimum viable products and immediately elicit customer feedback. Then, using customers' input to revise their assumptions, they start the cycle over again, testing redesigned offerings and making further small adjustments (iterations) or more substantive ones (pivots) to ideas that aren't working.

3) lean start-ups practice something called *agile development,* which originated in the software industry. Agile development works hand-in-hand with customer development. Unlike typical year-long product development cycles that presuppose knowledge of customers' problems and product needs, agile development eliminates wasted time and resources by developing the product iteratively and incrementally. It is the process by which start-ups create the minimum viable products they test.

This process continues until a reasonable number of tests point to the validation of critical assumptions.[3] Finally, when all the remaining assumptions have been validated, *product-market fit* is achieved. The fit implies that the product idea has a market and, therefore, that customers will be willing to pay for the value offered by the product. The ultimate goal of the lean start-up methodology is to guide entrepreneurs in finding this fit.

The core concept behind hypothesis-driven entrepreneurship – *test then invest* – has been practised in well-run new ventures for decades, and product development professionals have long recognized the value of small batches and rapid prototyping. The lean start-up methodology builds on these ideas, but takes them further, by focusing on the business model rather than the product, and by balancing the strong direction that comes from the founder's vision with the need for redirection

[3] There is a subtle difference between an assumption and a hypothesis. An assumption is any statement that is believed to be true, while a hypothesis is a proposition that is put forward to explain, for example, an economic relationship. In the lean start-up methodology this differentiation can be ignored. The methodology requires the validation of both assumptions and hypotheses; for example, the assumption that there is a large market for high quality fish in Switzerland, and the proposition that you would be able to charge relatively high prices for it.

that follows from market feedback. There are three alternative approaches that are often used to launch start-ups (Eisenmann *et al.* 2013):

- **Build-it-and-they-will-come** bypasses customer feedback and demand validation and relies solely on the founder's vision for initial guidance and an engineering-dominated team's energy to turn that vision into reality. This focus on product development is a risky strategy: the team receives no customer feedback until the product is built and launched, and if uncertainty about demand is high, then the odds of inventing the right product through a purely vision-led approach are low.

- **Waterfall planning** divides product development work into sequential stages, with each new phase commencing only when the work of the previous phase passes a formal review. The stages typically include concept exploration (that culminates in a business plan), product specification, product design, product development, internal testing, and alpha launch using pilot customers to validate technical performance. For start-ups developing and launching radically new products, rigid adherence to the plan can cause problems. After the concept exploration stage, little customer feedback is received until the alpha test, and if the external environment is rapidly changing, assumptions are bound to become outmoded by the time that all the stages have been completed.

- **Just do it!** relies on an improvisational approach that adapts a start-up's product and business model based on feedback from resource providers and customers. Without a strong vision, clear plan or hypotheses, however, it can be difficult to know when to change course, or which direction to take.

The build-it-and-they-will-come and waterfall planning approaches therefore both provide initial direction but make limited use of feedback to subsequently correct course. By contrast, the just do it! approach embraces feedback, but a lack of initial direction means that some adaptations may turn out to be costly and time-consuming detours. The lean start-up approach, on the other hand, by testing a comprehensive set of business model hypotheses, helps to ensure that pivots (feedback-induced adaptations) are efficient and effective. Research shows that start-ups that pivot once or twice are half as likely to scale prematurely – a leading cause of failure for start-ups – than those that pivot more than twice or not at all (Eisenmann *et al.* 2013).

As a process that avoids waste and speeds time to market, the lean start-up approach is broadly applicable to many types of new venture. There are, however, some situations where it yields fewer advantages (Eisenmann *et al.* 2013):

1. Where mistakes must be limited: the lean start-up methodology relies on the ability to make and learn from mistakes. However, start-ups do not always operate in environments where mistakes are tolerable, such as when there is no post-launch ability to correct mistakes (e.g. an unmanned space flight), when mistakes would impact customers' mission-critical activities (e.g. a cloud data storage facility), or when there is limited societal tolerance for mistakes (e.g. the development of new pharmaceuticals);

2. Where demand uncertainty is low: with strong unmet demand for a new product, there is less need to gather feedback about customer's needs (e.g. a low-cost, reliable green solution

for generating electricity that does not produce unpredictable off-peak spikes in output which require expensive power storage facilities);

3. When demand uncertainty is high but development cycles are long: with radically innovative products that require engineering breakthroughs or massive infrastructure deployment, and for which there is considerable uncertainty about customer demand, it is impossible to put a real product into the hands of real customers early in the product development process.

2.3.1 Hypothesis-driven entrepreneurship: process steps

While hypothesis-driven entrepreneurship is not a linear, step-by-step process, it still has a start and a finish. Figure 3 illustrates the iterative process through the build–measure–learn loop as proposed by Eisenmann *et al.* 2013.

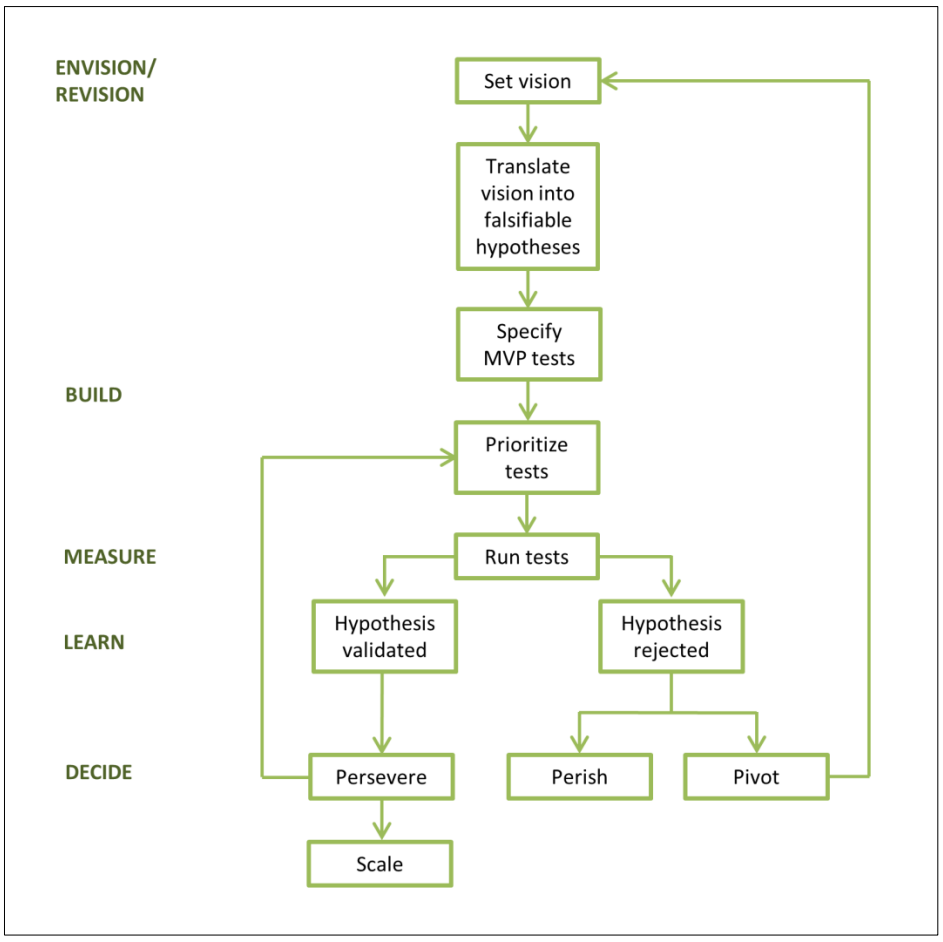

Figure 3: The hypothesis-driven entrepreneurship process (after Eisenmann *et al.* 2013)

Step 1: Develop a vision

Before an entrepreneur can generate business model hypotheses, they must have a vision for the problem that the start-up will address, and a potential solution to that problem. This first step is also called *ideation*. For some problems, especially in consumer markets, an entrepreneur's own interests and life experiences are adequate guides for ideation. To identify needs for business-to-business markets, however, an entrepreneur typically must tap the domain knowledge that follows from years

of industry experience. If they lack such experience, they will benefit from observing and interaxting with customers and/or domain experts.

Step 2: Translate the vision into hypotheses

Having developed a vision, the entrepreneur translates it into a falsifiable business model hypothesis. A business model is an integrated array of distinctive choices specifying a new venture's unique customer value proposition (the bundle of products and services that create value for the customer) and how it will configure activities to deliver that value and earn sustainable profits. These choices can be grouped into four elements – customer value proposition, technology and operation plan, go-to-market plan, and cash flow formula – and an entrepreneur needs to formulate a set of falsifiable hypotheses for each of these with quantitative metrics for validation. Due to serial dependence between business model elements, some assumptions cannot be analysed until others have been addressed first. For example, until a team has formulated hypotheses regarding what customer segments they will target, it cannot generate falsifiable hypotheses regarding customer acquisition costs.

Step 3: Specify MVP tests

For an entrepreneur confronted with uncertainty and with limited resources and team resources, it is essential to maximise learning per unit of time and effort expended. While uncertainty can be resolved to a certain extent through traditional market research techniques such as focus groups and customer surveys, entrepreneurs get more reliable feedback when they put a real product in the hands of real customers in a real-world context. Minimum viable products (MVPs) are characterised by the smallest set of features and/or activities needed to test a business model hypothesis. These may have constrained product functionality, where customers experience only a subset of the features envisoned for subsequent versions of the product. The simplest MVPs take the form of *smoke tests*, which assess demand for a product that does not exist yet. Web start-ups tyically use a landing page that provides a brief description of the planned online service, and ask visitors to leave an email address if they wish to be contacted when the service launches. Setting up a reward-based crowdfunding page (see Chapter 6) would be another type of smoke test. By launching a series of MVPs, an entrepreneur reduces product development batch sizes and cycle times, which accelerates customer feedback and makes it easier to interpret test results and to diagnose problems. This process is sometimes referred to as *launch early and often*.

Step 4: Prioritize tests

After generating business model hypotheses and specifying MVPs to test them, an entrepreneur must decide how to prioritize the tests. As a general principle, priority should be given to tests that can eliminate considerable risk at low cost. An example would be a patent search, since litigation costs over alleged patent infringement can shut down a start-up, so it would make no sense to start building and marketing a product until the search has been completed. When business model elements are serially dependent, then an entrepreneur will have little choice about how to sequence the tests. For example, hypotheses about a go-to-market plan or a technology sourcing strategy will usually depend on a start-up's customer value proposition.

Step 5: Run tests

In the next stage, an entrepreneur evaluates the feedback gained from the MVP tests, and needs to be on their guard for two potential sources of error. The first comes from customers whose stated preferences do not always correspond to their true preferences, while the second comes from the entrepreneur themselves, who may be seeing what they *want* to see, or what they *expect* to see.

Step 6: Persevere, pivot or perish

After evaluating MVP test results and other market feedback, an entrepreneur must decide whether to persevere, pivot, or perish.

- *Persevere*: if the MVP validates the business model hypothesis and other feedback does not prompt a shift in direction, then the entrepreneur perseveres on their current path, either testing the remaining hypotheses or, if all hypotheses have been validated, preparing to scale;

- *Pivot*: if the MVP rejects the business model hypothesis, or if it validates the hypothesis but other feedback indicates that greater opportunity lies elsewhere, then the entrepreneur may elect to change some business model elements while retaining others. Core aspects of the start-up's original vision are typically retained, such as a commitment to solving a particular problem, to serving a certain customer segment, or to employing a proprietary technology. A pivot is therefore a change of strategy while retaining one's original vision. Pivoting is neither a goal nor something to be avoided: while it can be costly and disruptive, failing to pivot when assumptions are known to be flawed can be fatal;

- *Perish*: if an MVP test decisively rejects a crucial business model hypothesis, and the entrepreneur cannot identify a plausible pivot, then they should shut down their business.

Step 7: Scaling and ongoing optimization

When an entrepreneur has validated all the key business model hypotheses, then they have achieved *product-market fit*, which means that the start-up has the right product for the market, with a demonstrated demand and a solid profit potential. This in turn implies that the venture can deliver adequate value to all relevant parties – employees, customers, partners, and investors. It is therefore time to scale – to invest aggressively in customer acquisition, and to amass the additional resources required, such as staff and infrastructure, to serve a rapidly growing customer base. However, even after confirming their business model assumptions, entrepreneurs should continue to utilize hypothesis-testing methods. The purpose of these tests shifts from *business model validation* to *business model optimization*.

2.3.2 The evolution of the start-up methodology

The lean start-up methodology has its foundations in Design Thinking – a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success. The lean start-up methodology is used to turn these proposed solutions into business models, underpinned by assumptions that are rapidly tested with actual customers to separate truth from fiction, learn and iterate towards product-market fit. Over the past decade the build–measure–learn loop (Ries 2011; Figure 2) has been further

elaborated. The double loop (van der Pijl *et al.* 2016) is founded on the simple observation that every idea, project, product or company starts with a point of view (POV) – about a market, customer, product or service, or competitor – which is either based on fact or on assumptions. The double loop takes your point of view into account, while adding rigour and continuity to the design process. This means that your point of view is always informed by understanding, which will spark new ideas, thereby further enhancing your point of view. These ideas are then prototyped and validated to test and measure their effectiveness, which in turn further informs your point of view and enables you to execute your ideas successfully. The top loop therefore represents the 'head in the clouds' stage, where we dream up ideas and ask questions, while the bottom loop represents the 'feet on the ground' stage, where ideas meet reality and we learn what really works. Every design journey also has a start and a goal: in the double loop model the journey starts with preparation and, hopefully, ends in scaling up. While the loops don't feel like linear progress, they constantly improve our point of view, and the cycle continues until we find an opportunity that can scale (Figure 4).

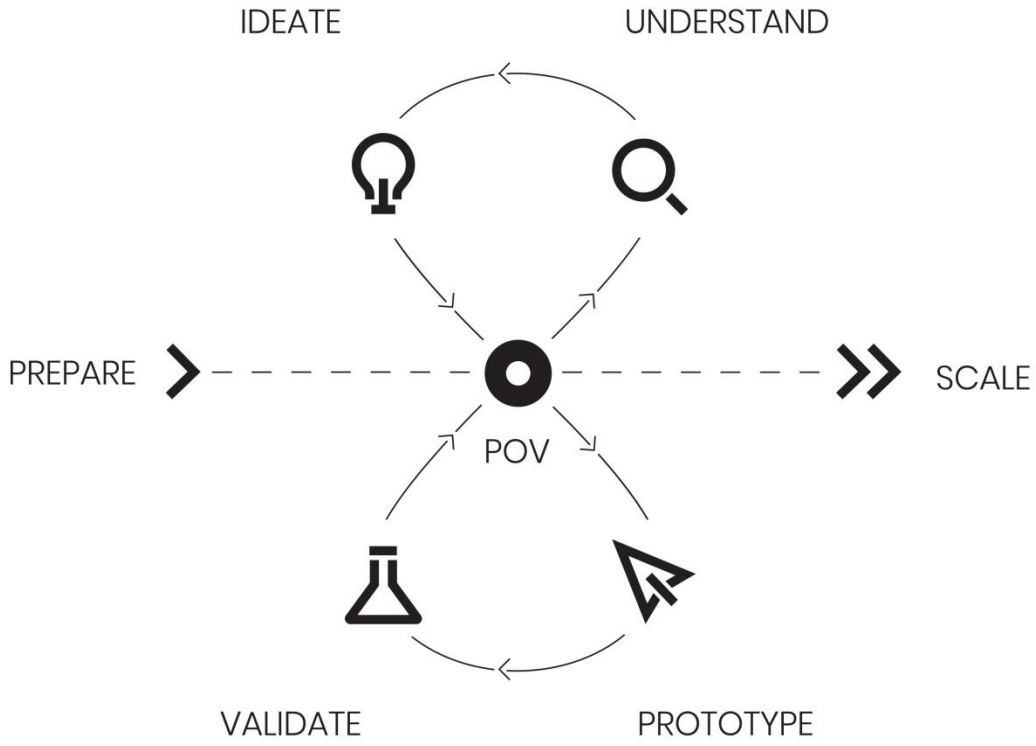

Figure 4: The double loop (van der Pijl *et al.* 2016)

Preparation is key to the design process. In order to set yourself and your team up for success you must prepare to observe your customers, business and context, and prepare to ideate, prototype and validate. And above all you must prepare your team and the environment within which it will operate, because success comes when a team of people are in it together and are collectively compelled to see the process through. The more viewpoints the team brings to the table, the more options that team will be able to generate. There is no single right solution in any design, business or otherwise (van der Pijl *et al.* 2016).

The double loop model has since been elaborated by Bland & Osterwalder (2019). The design journey starts with the team (skills, behaviour, environment, alignment) and ends with the goal (a validated business). In the design loop you shape and reshape your business idea to turn it into the best possible value proposition and business model. The business design loop has three steps: ideate – come up with as many alternative ways as possible to turn your idea into a strong business; business prototype – narrow down these alternatives by breaking them down into smaller testable chunks; and assess – by asking questions such as 'is this the best solution for our customers?' or 'is this the best way to monetize our idea?' Your first iterations of the business design loop are based on your intuition and starting point (product idea, technology, market opportunity, etc.), while subsequent iterations are based on evidence and insights from the test loop. The latter also has three steps – hypothesize – identify and prioritize the hypotheses underlying your idea; experiment – test your hypotheses; and learn – analyse the results and gain insights. The decision to persevere, pivot or perish lies at the nexus between the two loops (Figure 5).

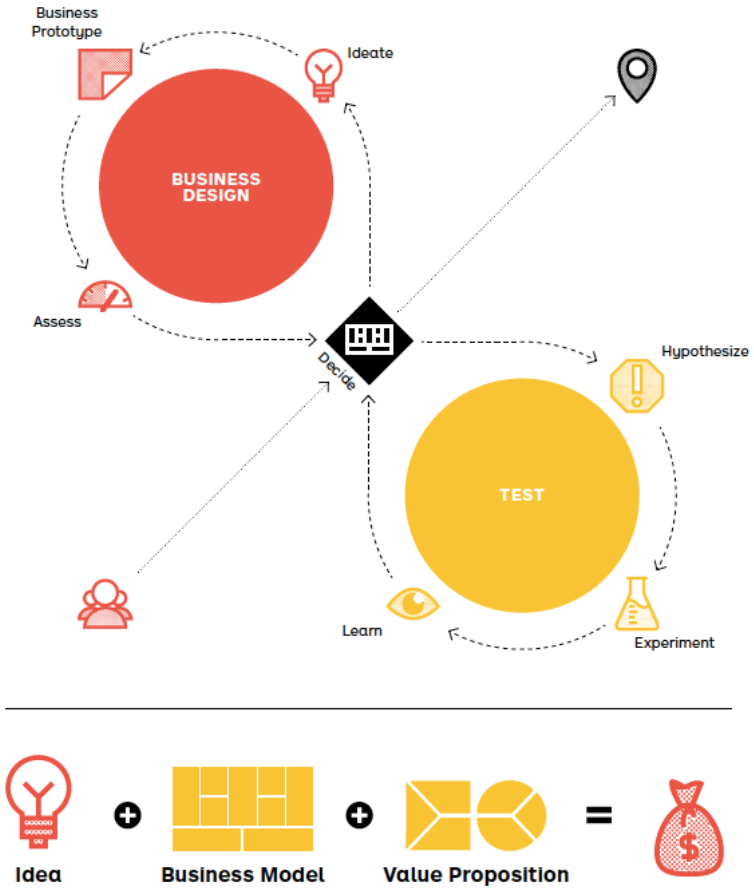

Figure 5: The iterative process of business concept design (Bland & Osterwalder 2019)

2.3.3 Lean start-up tools

The elaboration of the the build–measure–learn loop has led to the development of new Design Thinking tools to facilitate the iterative process. Design Thinking revolves around a deep interest in developing an understanding of the people for whom we are designing the products or services. It helps us to observe and develop empathy with the target user, and with the process of questioning: questioning the problem, the assumptions, and the implications. Design Thinking is extremely useful

in tackling problems that are ill-defined or unknown, by re-framing the problem in human-centric ways, and creating many ideas in brainstorming sessions.

Canvas tools are commonly used for brainstorming and to frame ensuing discussions throughout the process of hypothesis-driven entrepreneurship. These are structured templates, typically printed at A1 or A0 size, and post-it notes are used to fill each section of the template with ideas. By using post-it notes rather than writing directly on the template, the ideas can be moved around as needed until a consensus is reached by the team. A canvas is not a tool to be filled out and then put away. Rather, as an essential business design tool, it is constantly revisited and revised. The two stalwarts of the lean start-up methodology tool kit – Business Model Canvas (see Chapter 4) and Value Proposition Canvas (see Chapter 5) – have recently been joined by a plethora of other canvases which are intended to facilitate the journey of starting and scaling a successful business (van der Pijl *et al.* 2016). These include:

- Team Charter Canvas: your goals, expectations and values, and how you will deal with challenging situations. As a co-created document, it helps to clarify your team's direction while also establishing boundaries (who is the team leader, how will team members work together, and what will each person contribute?).

- 5 Bold Steps Vision Canvas: your shared vision (where do we want to go?), and the five bold steps you will take to achieve it (how will we get there?). Using this tool, your team will also be able to clarify what supports your vision, what may challenge it, and what opportunities may be created in working towards it. The vision canvas will also help to derive design criteria for your business model.

- Design Criteria Canvas: these incoprorate information about your vision and provide benchmarks that make it easy to determine whether you are on the right track. Some of the elements in your vision will be so important that they are non-negotiable; for example, your business must contribute to a greener planet. That also means that some elements are a bit more flexible, and categorizing these under 'Must', 'Should', 'Could' and 'Won't' will help you to prioritize. However, your vision makes up only part of the story when it comes to defining your design criteria. Other elements could include revenue, or your place in the market, or the public perception of your company, which also need to be categorized based on their respective priorities. Once you've started this exercise, you might find you need to adjust your vision slightly.

- Context Map Canvas: the external factors that might shape your start-up now, and in the future – demographic trends, rules and regulations, economy and environment, competition, technology trends, customer needs and uncertainties. Much of this information can be gathered from a PESTEL analysis (see Chapter 1). Context is not static. It changes on a daily basis, and continuous understanding requires continuous scanning. So, as you develop clear pictures of today's context, you also need to try to create a context for tomorrow, or five years from now, or perhaps even further out. What external factors do you expect to change over time?

- Riskiest Assumption Canvas: this tool helps you to rank your assumptions before moving on to experimentation. The canvas is modelled on a game of Jenga, where players in turn try to remove blocks from a wooden tower. Each block that is pulled out may make the tower collapse, but the blocks on the bottom are critical to keeping the tower upright. Think of your start-up idea as a Jenga tower where the bricks are assumptions; the ones that absolutely must be true for your idea to work are at the bottom of the stack, and are therefore the riskiest, while the ones that are less important or depend on other assumptions go higher up the stack. What are the things you are not sure about?

- Experiment Canvas: once you've identified your riskiest assumptions, you need to be able to test and measure them in a quantitative way. The experiment canvas helps you to specify a clear, falsifiable hypothesis (the expected outcome) and quantify your predictions. How many customers will do it? How many times? In what time frame? The metrics you define need to be actionable (they need to directly relate to the hypothesis) and accessible (you need to be able to see the results). Do your results validate or invalidate the hypothesis? Do you need to pivot, persevere, or redo the experiment?

- Validation Canvas: with your experiments in place, it is time to start testing them and tracking their progress over time. Running one experiment is almost never enough to know you are right. Some start-ups make many pivots before they find the right product-market fit. The goal of the validation process is to learn as much as possible, as fast as possible, which means running experiments iteratively. The canvas enables you to track your pivots, understand the choices you already made, and avoid the resurfacing of invalidated assumptions later in the process.

- Customer Journey Canvas: mapping this journey will provide you with insights into how customers experience a product or service, as well as how they might be better served. This is especially true if you are co-creating a journey together with your customers or when validating your assumptions with them. Through the mapping exercise you can identify where customers get stuck, where they have great experiences, and why. The underlying goal is to solve your customers' problems and to make them happy. Think from the customer's perspective. His or her goal in life is not to buy your product or use your service; that is usually a means to an end. What end is that? How do they experience the problem you are trying to solve? And do they really experience it? What do they currently do to deal with that problem? To make a good customer journey, you need to define who it is for. You don't want to specify generic customer segments here, but start from specific customers, and then generalize later. Who is the customer you are going to follow? An easy way to do this is by using the persona canvas.

- Persona Canvas: this can be used to give a customer segment a face and name and make it easier to step into their shoes. Personas make talking about customers and their characteristics more tangible and concrete, and make it easier to refer back to a pattern of characteristics. What are their needs, fears and hopes? What positive and negative trends do they experience in their lives? You can then validate your assumptions through observations, questionnaires and interviews with real or potential customers.

- Storytelling Canvas: during the design journey there will be many times when you need to tell your start-up's story – for example, to customers, partners, or potential funders. How will you sway people to your point of view, or at least convince them to explore your vision with you? Like the other fundamentals of your strategy, good stories can be designed, and the storytelling canvas helps you to design stories that resonante by harnessing visual, engaging, insightful and inspiring elements.

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3. ST GALLEN BUSINESS MODEL NAVIGATOR

3.1 Introduction

There are many companies with excellent products. Especially in Europe, many firms continuously introduce innovations to their products and processes. However, many companies will not survive in the long-term despite their product innovation capabilities. Why do prominent firms, which have been known for their innovative products for years, suddenly lose their competitive advantage? The answer is simple and painful: these companies have failed to adapt their business models to the changing environment. In future, competition will take place between business models, and not just between products and technologies. This chapter introduces the St Gallen Business Model Navigator and SWOT analysis. While the first provides ideas about how to innovate a business model, the second is a simple yet powerful tool for evaluating new or existing business ideas.

3.2 What is a business model?

The term 'business model' was first used in the late 1990s in the popular press. There is no agreed definition. According to Gassmann *et al*. 2013 it is a complex and changing system full of interdependencies and side effects. For Osterwalder & Pigneur (2010) 'a business model describes the rationale of how an organization creates, delivers, and captures value.' It can also be described as a blueprint of how a company creates and captures value. Increasingly the competition takes place between business models, and not just between products and technologies. Companies are urged to regularly review and, if necessary, overhaul their business model (Gassman *et al.* 2014). There are many examples of firms which were once known for their innovative products but which suddenly lost their competitive advantage. Strong players such as AEG, Grundig, Nixdorf Computers, Agfa, Kodak, Quelle and others have all vanished from the business landscape. They lost their capacity to market their former innovative strengths because they failed to adapt their business models to the changing environment (Gassmann *et al.* 2013). For example:

- Nixdorf Computer AG was a computer company founded by Heinz Nixdorf in 1952, with headquarters in Paderborn, Germany. It became the fourth largest computer company in Europe, and a worldwide specialist in banking and point-of-sale systems. But the company failed to follow developments in computers and missed important products like the personal computer. It was dissolved in 1990.
- Agfa film and cameras were once prominent consumer products. However, in 2004, the consumer imaging division was sold to a company founded via management buyout. AgfaPhoto GmbH, as the new company was called, filed for bankruptcy after just one year. The brands are now licensed to other companies by AgfaPhoto Holding GmbH, a holding firm. Following this sale, Agfa-Gevaert's commerce today is entirely business-to-business.

Too many companies are not questioning their own business model frequently enough. For example, in multinational corporations the investment in business model innovation lies at only 10%. Innovations are often variations on something that has existed elsewhere – in another industry, market or context. Indeed, 90% of all new business models are not new, but creative imitations of

business models from other companies and industries. A good business model is therefore vital to achieve success within a company. A company must also adapt its business model to the changing environment using an effective business model innovation process. The St Gallen Business Model Navigator is a great tool that allows existing businesses, innovators and entrepreneurs to catch a business opportunity and start moving (Gassmann *et al.* 2013).

3.3 The St Gallen Business Model Navigator

The St Gallen Business Model Navigator (BMN) avoids an explicit definition of business model. Instead, it refers to a conceptualization of a 'magic triangle', which suggests the elements of a business model (Figure 6). The 'magic triangle' consists of four elements (who, what, how, value), making it easy to use but at the same time sufficient enough to provide the business model architecture. The purpose of the BMN is to provide an action-oriented methodology that enables any company to innovate its own business model.

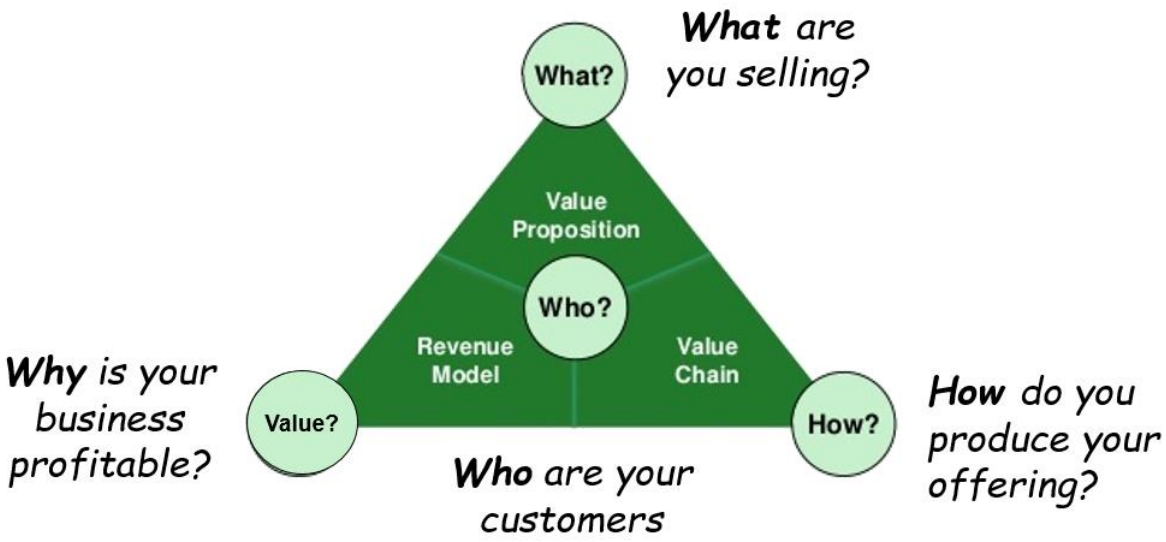

Figure 6: Magic Triangle: the elements of a business model (adapted after Gassmann *et al.* 2013)

Based on the St Gallen's Business Model Navigator, the elements of a business model include (Gassmann *et al.* 2013):

- **Who:** Who is the customer? Customers are the heart of any business model. It is important that you understand which customer segments are relevant for you and which ones you will and won't address with your business model. The target customer is the central dimension in designing a new business model.
- **What:** What is offered to the target customer? What is it that the customer values? This is the customer value proposition. This defines the company's products and services that are available to the customer.

- **How:** How does the company produce its products and services? It describes the processes and activities, along with the resources and capabilities involved as well as their coordination in order to create value (valuable products and services).
- **Value/Why:** This dimension explains why the business model is financially viable. It includes the cost structure and the revenue-generating mechanism. It answers the question: why does the business model work commercially?

Following the four elements of a business model makes the company's business model more tangible and gives the company a common ground for the re-thinking it. It is often called a 'boundary-spanning' concept that explains the position of a compamy in society and its interaction with its surrounding ecosystem (Gassmann *et al.* 2013).

3.3.1.Background

The St Gallen Business Model Navigator was developed at the Institute of Technology Management at the University of St Gallen, Switzerland. The St Gallen research revealed 55 recurring and successful patterns of business models, which served as the base for new business models in the past. The business model innovation map (Figure 7) represents the evolution of the 20 most popular business patterns and the companies that use them. Innovation is therefore not about reinventing the wheel, but rather the correct use of successful patterns of business models and transferring them to your own business (Gassmann *et al.* 2013).

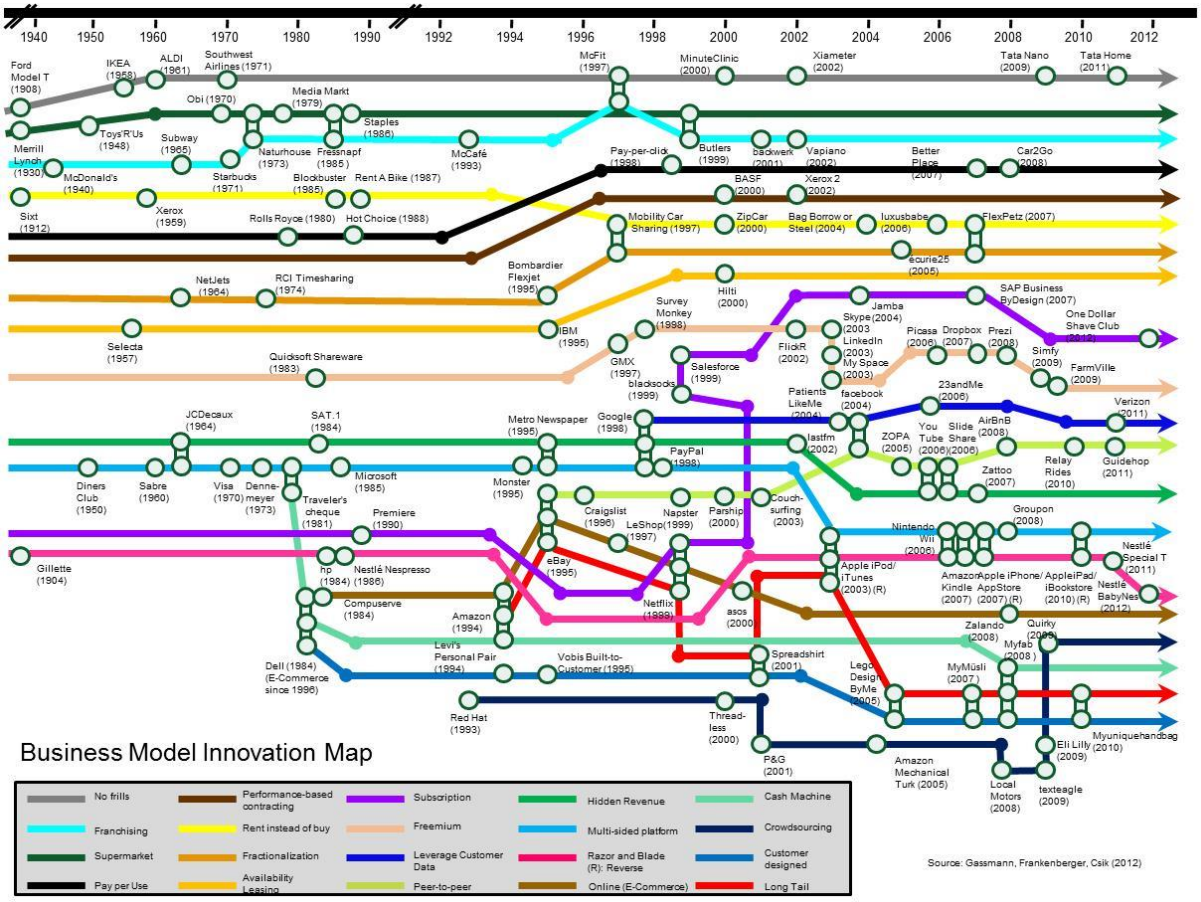

Figure 7: The business model innovation map (Gassmann *et al.* 2013)

3.3.2 Fifty-five business models

Table 1: The fifty-five business models responsible for 90% of the world's most successful companies (adapted after Gassmann *et al.* 2013)

#	Pattern name	Components	Examples	Pattern description
1	ADD-ON	What Value	Ryanair SAP Sega	The core offering is priced competitively, but there are numerous extras that drive the final price up. In the end, the customer pays more than they initially assumed. Customers benefit from a variable offer, which they can adapt to their specific needs
2	AFFILIATION	How Value	Amazon Store CDnow Pinterest	The focus lies in supporting others to successfully sell products and directly benefit from successful transactions. Affiliates usually profit from some kind of pay-per-sale or pay-per-display compensation. The company, on the other hand, is able to gain access to a more diverse potential customer base without additional active sales or marketing efforts
3	AIKIDO	Who What Value	The Body Shop Swatch Cirque du Soleil Nintendo	Aikido is a Japanese martial art in which the strength of an attacker is used against him or her. As a business model, Aikido allows a company to offer something diametrically opposed to the image and mindset of the competition. This new value proposition attracts customers who prefer ideas or concepts opposed to the mainstream
4	AUCTION	What Value	eBay Winebid Priceline Google	Auctioning means selling a product or service to the highest bidder. The final price is achieved when the end time of the auction is reached or when no higher offers are received. This allows the company to sell at the highest price acceptable to the customer. The customer benefits from the opportunity to influence the price of a product
5	BARTER	What Value	Procter & Gamble Pepsi Lufthansa	Barter is a method of exchange in which goods are given away to customers without the money transaction. In return, they provide something of value to the sponsoring organisation. The exchange does not have to show any direct connection and is valued differently by each party

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
6	CASH MACHINE	How Value	American Express Dell Amazon Store PayPal	The customer pays upfront for the products sold to the customer before the company is able to cover the associated expenses. This results in increased liquidity which can be used to amortise debt or to fund investments in other areas
7	CROSS SELLING	How What Value	Shell IKEA Tchibo Aldi	Services or products from a formerly excluded industry are added to the offerings, thus leveraging existing key skills and resources. In retail especially, companies can easily provide additional products and offerings that are not linked to the main industry on which they were previously focused. Thus, additional revenue can be generated with relatively few changes to the existing infrastructure and assets, since more potential customer needs are met
8	CROWD-FUNDING	How Value	Marillion Cassava Films Diaspora Brainpool	A product, project or entire start-up is financed by a crowd of investors who wish to support the underlying idea, typically via the Internet. If the critical mass is achieved, the idea will be realized and investors receive special benefits, usually proportionate to the amount of money they provided
9	CROWD-SOURCING	How Value	Threadless Procter & Gamble Cisco	The solution of a task or problem is adopted by an anonymous crowd, typically via the Internet. Contributors receive a small reward or have the chance to win a prize if their solution is chosen for production or sale. Customer interaction and inclusion can foster a positive relationship with a company, and subsequently increase sales and revenue
10	CUSTOMER LOYALTY	What Value	American Airlines Payback	Customers are retained and loyalty assured by providing value beyond the actual product or service itself, i.e., through incentive-based programs. The goal is to increase loyalty by creating an emotional connection or simply rewarding it with special offers. Customers are voluntarily bound to the company, which protects future revenue

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
11	DIGITIZATION	What How	Hotmail CEWE Color SurveyMonkey Napster Wikipedia Facebook Dropbox Netflix	This pattern relies on the ability to turn existing products or services into digital variants, and thus offer advantages over tangible products, e.g., easier and faster distribution. Ideally, the digitization of a product or service is realized without harnessing the value proposition which is offered to the customer. In other words: efficiency and multiplication by means of digitization does not reduce the perceived customer value.
12	DIRECT SELLING	What How Value	Tupperware Nestlé Nespresso Dollar Shave Club	This is a scenario whereby a company's products are not sold through intermediary channels, but are available directly from the manufacturer or service provider. In this way, the company skips the retail margin or any costs associated with the intermediates. These savings can be forwarded to the customer and a standardized sales experience established. Additionally, such close contact can improve customer relationships.
13	E-COMMERCE	What How Value	Dell Asos Amazon Store Blacksocks	Traditional products or services are delivered through online channels only, thus removing costs associated with running a physical branch. Customers benefit from higher availability and convenience, while the company can integrate its sales and distribution with other internal processes.
14	EXPERIENCE SELLING	What Who Value	IKEA Starbucks Swatch Nestlé Nespresso	The value of a product or service is increased with the customer experience offered with it. This opens the door for higher customer demand and commensurate increase in prices charged. This means that the customer experience must be adapted accordingly, e.g. by attuning promotion or shop fittings.
15	FLAT RATE	What Who Value	Netflix Next Issue Media	A single fixed fee for a product or service is charged, regardless of actual usage or time restrictions on it. The user benefits from a simple cost structure while the company benefits from a constant revenue stream

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
16	FRACTIONAL OWNERSHIP	What How Value	Hapimag Netjets Mobility Carsharing	This pattern describes the sharing of a certain asset amongst a group of owners. Typically, the asset is capital intensive but only required occasionally. While the customer benefits from the rights as an owner, the entire capital does not have to be provided alone.
17	FRANCHISING	What How Value	McDonald's Starbucks Subway	The franchisor owns the brand name, products, and corporate identity, and these are licensed to independent franchisees who carry the risk of local operations. Revenue is generated as part of the franchisees' revenue and orders. The franchisees benefit from the usage of well-known brands, know-how, and support.
18	FREEMIUM	What Value	Hotmail SurveyMonkey LinkedIn Skype Spotify Dropbox	The basic version of an offering is given away for free in the hope of eventually persuading the customers to pay for the premium version. The free offering attracts the highest volume of customers possible for the company. The generally smaller volume of paying 'premium customers' generates the revenue, which also cross-finances the free offering.
19	FROM PUSH- TO-PULL	What How	Toyota Zara Dell Geberit	This pattern describes the strategy of a company to decentralize and thus add flexibility to the company's processes in order to be more customer focused. To quickly and flexibly respond to new customer needs, any part of the value chain - including production or even research and development - can be affected.
20	GUARANTEED AVAILABILITY	What How Value	NetJets IBM Hilti ABB Turbo Systems	The availability of a product or service is guaranteed, resulting in almost zero downtime. The customer can use the offering as required, which minimizes losses resulting from downtime. The company uses expertise and economies of scale to lower operation costs and achieve these availability levels.

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
21	HIDDEN REVENUE	What How Value	JCDecaux Metro Newspaper Google Facebook Spotify Zattoo	The logic that the user is responsible for the income of the business is abandoned. Instead, the main source of revenue comes from a third party, which cross-finances whatever free or low-priced offering attracts the users. A very common case of this model is financing through advertisement, where attracted customers are of value to the advertisers who fund the offering. This concept facilitates the idea of 'separation between revenue and customer'.
22	INGREDIENT BRANDING	What How Value	DuPont Teflon Intel Carl Zeiss Shimano	Ingredient branding describes the specific selection of an ingredient, component, and brand originating from a specific supplier, which will be included in another product. This product is then additionally branded and advertised with the ingredient product, collectively adding value for the customer. This projects the positive brand associations and properties on the product, and can increase the attractiveness of the end product
23	INTEGRATOR	What How	Carnegie Steel Ford Zara	An integrator is in command of the bulk of the steps in a value-adding process. The control of all resources and capabilities in terms of value creation lies with the company. Efficiency gains, economies of scope, and lower dependencies from suppliers result in a decrease in costs and can increase the stability of value creation
24	LAYER PLAYER	How Value	Wipro Technologies TRUSTe PayPal Amazon Web Services	A layer player is a specialized company limited to the provision of one value-adding step for different value chains. This step is typically offered within a variety of independent markets and industries. The company benefits from economies of scale and often produces more efficiently. Further, the established special expertise can result in a higher quality process.

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
25	LEVERAGE CUSTOMER DATA	What How	Amazon Store Google Facebook 23andMe Twitter	New value is created by collecting customer data and preparing it in beneficial ways for internal usage or interested third-parties. Revenues are generated by either selling this data directly to others or leveraging it for own purposes, i.e., to increase the effectiveness of advertising
26	LICENSE	How Value	BUSCH IBM Max Havelaar	Efforts are focused on developing intellectual property that can be licensed to other manufacturers. This model, therefore, relies not on the realization and utilization of knowledge in the form of products, but attempts to transform these intangible goods into money. This allows a company to focus on research and development. It also allows the provision of knowledge, which would otherwise be left unused and potentially be valuable to third parties
27	LOCK-IN	What How Value	Gillette Lego Microsoft Hewlett-Packard Nestlé Nespresso	Customers are locked into a vendor's world of products and services. Using another vendor is impossible without incurring substantial switching costs, and thus protecting the company from losing customers. This lock-in is either generated by technological mechanisms or substantial interdependencies of products or services
28	LONG TAIL	How Value	Amazon Store eBay Netflix Apple iPod/iTunes YouTube	Instead of concentrating on blockbusters, the main bulk of revenues is generated through a 'long tail' of niche products. Individually, these neither demand high volumes, nor allow for a high margin. If a vast variety of these products are offered in sufficient amounts, the profits from resultant small sales can add up to a significant amount
29	MAKE MORE OF IT	Who What How Value	Porsche Festo Didactic BASF Amazon Web Services	Know-how and other available assets existing in the company are not only used to build own products, but also offered to other companies. Slack resources, therefore, can be used to create additional revenue besides those generated directly from the core value proposition of the company

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
30	MASS CUSTOMIZATION	What Value	Dell Levi's Miadidas Factory121 mymuesli	Customizing products through mass production once seemed to be an impossible endeavour. The approach of modular products and production systems has enabled the efficient individualization of products. As a consequence, individual customer needs can be met within mass production circumstances and at competitive prices
31	NO FRILLS	How What Value	Ford Aldi McDonald's Accor McFit	Value creation focuses on what is necessary to deliver the core value proposition of a product or service, typically as basic as possible. Cost savings are shared with the customer, usually resulting in a customer base with lower purchasing power or purchasing willingness
32	OPEN BUSINESS MODEL	What Who Value	Valve Corporation Abril	In open business models, collaboration with partners in the ecosystem becomes a central source of value creation. Companies pursuing an open business model actively search for novel ways of working together with suppliers, customers, or complementors to open and extend their business
33	OPEN SOURCE	Who What How Value	IBM Mozilla Wikipedia Local Motors	In software engineering, the source code of a software product is not kept proprietary, but is freely accessible for anyone. Generally, this could be applied to any technology details of any product. Others can contribute to the product, but also use it free as a sole user. Money is typically earned with services that are complimentary to the product, such as consulting and support
34	ORCHESTRATOR	How Value	Procter & Gamble Li & Fung Nike Bharti Airtel	Within this model, the company's focus is on the core competencies in the value chain. The other value chain segments are outsourced and actively coordinated. This allows the company to reduce costs and benefit from the suppliers' economies of scale. Furthermore, the focus on core competencies can increase performance

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
35	PAY PER USE	What How Value	Hot Choice Google Better Place Car2Go	In this model, the actual usage of a service or product is metered. The customer pays on the basis of what he or she effectively consumes. The company is able to attract customers who wish to benefit from the additional flexibility, which might be priced higher
36	PAY WHAT YOU WANT	How Value	Radiohead Humble Bundle Panera Bread Bakery	The buyer pays any desired amount for a given commodity, sometimes even zero. In some cases, a minimum floor price may be set, and/or a suggested price may be indicated as guidance for the buyer. The customer is allowed to influence the price, while the seller benefits from higher numbers of attracted customers, since individuals' willingness to pay is met. Based on the existence of social norms and morals, this is only rarely exploited, which makes it suitable to attract new customers
37	PEER-TO- PEER (P2P)	What Value	eBay Napster LinkedIn Skype SlideShare Twitter Dropbox Airbnb	This model is based on a cooperation that specializes in mediating between individuals belonging to a homogeneous group. The company offers a meeting point, i.e., an online database and communication service that connects these individuals (these could include offering personal objects for rent, providing certain products or services, or the sharing of information and experiences)
38	PERFORMANCE-BASED CONTRACTING	What Value	Rolls-Royce Smartville BASF Xerox	A product's price is not based upon the physical value, but on the performance or valuable outcome it delivers in the form of a service. Performance based contractors are often strongly integrated into the value creation process of their customers. Special expertise and economies of scale result in lower production and maintenance costs of a product, which can be forwarded to the customer. Extreme variants of this model are represented by different operation schemes in which the product remains the property of the company and is operated by it

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
39	RAZOR AND BLADE	What How Who	Standard Oil Company Gillette Hewlett-Packard Nestlé Nespresso Amazon Kindle	The basic product is cheap or given away for free. The consumables that are needed to use or operate it, on the other hand, are expensive and sold at high margins. The initial product's price lowers customers' barriers to purchase, while the subsequent recurring sales cross-finance it. Usually, these products are technologically bound to each other to further enhance this effect
40	RENT INSTEAD OF BUY	What How Value	Xerox Rent a Bike Mobility Carsharing Luxusbabe	The customer does not buy a product, but instead rents it. This lowers the capital typically needed to gain access to the product. The company itself benefits from higher profits on each product, as it is paid for the duration of the rental period. Both parties benefit from higher efficiency in product utilization as time of non-usage, which unnecessarily binds capital, is reduced on each product
41	REVENUE SHARING	What How Value	CDnow HubPages Apple iPhone/AppStore Groupon	Revenue sharing refers to firms' practice of sharing revenues with their stakeholders, such as complementors or even rivals. Thus, in this business model, advantageous properties are merged to create symbiotic effects in which additional profits are shared with partners participating in the extended value creation. One party is able to obtain a share of revenue from another that benefits from increased value for its customer base
42	REVERSE ENGINEERING	What Value	Bayer Pelikan Brilliance China Auto Denner	This pattern refers to obtaining a competitor's product, taking it apart, and using this information to produce a similar or compatible product. Because no huge investment in research or development is necessary, these products can be offered at a lower price than the original product
43	REVERSE INNOVATION	What Value	Logitech Nokia Renault General Electric	Simple and inexpensive products, that were developed within and for emerging markets, are also sold in industrial countries. The term 'reverse' refers to the process by which new products are typically developed in industrial countries and then adapted to fit emerging market needs

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
44	ROBIN HOOD	How What	One Laptop per Child TOMS Shoes	The same product or service is provided to 'the rich' at a much higher price than to 'the poor'. Thus, the main bulk of profits are generated from the wealthy customer base. Serving 'the poor' is not profitable per se, but creates economies of scale, which other providers cannot achieve. Additionally, it has a positive effect on the company's image
45	SELF-SERVICE	What How	McDonald's IKEA Accor Mobility Carsharing	A part of the value creation is transferred to the customer in exchange for a lower price of the service or product. This is particularly suited for process steps that add relatively little perceived value for the customer, but incur high costs. Customers benefit from efficiency and time savings, while putting in their own effort. This can also increase efficiency, since in some cases, the customer can execute a value- adding step more quickly and in a more target-oriented manner than the company
46	SHOP-IN-SHOP	Who Value	Tim Hortons Tchibo Deutsche Post Bosch MinuteClinic	Instead of opening new branches, a partner is chosen whose branches can profit from integrating the company's offerings in a way that imitates a small shop within another shop (a win-win situation). The hosting store can benefit from more attracted customers and is able to gain constant revenue from the hosted shop in the form of rent. The hosted company gains access to cheaper resources such as space, location, or workforce
47	SOLUTION PROVIDER	What How	Tetra Pak Apple iPod/iTunes 3M Services	A full-service provider offers total coverage of products and services in a particular domain, consolidated via a single point of contact. Special know-how is given to the customer in order to increase his or her efficiency and performance. By becoming a full-service provider, a company can prevent revenue losses by extending their service and adding it to the product. Additionally, close contact with the customer allows great insight into customer habits and needs which can be used to improve the products and services

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
48	SUBSCRIPTION	How What	Blacksocks Netflix Spotify Next Issue Media	The customer pays a regular fee, typically on a monthly or an annual basis, in order to gain access to a product or service. While customers mostly benefit from lower usage costs and general service availability, the company generates a steadier income stream
49	SUPERMARKET	What Value	Merrill Lynch Toys“R”Us The Home Depot Best Buy Staples	A company sells a large variety of readily available products and accessories under one roof. Generally, the assortment of products is large but the prices are kept low. More customers are attracted due to the great range on offer, while economies of scope yield advantages for the company
50	TARGET THE POOR	What How Value	Grameen Bank Arvind Mills Bharti Airtel Hindustan Unilever Tata Nano Walmart	The product or service offering does not target the premium customer, but rather, the customer positioned at the base of the pyramid. Customers with lower purchasing power benefit from affordable products. The company generates small profits with each product sold, but benefits from the higher sales numbers that usually come with the scale of the customer base
51	TRASH-TO- CASH	Who What How Value	Freitag lab.ag Greenwire Emeco H&M	Used products are collected and either sold in other parts of the world or transformed into new products. The profit scheme is essentially based on low-to-no purchase prices. Resource costs for the company are practically eliminated, whilst the supplier's waste disposal is either provided, or associated costs are reduced. This also addresses customers’ potential environmental awareness ideals
52	TWO-SIDED MARKET	What How Value	JCDecaux Sat.1 Amazon Store eBay Metro Newspaper Google Facebook	A two-sided market facilitates interactions between multiple interdependent groups of customers. The value of the platform increases as more groups or as more individual members of each group are using it. The two sides usually come from disparate groups, e.g., businesses and private interest groups

Table 1 continued

#	Pattern name	Components	Examples	Pattern description
53	ULTIMATE LUXURY	What Value	Lamborghini Jumeirah Group MirCorp The World Abbot Downing	This pattern describes the strategy of a company to focus on the upper side of society's pyramid. This allows a company to distinguish its products or services greatly from others. High standards of quality or exclusive privileges are the main focus to attract these kinds of customers. The necessary investments for these differentiations are met by the relatively high prices that can be achieved - which usually allow for very high margins
54	USER DESIGNED	What How Value	Lego Factory Amazon Kindle Apple iPhone/AppStore Createmytattoo Quirky	Within user manufacturing, a customer is both the manufacturer and the consumer. As an example, an online plat- form provides the customer with the necessary support in order to design and merchandise the product, e.g., product design software, manufacturing services, or an online shop to sell the product. Thus, the company only supports the customers in their undertakings and benefits from their creativity. The customer benefits from the potential to realize entrepreneurial ideas without having to provide the required infrastructure. Revenue is then generated as part of the actual sales
55	WHITE LABEL	What How	Foxconn Richelieu Foods Printing-In-A-Box	A white label producer allows other companies to distribute its goods under their brands, so that it appears as if they are made by them. The same product or service is often sold by multiple marketers and under different brands. This way, various customer segments can be satisfied with the same product

3.3.3 Methodology

The Business Model Navigator provides a structured methodology for innovating one's own business model. Three basic strategies have been used to generate new business ideas from the pool of 55 business models:

- **Transfer:** An existing business model is simply transferred to new industry;
- **Combination:** Two or more business models are transferred and linked;
- **Repetition:** A successful business model is transferred to another product.

The central idea of the Navigator is to provide a structured approach to recombine the 55 patterns to develop business innovations using four steps (Gassmann *et al.* 2013):

1. **Initiation:** analysis of the ecosystem. Before embarking on a new business model, it is important to describe the current business model and its value logic. You can do this is in terms of 'Who, What, How and Why?' Who are your customers? What customer problems do you solve? How is your business organized (e.g. physical labour, financial resources, intellectual property)? The analysis of the ecosystem also includes a review of the current partners, the current distribution system, the technology used, and the market trends. The process will be more successful if you:

    - Involve people with different functions in your team. This supports thinking outside the box
    - Do not use the dominant industry logic. Never use forbidden sentences like "this has always worked like that in our industry". Use funeral speeches like "Why did the company die?" to overcome the past and mental barriers
    - Use methodological support when designing your business model, such as card sets, business model innovation software, online learning etc. (Gassmann *et al.* 2013).

2. **Ideation:** adapting pattern. This is the most important part. Ideation is the use of the 55 successful business model patterns and adapting them to one's own initial situation. The process is typically a brainstorming activity carried out by a group of three to five people. The question to ask is how the pattern would change the business model if it were applied to the particular situation. The process will be more successful if you:

    - Try not only the close patterns, but also confront more distant patterns
    - Keep on trying

3. **Integration:** shaping the business model. There is no idea that is clear enough to be immediately implemented. Promising ideas need to be gradually elaborated into business models. Success factors include consistency between the internal and the external world. There has to be a fit between the internal core competencies, the competitor's perspective, and the perceived customer value. Another big success factor is persistence. Developing a business model and implementing the idea in one's own company requires a lot of time and energy.

4. **Implementation:** realisation of the plans. Once the design phase of the business model innovation is completed, a new chapter starts, consisting of building a prototype of the business model and the testing it.

While steps 1 to 3 cover the design process, which concerns the development of the new business model, and step 4 consists of implementation, it is important to note that these phases are not carried out in isolation from each other (Figure 8).

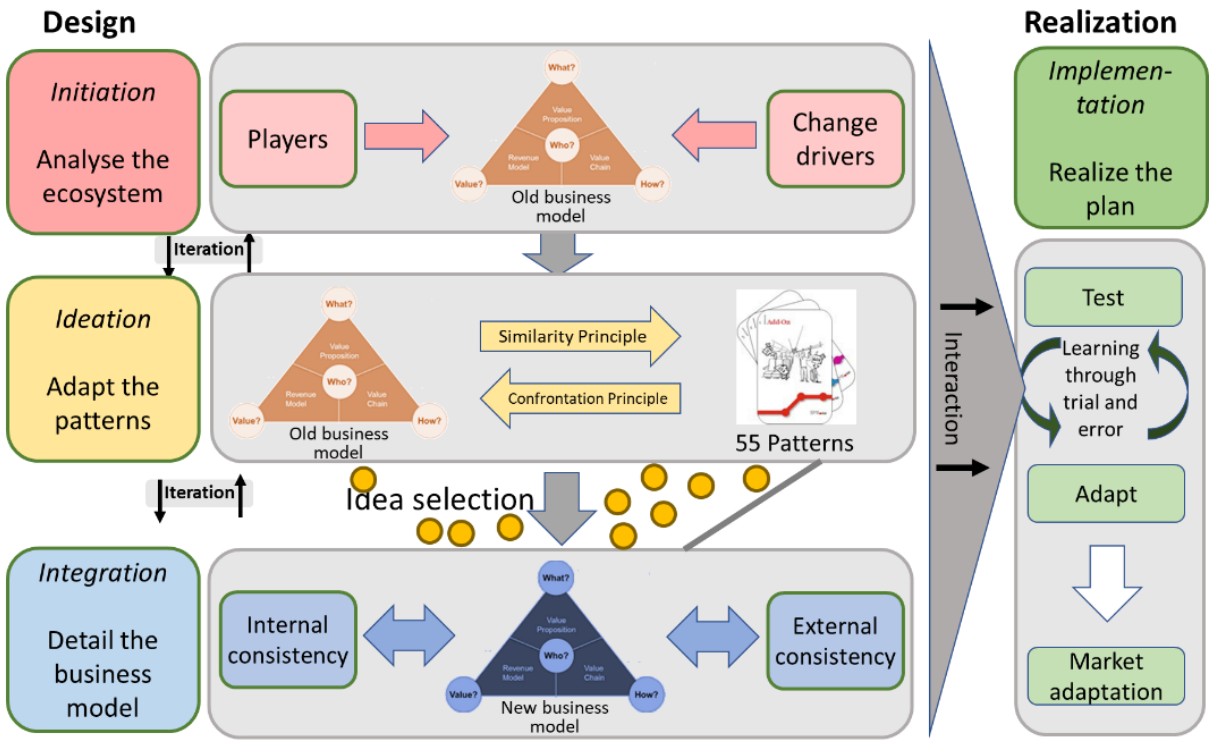

Figure 8: The St Gallen BMN as a management model for creating new business models (adapted from Gassmann *et al.* 2014)

3.3.4 Business model innovation

Business model innovation introduces a new logic of how a company creates and captures value by changing at least two dimensions of a business model. Solely innovating the value proposition merely results in product innovation. As a result of the systematic thought process (initiation, ideation, integration) the current business model is either confirmed or changed. The changes can occur in various dimensions. A change in the product or the product composition amounts to value or product innovation. If more than one dimension of the business model is changed then the logic of the business model is changed which defines business model innovation. Therefore, in the eyes of the Business Model Navigator, business model innovation takes place once at least two of the four components of Who-What-How-Why are significantly changed (Figure 9).

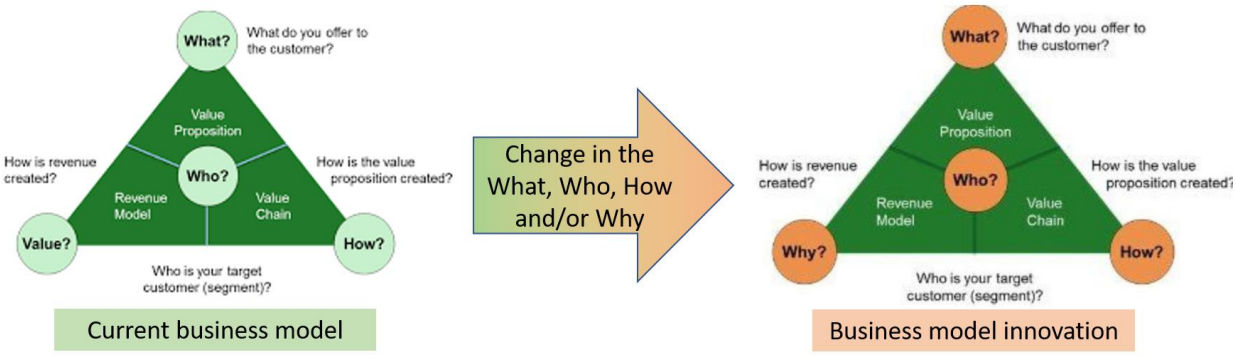

Figure 9: Business model innovation (adapted after Gassmann *et al.* 2014)

3.3.5 Potential business models for aquaponics

Urban farm

Who: Key customer segments: B2B (Business-to-Business)

- Private: restaurants, supermarkets
- Public: hospitals and canteens

What: Fresh vegetables and fresh fish, locally produced

How: Production of vegetables and fish in the city, close to the customers

Value: The profitability requires two assumptions to be tested in order to ensure that the model is financially sound:

- Above standard pricing of fishes and plants as a niche product for health-conscious customers
- Saving potential due to local production

Commercial aquaponic system

Who: B2B: Farmers, communities

What: Selling and/or renting horizontal and vertical aquaponic systems

How: Based on engineering know-how & research and experience in aquaponics

Value: The prototype of the aquaponic system was very well received by a sample of 20 customers. Several assumptions need to be tested in order to ensure that the model is financially sound:

- National market size
- Potential international market size

Domestic aquaponic system

The design, production, installation and service of small-scale aquaponics systems for home use (indoor and/or outside) is a potential business model.

Who: B2C: Retail customers (households, hobby gardeners)

What: Customers can either buy or rent various models of home aquaponic systems. The company sells life quality in terms of:

- Home-produced fresh vegetables and/or fish especially in countries without trusted food controls,
- Home-based leisure activity contributing to life satisfaction.

How: Based on support from academic partners (engineering know-how & research and experience in aquaponics).

Value: Determination of market potential

3.4 SWOT analysis

SWOT analysis is a technique used to help identify strengths, weaknesses, opportunities, and threats related to business competition or project planning. Strengths and weakness are frequently internally related, while opportunities and threats commonly focus on the external environment. The technique can also be used to evaluate new business model ideas in conjunction with any of the methods described here, or as a standalone exercise.

The name is an acronym for the four parameters (Figure 10):

- **S**trengths: characteristics of the business or project that give it an advantage over others.
- **W**eaknesses: characteristics of the business that place the business or project at a disadvantage relative to others.
- **O**pportunities: elements in the environment that the business or project could exploit to its advantage.
- **T**hreats: elements in the environment that could cause trouble for the business or project.

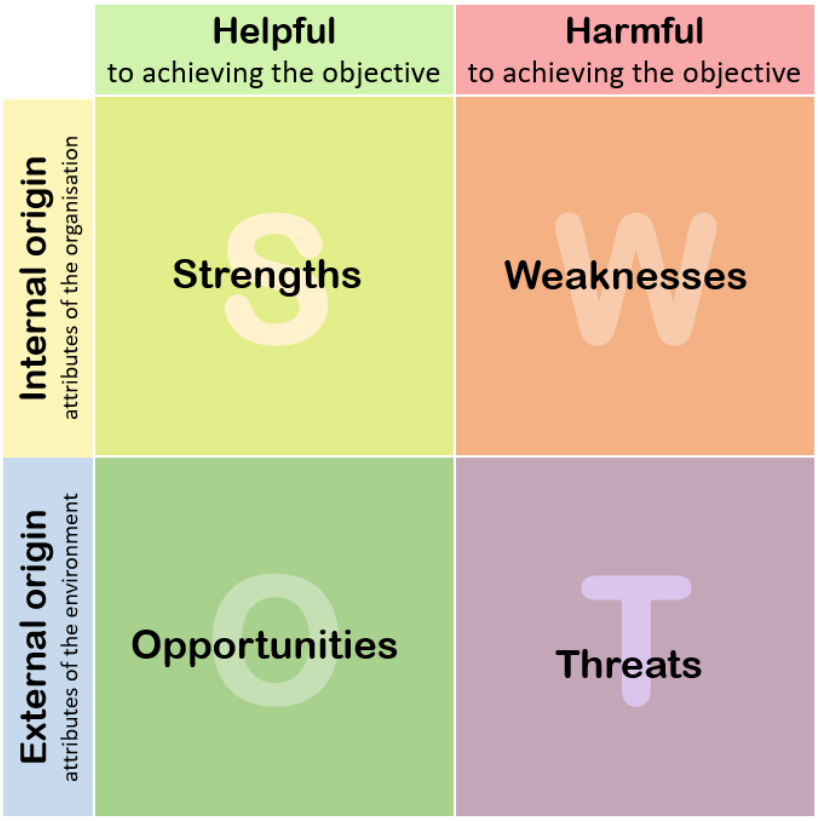

Figure 10: SWOT analysis matrix

3.5 References

Gassmann, O., Frankenberger, K. & Csik, M. 2013. *The St Gallen Business Model Navigator*. University of St Gallen, Switzerland.

Gassmann, O., Frankenberger, K. & Csik, M. 2014. *The Business Model Navigator: 55 Models that will Revolutionise your Business.* Pearson.

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4. BUSINESS MODEL CANVAS

4.1 Introduction

Business Model Canvas is a tool developed by Osterwalder & Pigneur (2010) to structure and organize a business idea and to develop step-by-step a comprehensive business model. The tool consists of a one-page template with nine building blocks which describe the key components of the company or the start-up (Figure 11).

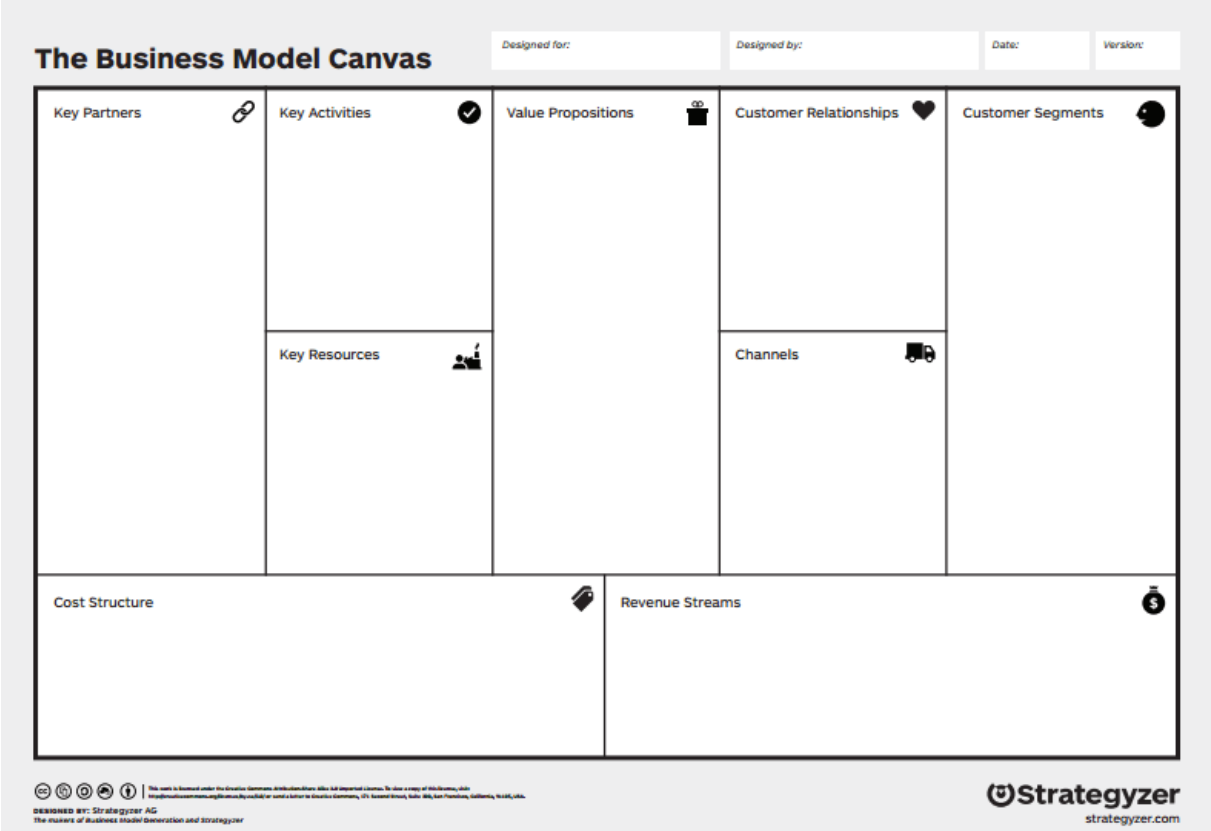


Figure 11: The nine building blocks of the Business Model Canvas (https://assets.strategyzer.com/assets/resources/the-business-model-canvas.pdf)

The nine building blocks are:

- **Value Proposition**, which concerns the products and services the company offers
- **Customer Segments**, such as buyers, users and beneficiaries
- **Distribution Channels** used to reach the customers and to deliver the product/service
- **Customer Relationships** to communicate and interact with the customers in order to understand their needs
- **Revenue Streams** are generated by the value propositions
- **Key Activities** to make the business model work

- **Key Resources**, which are the assets (hardware, software, human capital etc.) of the business model
- **Key Partnerships** in order to leverage the company's resources
- **Cost Structure**, the incurred costs of the business model

Osterwalder & Pigneur (2010) attach great importance to the visual presentation of the Business Model Canvas. It should be clearly displayed on one page, with a focus on the interaction between the nine building blocks, thereby providing a holistic view of the logic of the business model. It is not a static business plan but a dynamic business model that should be adapted as the company or start-up moves through the business development process. The model is therefore continuously tested, validated and improved. Sticky notes are used for the key points of each building block and the flows between them, as well as to propose and to test alternatives in an interactive process (Figure 12).

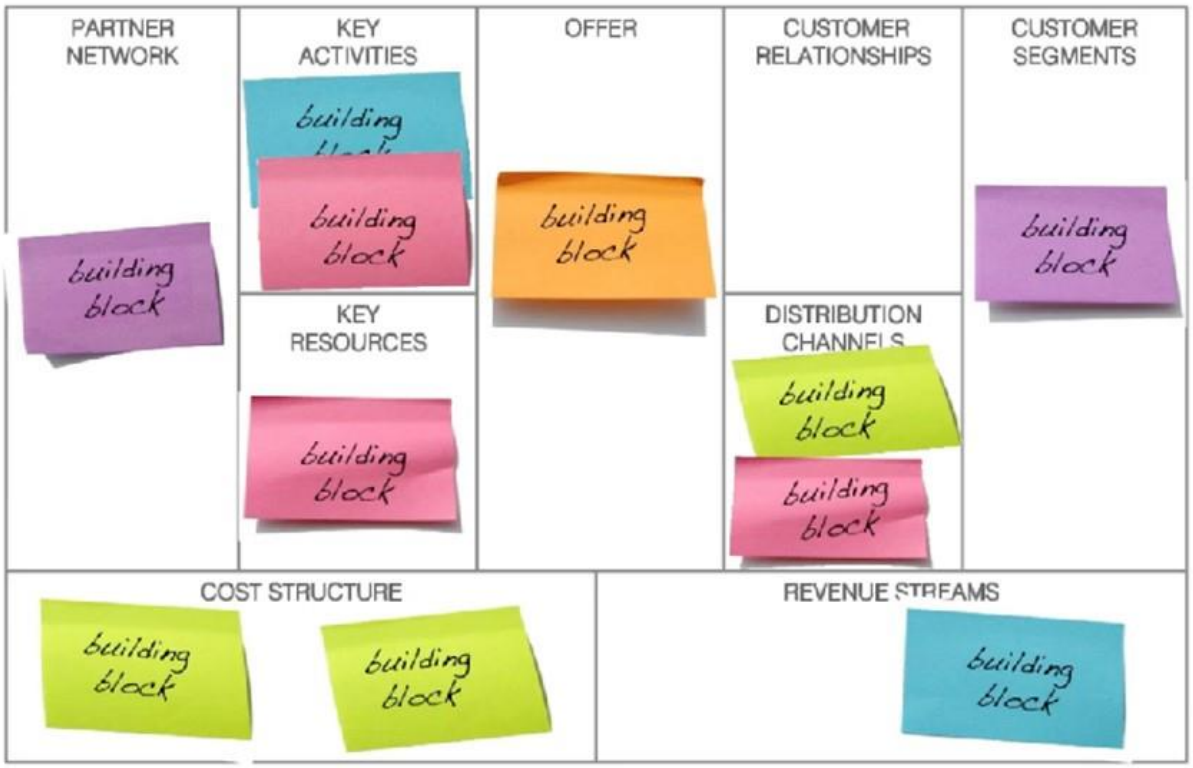


Figure 12: The process of developing a business model (Osterwalder & Pigneur 2010)

This approach has three advantages (Cowan 2016):

- **Focus:** The Canvas approach focuses on the key drivers of the business;
- **Flexibility:** The sticky notes should be moved and replaced as the team develops its ideas and discusses matters, trys new things and optimizes the model;
- **Transparency:** The approach is transparent and well suited for teamwork.

Due to these advantages, the Canvas approach is now a well-established tool in practitioner circles, and recently it has also attracted the interest of academics (Blank *et al.* 2012; Jackson *et al.* 2015).

The arrangement of the building blocks follows a deliberate system. As noted by Jackson *et al.* (2015):

1) The building blocks that influence each other most strongly are positioned side by side;
2) The structure of the template mimics the functionality of the human brain. The building blocks to the left – Key Activities, Key Resources, Key Partners and the Cost Structure – are driven by logic and accounting relationships, while the blocks on the right – Customer Segments, Customer Relationships, Channels and Revenue – are governed by emotions, respectively the interactions with the customer and user. The Value Proposition is at the centre of the template;
3) In a similar way, the blocks toward the top of the Canvas template are more abstract and qualitative, while the bottom blocks are specific and quantitative.

4.2 The Canvas building blocks in detail

It does not really matter which building block one starts with. The key points are to ask and answer the relevant questions for each building block, and to understand the underlying interactions between them. In this section we provide a definition for each building block and then focus on the questions and the links between the key components of the model, using Edelkrebs AG as a case study (Boxes 1-9).

Box 1: Short description of Edelkrebs AG

Edelkrebs AG (https://www.edelkrebs.ch) is a spin-off of the Zurich University of Applied Sciences. It was founded in 2013 and specializes in breeding native crayfish and grayling in closed-loop systems. In collaboration with ZHAW, the company has developed fattening and reproduction protocols for native crayfish, and for selected fish species. The company is building a 150 m^3 state of the art RAS that will be completed in 2020. The engineering is being done by an external RAS-planning company. While the existing plant can produce a maximum of 2 t of Cherry Salmon or 1 t of Grayling each year, the new plant will produce 13 t of Cherry Salmon, which will be raised free of medicines and antibiotics. The first products from the new plant will be introduced on the market at the end of 2021.

4.2.1 Customer segments

It is convenient to start with the customer segments (Figure 13). They are the groups of people for whom your business creates value. The questions that need to asked are:

- What kind of market do you have?
- For whom are you creating value?
- Who are your most important or key customers?
- Can you differentiate between different customer groups/segments?
- What do your customers need or want? How do they think? See? Feel? Do?

The output from this exercise is a list of customer segments sometimes characterized by individual personas (archetypes) for each segment. It combines everything you know about your typical customers. The better you understand your customer, their needs and motivations, the more you will be able to offer the right products and services (value proposition) and to earn an appropriate income.

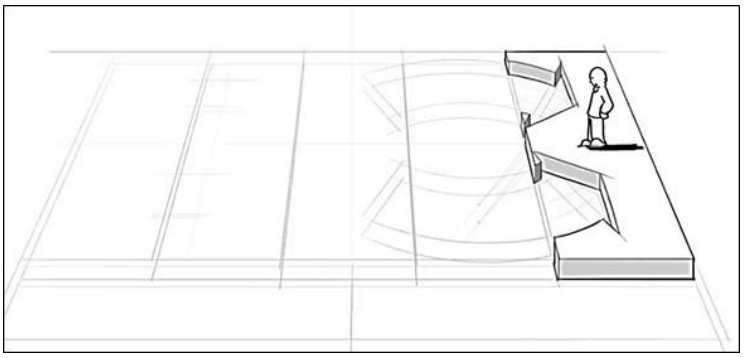


Figure 13: Customer segments or targeted customers
(adapted after Osterwalder & Pigneur 2010)

Box 2: Customer segments of Edelkrebs AG

Edelkrebs AG identified two distinct customer segments:

- the Business-to-Business (B2B) segment: gourmet restaurants and their well-heeled clientele (personas such as LOHAS – Lifestyles of Health and Sustainability – and DINK – Double Income, No Kids – and other wealthy and well-educated personas);
- the Business-to-Customer (B2C) segment: retail customers willing to pay a premium for high quality food

4.2.2 Value proposition

The value proposition is the heart of your business. It says how you provide value to customers and why you stand out from your competitors. It is a description of your products and service, the value they provide to the customers, and why they are unique (Figure 14). The development of value proposition typically starts with a list of the products and/or services being offered to the customers. It includes the vision, the product features/benefits, and an example of the typical product. The questions that need to be answered are:

- What kind of value do you deliver to your customers, or: which customer needs are you satisfying (e.g. efficiency, convenience, social status, low prices)?
- What is compelling about your proposition, product, service? Why do customers buy/use it?
- Which of your customer's problems are you helping to solve?
- What bundles of products and services are you offering to each customer segment?

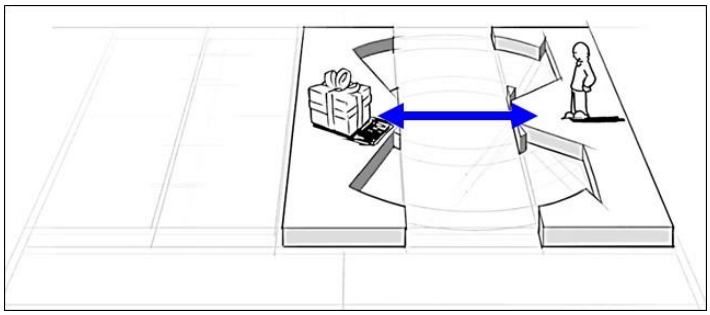


Figure 14: The value proposition (adapted after Osterwalder & Pigneur 2010)

Box 3: Value Proposition of Edelkrebs AG

The vision of Edelkrebs AG is to provide fresh fish that are available to the customer with a premium service no later than 24 hours after slaughter. The product – grayling (*Thymallus tyhmallus*) and cherry hybrid salmon (*Oncorhynchus masou)* – is raised in an animal-friendly manner without additives and antibiotics. The fish are born, raised, and slaughtered in Switzerland. Edelkrebs AG has full control over the entire production, from the egg to the fish on the plate. This is documented and transparent to the customers. In addition, the fish is delivered as a bone-free fillet and is guaranteed to be free of off-flavour.

4.2.3 Channels

Channels are the way in which you effectively reach the customer segments who buy your products and services. Channels are the ways you let your customers know about, sell, deliver, and maintain your products and services (Figure 15). The questions to be answered are:

- Through which channels do your customers want to be reached? (own store, partner store, web sales, etc.)
- Which channels work best for each customer segment?
- Which channels are the most cost efficient?
- How are you reaching them now? Which ones work best?
- How are your channels integrating with the customer routines?

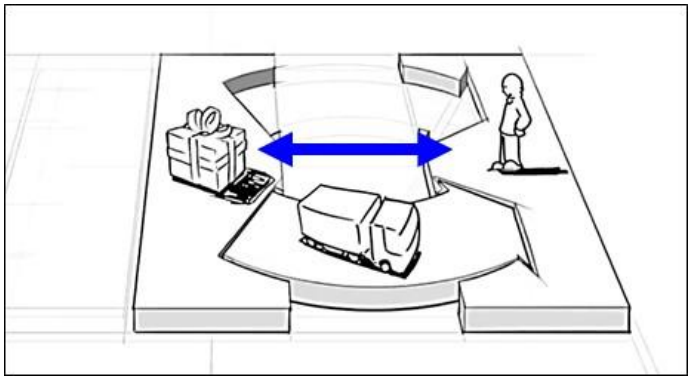


Figure 15: Channels connect the value propositions with the customers
(adapted after Osterwalder & Pigneur 2010)

Box 4: Channels of Edelkrebs AG

The products of Edelkrebs AG are only available through direct sales to gourmet restaurants and private customers. Edelkrebs AG uses three channels:

- a website, social media sites and personal contacts
- delivery services (DHL, UPS, etc.)
- a small fish shop open on Saturdays

4.2.4 Customer relationships

Customers relationships are the interactions and communication channels your business must have to establish and maintain your customer base. It deals with the way in which you attract, keep and maintain your customers (Figure 16).

- Which type of relationship does each of your customer segments expect you to establish and maintain with them?
- Which ones have you established?
- How are they integrated with the rest of your business model?
- How costly are they?

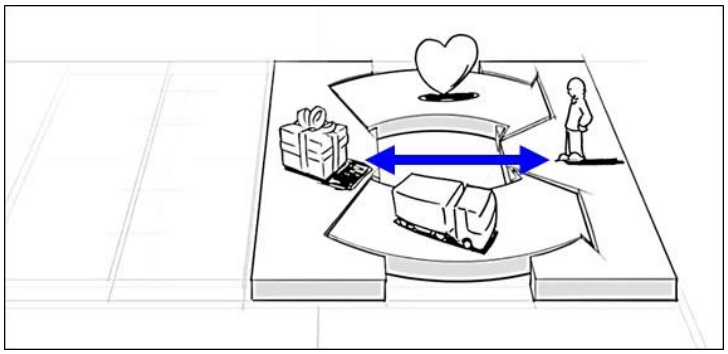


Figure 16: Customer relationships (adapted after Osterwalder & Pigneur 2010)

Box 5: Customer Relationships of Edelkrebs AG

Edelkrebs AG acquires and retains their 'business-to-business' (B2B) customers through a network of personal relationships with gourmet restaurants and their chefs. Personal contacts are key to this business. Accordingly, Edelkrebs AG arranges appointments with the restaurant owners and chefs, provides fish samples, collects feedback, and encourages word-of-mouth recommendation. As for their 'business-to-customer' (B2C) business based on direct sales to the end customer, Edelkrebs AG organises gastro events via the website or at the farmgate at defined opening times.

4.2.5 Revenue streams

Revenue streams are the ways in which your business earns money – the products and services customers are willing to pay for, and how they do that (Figure 17). The revenue streams crystallize

the building blocks of the right-hand side of the Canvas: the value you are creating, for whom you deliver, and how you are capturing value for your business (taking into account the potential market size and the pricing). The questions to be answered are:

- What value are your customers willing to pay? For what do they currently pay? How are they currently paying? How much would they prefer to pay?
- What form does the revenue have (e.g. sales, subscription fee, renting fee, advertisement, etc.)?
- What pricing mechanism is applied (fixed pricing based on customer segments and product quality, dynamic pricing depending upon market conditions)?
- How much does each revenue stream contribute to overall revenues?

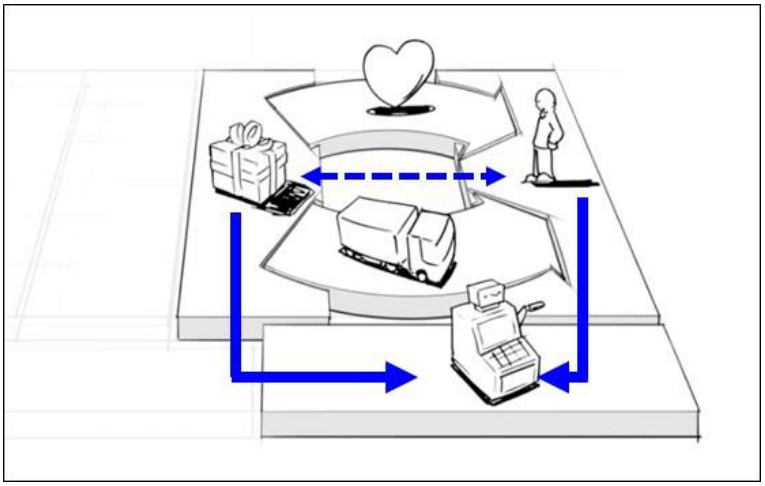


Figure 7: 1Revenue streams are the ways in which your business earns money (adapted after Osterwalder & Pigneur, 2010)

Box 6: Revenue Streams of Edelkrebs AG

Edelkrebs AG follows a small-scale or limited production and sales approach. Maintaining the high quality and exclusiveness of the product is paramount. Accordingly, the fish prices are high for the B2B customers. The B2C retail sales are also limited, but prices lie only marginally above fish prices in the retail store.

4.2.6 Key resources

Key resources are the assets required to offer and deliver the previously described elements. This includes not only physical and financial assets, but also the strategic assets which you need in order to launch, maintain, and improve your business, product or service (Figure 18). The questions to be answered are:

- What unique assets/resources/equipment/infrastructure must the business have in order to compete?
- What key resources do your value propositions/distribution channels/customer relationships /revenue streams require?

- What assets give your business a competitive edge?

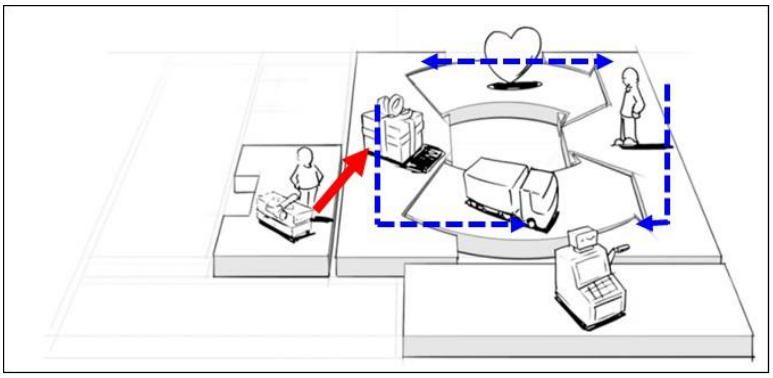


Figure 18: Key resources are the assets required to offer and deliver the previously described elements (adapted after Osterwalder & Pigneur 2010)

Box 7: Key resources of Edelkrebs AG

The key resources of the Edelkrebs AG are:

- the human capital which is recorded in the production log
- the interdisciplinary team with specialist knowledge in environmental sciences, entrepreneurship and aquaculture systems. This experience is complemented by further expertise in the fields of biochemistry, supply chain management and IT

The most important physical assets are:

- the fish and crayfish production facilities (tanks, biofilters, cooling and heating devices, monitoring hardware)
- the fish and crayfish reproduction facilities
- the fish processing facilities
- the abundant water supply

4.2.7 Key activities

Key activities are those which are crucial to your business and value proposition (Figure 19). The questions that need to be answered are:

- What unique activities does the business need to do in order to deliver its value proposition?
- What activities are most important for your value propositions, effective distribution channels, customer relationships, and developing revenue streams?

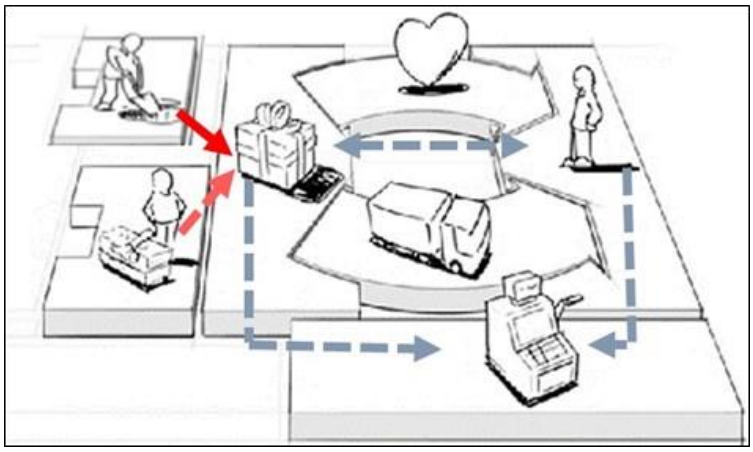


Figure 19: Key activities are those which are crucial to your business and value proposition (adapted after Osterwalder & Pigneur 2010)

Box 7: Key activities of Edelkrebs AG

The key activities are:

- Constant production of fish in a consistently high quality for the premium market in Switzerland
- Service: Breeding eggs and raising juveniles for the wildlife authorities of species which require special know-how to breed and raise
- Service: Providing authorities with high quality seedlings for stocking in the required size
- Transparent, fast, and honest communication with customers

4.2.8 Key partners

Key partners are external people and organizations that support your business (Figure 20). Partnerships, suppliers, and joint ventures fit into this segment. Certain activities and resources need to be outsourced. Partnerships leverage your resources to add further value. The questions to be answered are:

- Who are your partners that help you to create value?
- Who are your key suppliers?
- Which key resources are you acquiring from your key partners?
- Which key activities do your key partners perform?
- What activities can be outsourced so that your business can focus on core activities?

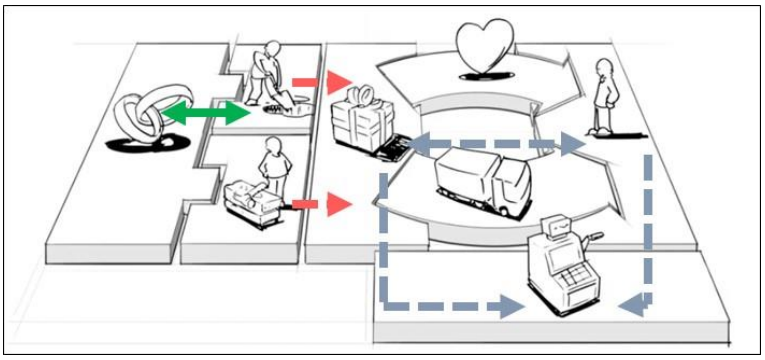


Figure 20: Key partners are external people and organizations that support your business (adapted after Osterwalder & Pigneur 2010)

Box 8: Key partners of Edelkrebs AG

The key partnerships of Edelkrebs AG fall into 3 broad categories:

1) from the point of view of sales:

- Gourmet chefs: while they are customers, they are also partners, because they communicate their requirements to the production team (such as the required size of the fish, the timing of production, etc.)
- Logistics partner
- Enterprise-Resource-Planning-System (ERP)

2) from the point of view of production:

- Feed supplier
- Engineering company of the facility
- Energy supplier (EKZ Renewables AG, photovoltaic system)
- Research partner (ZHAW)

3) from the point of view of management:

- Accounting (Alex Gemperle AG)
- Construction expertise (Alex Gemperle AG)
- Legal advice (Alex Gemperle Holding)
- Network (Alex Gemperle Holding)

4.2.9 Cost structure

The cost structure describes the most important costs incurred of your business model. Costs are estimated based on the previously identified Key Resources, Key Activities, and Key Partnerships (Figure 21). The questions to be answered are:

- What costs arise from creating and delivering value to your customers, and from your key activities and key resources? What are the most important costs inherent in your business model?
- What are the major cost drivers for your business and how are they linked to revenue and delivery of your value proposition?
- Which key resources are the most expensive?

- Which key activities are the most expensive?

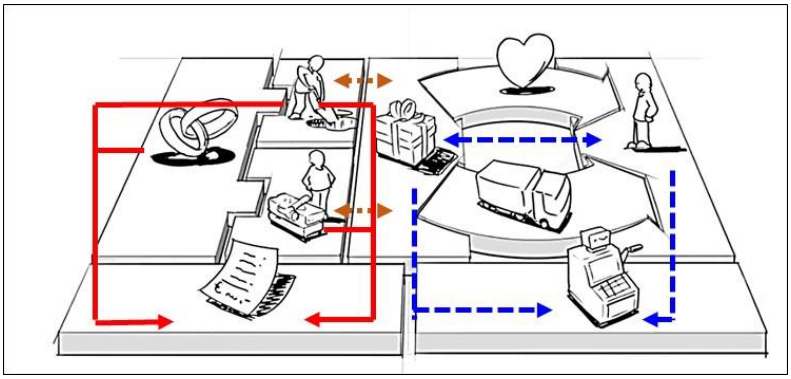
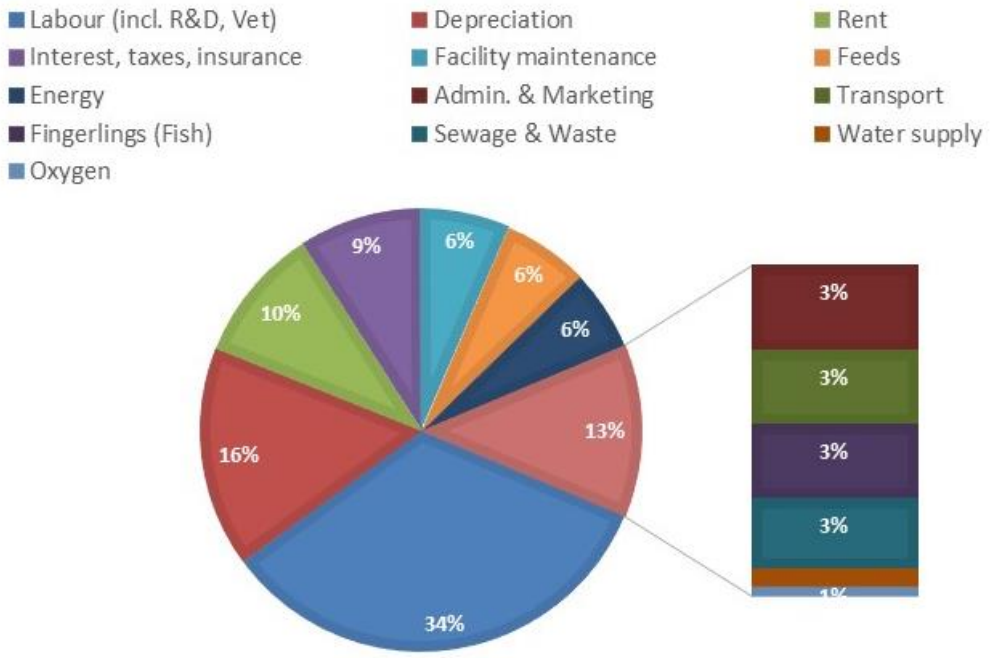


Figure 21: The cost structure describes the most important costs incurred in the business model (adapted after Osterwalder & Pigneur 2010)

Box 9: The cost structure of Edelkrebs AG

The most important costs are: Labour, depreciation of facilities, and the rent. Water supply costs are surprisingly low, because Edelkrebs AG obtained a water concession for water spring on its area. Energy costs are offset by the solar installation on the roof of facilities. It is important to notice a significant cost for fish feeds. High quality feeds have their price!



The links beetween the different building blocks can then be summarised (Figure 22 and Table 2). Table 3 shows the Buisness Model Canvas for Edelkrebs AG.

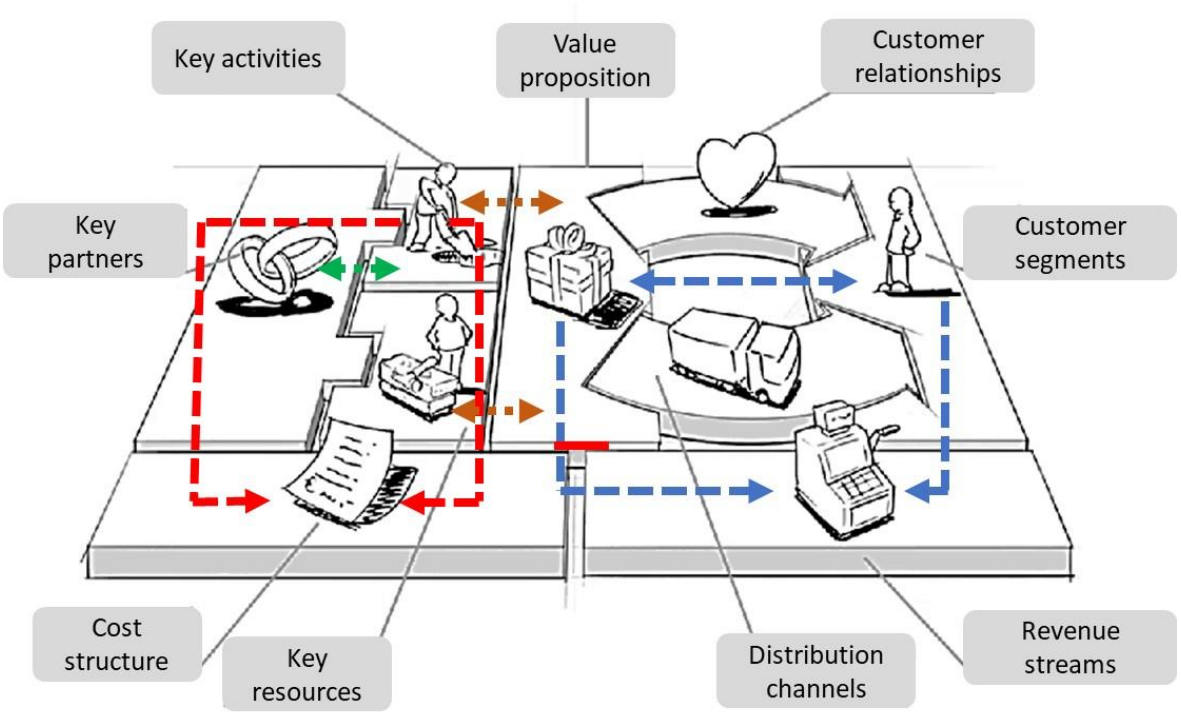


Figure 22: A summary of links between the various building blocks (adapted after Osterwalder & Pigneur 2010)

4.3 References

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Cowan, A. 2016. The 20 Minute Business Plan: Business Model Canvas Made Easy.

Jackson, W.T., Scott, D.J. & Schwagler, N. 2015. Using the business model canvas as a methods approach to teaching entrepreneurial finance. *Journal of Entrepreneurship Education* 18 (2), 99-111.

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Table 2. A summary of the Business Model Canvas (https://strategyzer.com/canvas/business-model-canvas)

<table>
<tr>
<td rowspan="2">Key Partners
Who are our key partners?
Who are your key suppliers?
Which key resources are we acquiring from our key partners?
Which key activities do our key partners perform?</td>
<td>Key Activities
Which key activities do our value propositions require?
Our distribution channels?
Customer relationships?
Revenue streams?</td>
<td rowspan="2">Value Proposition
What value do we deliver to our customers?
Which of our customer's problems are we helping to solve?
What bundles of products and services are we offering to each customer segment?
Which customer needs are we satisfying?</td>
<td>Customer Relationships
Which type of relationship does each of our customer segments expect us to establish and maintain with them?
Which ones have we established?
How are they integrated with the rest of our business model?
How costly are they?</td>
<td rowspan="2">Customer Segments
For whom are we creating value?
Who are our most important customers?</td>
</tr>
<tr>
<td>Key Resources
What key resources do our value propositions require?
Our distribution channels?
Customer relationships?
Revenue streams?</td>
<td>Channels
Through which channels do our customers want to be reached? How are we reaching them now?
How are our channels integrated?
Which ones work best?
Which ones are most cost efficient?</td>
</tr>
<tr>
<td colspan="3">Cost Structure
What are the most important costs inherent in our business model?
Which key resources are the most expensive?
Which key activities are the most expensive?</td>
<td colspan="2">Revenue Streams
For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How much would they prefer to pay?
How much does each revenue stream contributing to overall revenues?</td>
</tr>
</table>

Table 3. Business Model Canvas of Edelkrebs AG

<table>
<tr>
<td rowspan="2">Key Partners
1) sale:
- Gourmet chefs
- Logistics partner
- Enterprise-Resource-Planning-System (ERP)
2) production:
- Feed supplier
- Engineering company of the facility
- Energy supplier (EKZ, photovoltaic system)
- Research partner (ZHAW)
3) management:
- Alex Gemperle AG (accounting, construction expertise)
- Alex Gemperle Holding (legal advice, network)</td>
<td>Key Activities
Constant production of fish of a consistently high quality
Service for wildlife authorities:
- breeding eggs and raising of juveniles
- providing high quality seedlings for re-stocking
Transparent, fast, and honest communication with customers</td>
<td rowspan="2">Value Proposition
Fresh fish available to the customer with a premium service</td>
<td>Customer Relationships
B2B customers: based on a network of personal relationships with the gourmet restaurants and chefs
B2C customers: gastro events, directly via the website or at the farmgate at defined opening times</td>
<td rowspan="2">Customer Segments
B2B: Gourmet restaurants and their well-heeled customers
B2C: Retail customers willing to pay a premium for high quality food</td>
</tr>
<tr>
<td>Key Resources
- human capital
- interdisciplinary team with specialist knowledge in environmental sciences, entrepreneurship, aquaculture systems, biochemistry, supply chain management, and IT
- physical assets (fish and crayfish production, reproduction, and processing facilities)
- the abundant water supply</td>
<td>Channels
Homepage for both B2B and B2C sales
Delivery services (DHL, UPS, etc.)
A small fish shop open on Saturdays</td>
</tr>
<tr>
<td colspan="3">Cost Structure
The most important cost drivers are labour, depreciation of facilities, and rent</td>
<td colspan="2">Revenue Streams
Profitability is based on small-scale production and high prices for exclusive products.</td>
</tr>
</table>

5. MARKETING AND PRICING

5.1 Introduction

When considering new products from new technologies, it is important to analyse customers' knowledge and their acceptance of the product in order to be able to define a marketing and pricing strategy. Willingness to pay when buying food is mainly based on price and whether the produce is free of antibiotics, pesticides and herbicides. Some customers are also attracted by produce which is local. Aquaponic farmers should therefore focus their marketing on local stores and restaurants, and emphasize the sustainability of the production method. Aquaponic farming also offers opportunities to get involved in the experience economy (Miličić *et al.* 2017).

5.2 Competition

Understanding the forces that shape industry competition is the starting point for developing a marketing and pricing strategy. A start-up needs to know what the average profitability of its industry is, and how that has been changing over time, in order to determine the strengths and weaknesses of the business sector it is planning to step into. So first we need to ask ourselves "Do we really know our industry?" To answer this question, we can use Porter's 'Five Forces that Shape Strategy' model (Figure 23) which is widely used for:

- analysing the state-of-the-art of an industry;
- analysing the competitive environment;
- generating ideas for strategic responses.

Considering all five forces prevents gravitating towards any one element, and the attention remains focused on structural conditions rather than on fleeting factors. The five forces reveal why profitability is what it is. By systematically identifying and analysing how the five competitive forces influence your industry, you can then incorporate industry conditions into your strategy for enhancing your company's long-term profits.

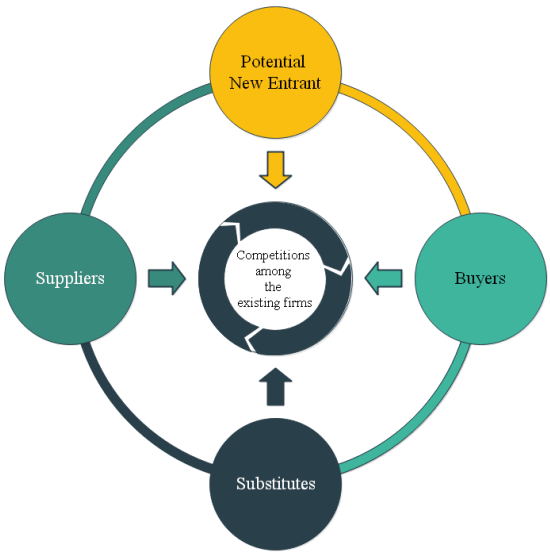

Figure 23: The Five Forces That Shape Industry Competition (Porter 2008)

5.2.1 Threat of entry

New entrants to an industry bring new capacity and a desire to gain market share that puts pressure on prices, costs, and the rate of investment necessary to compete. Particularly when new entrants are diversifying from other markets, they can leverage existing capabilities and cash flows to shake up competition. The threat of entry depends on the height of entry barriers that are present and on the reaction entrants can expect from incumbents. The major factors that become barriers to entry are economies of scale, product differentiation, capital requirements, switching costs, access to distribution channels, cost disadvantages independent of scale, and government policy. If entry barriers are low and newcomers expect little retaliation from the entrenched competitors, the threat of entry is high and industry profitability is moderated. It is the threat of entry, not whether entry actually occurs, that holds down profitability. The bottom-line question is "What are the barriers to entry and how strong are they?"

5.2.2 The power of suppliers

Companies depend on a wide range of different supplier groups for resources. Powerful suppliers capture more of the value for themselves by charging higher prices, limiting quality or services, or shifting costs to industry participants. Powerful suppliers can therefore squeeze profitability out of a business that is unable to pass on cost increases in its own prices. The more suppliers you have to choose from, the easier it will be to switch to a cheaper alternative. But the fewer suppliers there are, and the more you need their help, the stronger becomes their position and their ability to charge you more. The bottom-line question is "Who are potential suppliers and what is their power?"

5.2.3 The power of buyers

Powerful customers can capture more value by forcing down prices, demanding better quality or more service (thereby driving up costs), and generally playing industry participants off against one another, all at the expense of the profitability of your business. When you deal with only a few buyers, they have more power, but your power increases if you have many buyers. The bottom-line question is "Who are potential buyers and what is their power?"

5.2.4 The threat of substitutes

A substitute performs the same or a similar function as a company's product by a different means. For example, e-mail is a substitute for express mail. Sometimes the threat of substitution is downstream or indirect, when a substitute replaces a buyer industry's product. Substitutes are always present, but they are easy to overlook because they may appear to be very different from the industry's product. A substitution that is easy and cheap to make can weaken your position. The bottom-line question is "How else do your potential buyers satisfy their needs and what is the power of these alternatives?"

5.2.5 Rivalry among existing competitors

Rivalry among existing competitors takes many familiar forms, including price discounting, new product introductions, advertising campaigns, and service improvements. High rivalry limits the profitability of a business. The degree to which rivalry drives down a business's profit potential

depends on the intensity with which companies compete, and on what basis they compete. If it is cheap and easy to enter your market and compete effectively, or if you have little protection for your key technologies, then rivals can quickly weaken your position. If you have strong and durable barriers to entry, on the other hand, then you can preserve a favourable position and take fair advantage of it. The bottom-line question is 'Who are your competitors really and how strong are they?'

5.3 Experience economy

We are living in an era when many people do not want to buy products as such anymore, but instead are looking for experiences and memorable moments. Producers must thus therefore offer memorable experiences for customers. The experiences are not services, just as services are not goods: for example, buying ingredients for a birthday cake (goods), ordering a birthday cake at a bakery (service) or buying a birthday event (experience) that probably also includes a cake. In the experience economy the buyer is not a client, as they are in the service economy, but instead they become a guest and the seller becomes an actor on the stage (Table 4).

Table 4: Economic distinctions (adapted from Pine & Gilmore 1998)

Economic offering	Goods	Products	Services	Experiences
Economy	Extract	Industrial	Service	Experience
Key attribute	Natural	Standardized	Customized	Personalized
Seller	Trader	Manufacturer	Provider	Stager
Buyer	Market	User	Client	Guest
Nature of offering	Fungible	Tangible	Intangible	Memorable
Factors of demand	Characteristics	Features	Benefits	Sensations

The term 'experience economy' was established by Pine and Gilmore in 1998. The experience can be explained in two dimensions: customer participation and customer connection. Customer participation ranges from active (customers play crucial roles in forming the experience) to passive (customers don't affect the experience), while customer connection ranges from absorption (such as listening to a lecture, or watching a movie at home) to immersion (such as going to a 3D cinema). Within these two dimensions the experience can be categorized into four main groups (Figure 24):

1. **Entertainment** (passive absorption): what can you do to get your guest to stop and stay? How can you make the experience more fun and enjoyable? (e.g. festivals, online video contents)
2. **Educational** (active absorption): what do you want them to learn from the experience? What information or activities will help them in the exploration of knowledge or skills? (e.g. guided tours, demonstration of experiments)

3. **Escapist** (active immersion): what should your guests do? How can they become more immersed in activities? How can you get them to become active participants in the experience? (e.g. hiking, harvesting grapes)
4. **Esthetic** (passive immersion): what makes your guests want to come and hang out? How can the environment be changed to be more inviting, more interesting or more comfortable? (e.g. art and craft fairs, indoor design)

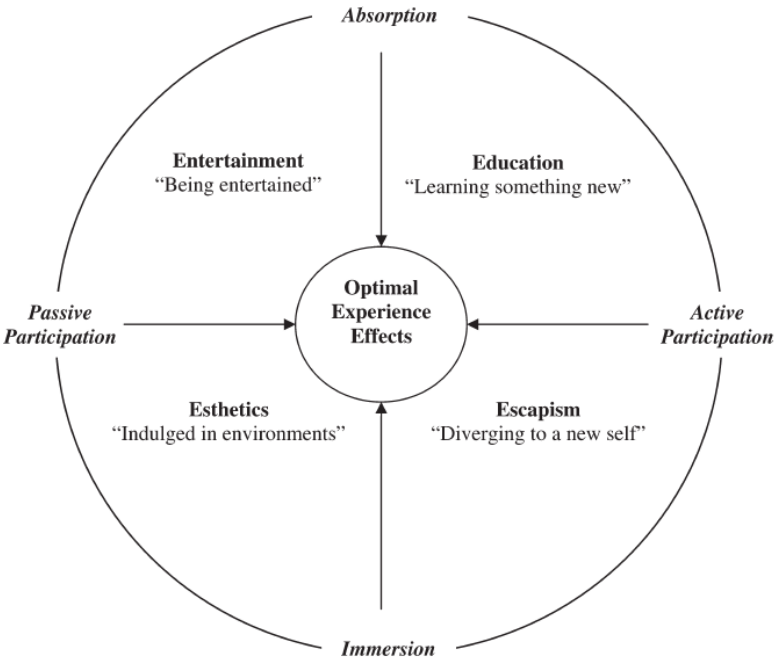

Figure 24: Four realms of experience (Oh *et al.* 2007)

In the agricultural sector, many different products and services can provide an experience to the consumer, ranging from produce where the experience is only one aspect in the consumer's decision to buy it (e.g. organic produce, for which quality and health concerns also play a crucial role) to products and services where the experience feature is the most important driver (e.g. fair trade produce, free range eggs). Consumers value 'experience produce' for the story that is attached to it – in the case of fair trade produce, it is the belief that poor farmers in developing coungtries will receive a fair share of the proceeds. These additional experience characteristics positively affect consumers' willingness to pay a higher price than they would for a conventional product (Swinnen *et al.* 2012).

5.4 Marketing

The customer-centric philosophy of the lean start-up methodology can also be applied to your marketing strategy. Understanding your customers will help you decide where to focus your marketing efforts, for example which social media channels will be most successful for your brand. Just like building a start-up, creating a brand is an ongoing process. It requires constant learning, testing, and pivoting to find out what works the best.

5.4.1 Branding – building customer loyalty

As an entrepreneur, it is essential that you understand the difference between branding and marketing. Branding is who you are, while marketing is how you build awareness of who you are. Marketing therefore refers to the tools you use to deliver the message of your brand. In order to determine who your brand is, you need to ask yourself several questions:

- What are your core principles and values?
- What is your mission statement?
- What inspired you to build your business?
- Why do you want to offer your products or services to your target audience?
- What makes you unique?
- What is your internal company culture?
- What is your professional sense of style?
- What are your communication characteristics?
- What do you want to come to mind when someone hears your business name?
- How do you want people to feel when they think of your business?
- How do you want customers to describe you as a company?

All of the questions are related to your internal operations and your internal culture. Therefore, what you build on the inside is what will emanate externally. Your branding will cultivate what your consumers can expect of you, and what they will experience when they utilize your products or services. By clearly defining who you are, your branding can then be utilized to precede and underlie your marketing efforts.

In recent years, marketers have been using brand communities (e.g. Jeep, Apple smartphones) to build brands. A brand community can be defined as a 'group of consumers with a shared enthusiasm for the brand and a well-developed social identity, whose members engage jointly in group actions to accomplish collective goals and/or express mutual sentiments and commitments' (Bagozzi & Dholakia 2016). It provides consumers with a variety of information pieces, such as products, user experience and competition between companies. It can also be used to enhance brand loyalty and commitment (Lin *et al.* 2019).

In a competitive environment, a brand which has been on the market for a long time provides an opportunity for companies to differentiate themselves from their rivals. In general, two brand naming strategies exits for creating a brand. Retailers use their own name or they use a new name. Additionally, a brand results in greater profitability and increased loyalty, which may be vital to surviving in the competitive retail industry. In this regard, trust plays an important role for consumers. The concept of brand trust refers to 'the willingness of the average consumer to rely on the ability of the brand to perform its stated function' (Konuk 2020). Product packaging design needs to draw your customers to brand identity, shouting out your unique selling points (Figure 25).

Figure 25: ECF Farmsystems package design (http://www.ecf-farmsystems.com)

5.4.2 Market segmentation

Market segmentation is the process of dividing existing and potential customers into sub-groups of consumers (known as segments) based on common characteristics, so that companies can market to each segment in an appropriate and effective manner. Market researchers typically look for common characteristics such as shared needs, common interests, similar lifestyles or even similar demographic profiles. The overall aim of segmentation is to identify high yield segments – those that are likely to be the most profitable or that have growth potential – so that these can be selected for special attention (i.e. become target markets). Business-to-business (B2B) companies might segment the market into different types of businesses or countries, while business-to-consumer (B2C) companies might segment the market into demographic profiles, location (urban, suburban, rural), life stage (single, married, divorced, empty-nester, retired, etc.), or any other meaningful segment. Market segmentation assumes that different market segments require different marketing programs – different offers, prices, promotion, distribution, or some combination of marketing variables. Market segmentation is not only designed to identify the most profitable segments, but also to develop profiles of key segments in order to better understand their needs and purchase motivations. Insights from segmentation analysis are subsequently used to support marketing strategy development and planning. Segmentation therefore allows marketers to better tailor their marketing efforts to various audience subsets. Those efforts can relate to both communications and product development. Specifically, segmentation helps a company to:

- Create and communicate targeted marketing messages that will resonate with specific groups of customers, but not with others (who will receive messages tailored to their needs and interests instead);
- Select the best communication channel for the segment, which might be email, social media posts, radio advertising, or another approach, depending on the segment;
- Identify ways to improve products or new product/service opportunities;
- Establish better customer relationships;
- Test pricing options;

- Focus on the most profitable customers;
- Improve customer service;
- Upsell and cross-sell other products and services.

When it comes to new technology, marketers have traditionally identified five different kinds of consumer, each of which has its own response to novelty, and its own psychographic profile – attributes relating to personality, values, attitudes, interests, or lifestyles:

- **Innovators** seek out novel technology. There aren't many Innovators, and because they are keen to try new things, they are important: other people see them use new things and feel braver themselves about trying them;
- **Early Adopters** are quick to understand the benefits of new technology. Unlike the Innovators, they don't love technology for its own sake. This group relies on its own intuition and vision to make buying decisions;
- **Early Majority** are practical minded consumers. If a product seems useful, this group will try it, but they are cautious of fads;
- **Late Majority** consumers wait for something to become well established since they don't feel confident in their ability to deal with technology;
- **Laggards** are those consumers who, for personal and/or economic reasons, are not looking to buy new technology.

Most people fall into the Early and Late Majority categories, but understanding all five customer segments is crucial for marketing. The traditional model assumed that, in the lifespan of a product, the market is first dominated by the Innovators, then the Early Adopters, and so on. This model implies a level of inevitability in the flow from one segment to another, so markets are developed according to the model, starting with the Innovators and working down to the Laggards. However, this process is harder in real life than it is in theory. It isn't a simple thing to sell to one segment and then adjust one's marketing to sell to the next segment down the line. Since the segments are different from each other, the same strategies won't work.

In addition, there are gaps in the model large enough to derail the most promising start-ups as they transition from one customer segment to the next. The gap between Innovators and Early Adopters, for example, arises when there is new technology that motivates the Innovators, but not the Early Adopters, since there aren't any practical applications for the technology. The gap between the Early Majority and the Late Majority occurs because members of the former group are willing to learn a little about the technology in order to use it, while the latter aren't prepared to invest any energy in learning it. For the Late Majority, the technology therefore has to be intuitive and easy to use. The biggest gap, however, is the one between Early Adopters and the Early Majority. This gap is so significant that it has been called a 'chasm', and it divides the customer segments into two groups – the Early Market and the Mainstream Market (Moore 2014; Figure 26). The 'chasm' coincides with the Trough of Disillusionment in Gartner's Hype Cycle (see Chapter 1).

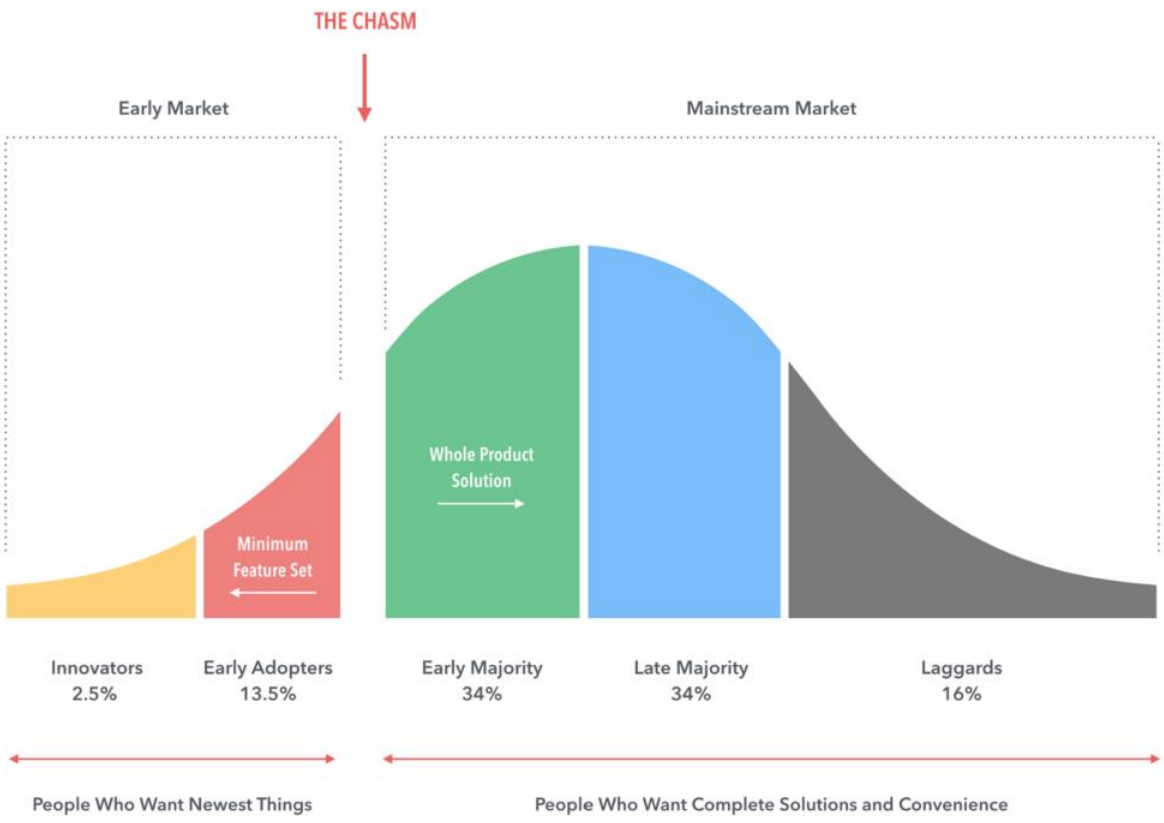

Figure 26: The technology adoption lifecycle (Moore 2014)

Early Adopters and the Early Majority can superficially appear similar — the difference is the expectations of the customer. Early Adopters know that being first with a new technology likely means that there will be glitches and problems, but they are comfortable with that. The Early Majority, on the other hand, is looking for productivity improvement. They favour evolution over revolution; they want things to work smoothly. Because these two groups are so different, Early Adopters don't serve as examples and role models for the Early Majority. The Early Majority need a reference: they need to see how the product works for someone like themselves (Moore 2014).

In terms of marketing, crossing the chasm involves transitioning from product-based to market-based values. The Early Market is all about technology and product, while the Mainstream Market is driven by the company and the market. It is therefore important to adjust your marketing to each customer segment. The first customers of high tech products are Innovators ('techies') and Early Adopters ('visionaries'). Because **Innovators** like technology for its own sake, they are willing to overlook all sorts of problems with new technology in order to be at the cutting edge. They want to be the first to get the new product, and they want the product cheaply. Because Innovators are an important part of the early market, sometimes it is worth giving them a product for free, or at a discount. Direct response advertising, such as an advertisement with a time-limited discounted offer, is therefore particularly effective with this segment. Innovators are a useful market group, because they will give you early feedback on your product, and they can ignite enthusiasm for it (Moore 2014).

Early Adopters, on the other hand, are visionaries. They are looking for breakthrough technology – game changers – and they are willing to pay for that technology. They have high expectations and they get disappointed easily. These customers tend to be the ones who see the possibilities in new products, and so marketing should start with them. However, it is important to manage expectations: you need a direct sales force that understands what their dreams are, and you need to be flexible and accommodate their goals (Moore 2014). Direct sales occur when companies sell their product to consumers without the use of a middleman (as opposed to channel sales, which happen when companies rely on a third party to sell their product). Apple is an example of a company that utilizes a direct sales strategy, as you generally buy their products either in their stores or on the company website. Because the entire lifecycle of the product – from manufacturing to the final sale to the end user – is handled in-house, this generates a lot of feedback from the consumer, which provides companies with valuable information about their client base, and also allows them to identify issues quickly because they hear complaints directly.

The real money is to be made, naturally enough, by selling to the Mainstream Market. The **Early Majority** are pragmatists. They are risk averse, so they want the complete product, not a beta version. Competition in this market results from the evaluation and comparison of products and vendors within a product category. The pragmatist is reassured by following a procedure using checklists and ratings systems. They are hard to win over, but once you have done so, they are loyal. If you sell to B2B customers, standardization may be important to them for practical and pragmatic reasons, so once your product has been selected for use within an organization, purchasing from you will be part of their regular process. The **Late Majority** consist of about one-third of potential customers for technology. They could be classified as conservative when it comes to change. This group doesn't like disruptive innovation. They are believers in tradition, not progress. If their technology works for them they see no reason to change it. However, although they resist new technology, the Late Majority will adapt eventually, in order to keep in step with the rest of the world. They buy at the end of a cycle, and they like to buy cheaply. Unfortunately, because they buy cheaply, they sometimes buy junk, and this reinforces their negative opinion of technology. But there is a great deal of benefit to be gained by understanding the Late Majority. Since they want proven technology, they give companies a market for a technology that is otherwise losing steam, so there is opportunity to be had in bundling existing components together and selling them at discount (Moore 2014).

5.4.3 Value Proposition Canvas – creating value for your customers

The value proposition is the reason why customers turn to one company rather than another. It solves a customer problem, or satisfies a customer need. Each value proposition consists of a selected bundle of products and/or services that caters to the requirements of a specific customer segment. Some value propositions may be innovative and represent a new or disruptive offer, while others may be similar to existing market offers, but with added features and attributes. Values may be quantitative (e.g. price, speed of service) or they may be qualitative (e.g. design, customer experience).

The Value Proposition Canvas (VPC) zooms in on two of the building blocks of the Business Model Canvas: Customer Segments – the different groups of people you aim to reach and create value for

with a dedicated value proposition, and Value Propositions – the bundle of products and services that create value for a specific Customer Segment. VPC helps you to design and test great value propositions in an iterative search for what customers want. Your value proposition is the crunch point between your business strategy and your brand strategy. Value proposition design is a never-ending process in which you need to evolve your value proposition constantly in order to keep it relevant to customers (Osterwalder *et al.* 2014). VPC has two sides (Figure 27): with the Customer Profile you clarify your customer understanding, and with the Value Map you describe how you intend to create value for that customer:

- **The Customer (Segment) Profile** describes a specific customer segment in your business model. It breaks the customer down into its jobs (what they are trying to get done in their lives, as expressed in their own words, pains (bad outcomes, risks, and obstacles related to customer jobs), and gains (the outcomes customers want to achieve or the concrete benefits they are seeking.
- **The Value (Proposition) Map** describes the features of a specific value proposition in your business model in a more structured and detailed way. It breaks your value proposition down into products and services, pain relievers (how your products and services alleviate customer pains), and gain creators (how your products and services create customer gains).

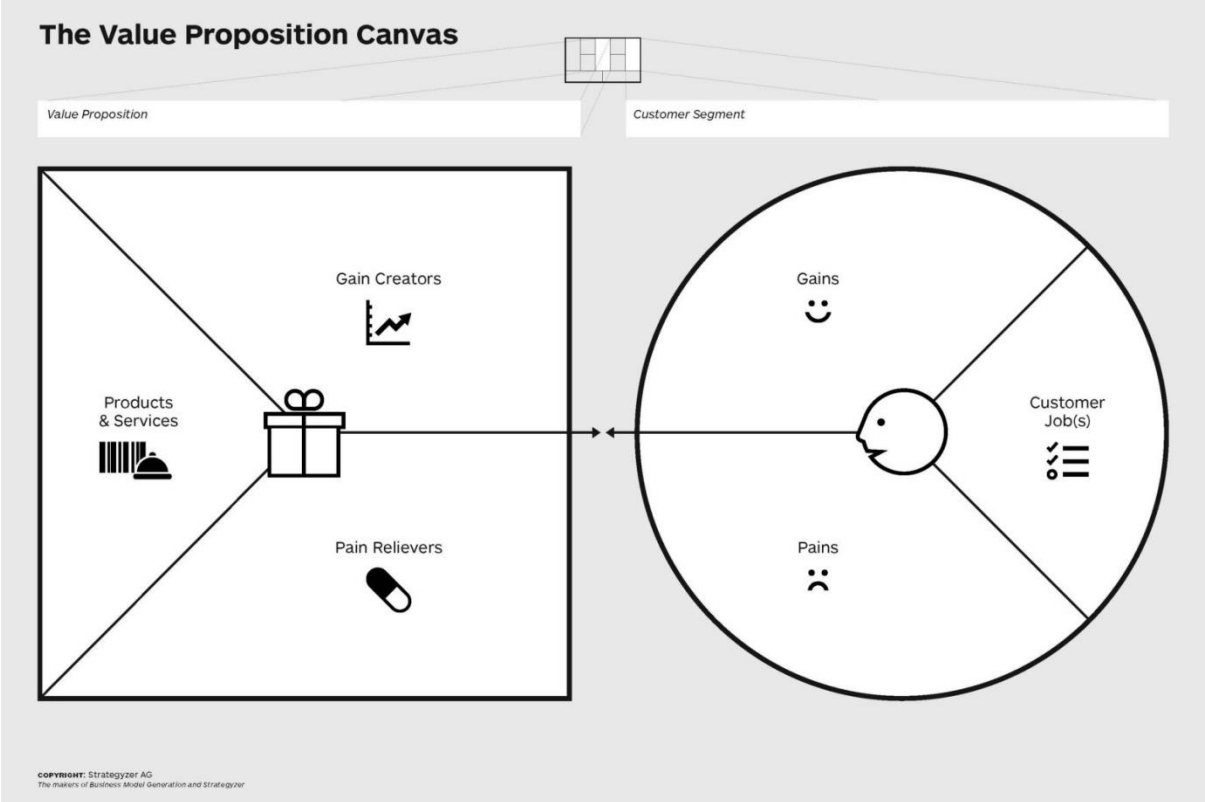

Figure 27: Value Proposition Canvas
(https://assets.strategyzer.com/assets/resources/the-value-proposition-canvas.pdf)

You achieve 'Fit' when your value map meets your customer profile – when your products and services produce pain relievers and gain creators that match one or more of the jobs, pains and gains

that are important to your customer. Fit between what a company offers and what customers want is the number one requirement of a successful value proposition. Fit happens in three stages:

1. When you identify relevant customer jobs, pains and gains you believe you can address with your value proposition (*problem-solution fit*);
2. When customers react positively to your value proposition and it gets traction in the market (*product-market fit*);
3. When you find a business model that is scalable and profitable (*business model fit*).

Value propositions in **business-to-business (B2B)** transactions typically involve several customer segments in the search, evaluation, purchase and use of a product or service. Each one has a different profile, with different jobs, pains and gains (Osterwalder *et al.* 2014):

- Influencers – individuals or groups whose opinions might count and whom the decision maker might listen to, even in an informal way;
- Recommenders – the people carrying out the search and evaluation process and who make a formal recommendation for or against a purchase;
- Economic buyers – the individual or group who controls the budget and makes the actual purchase. Their concerns are typically about financial performance and budgetary efficiency;
- Decision makers – the person or group ultimately responsible for the choice of a product/service and for ordering the purchase decision;
- End users – the ultimate beneficiaries of a product or service. End users may be passive or active, depending on how much say they have in the decision making and purchase process;
- Saboteurs – the people and groups who can obstruct or derail the process of searching, evaluating and purchasing a product or service.

While decision makers typically sit inside the customer's organization, infleuncers, recommenders, economic buyers, end users and saboteurs can sit either inside or outside. Once the most important stakeholders have been identified, a Value Proposition Canvas needs to be sketched out for each one of them. Value propositions for **business-to-consumer (B2C)** transactions may also involve several stakeholders in the search, evaluation, purchase and use of a product or service. For example, consider a family that intends to buy a games console. It therefore makes sense to sketch out a different Value Proposition Canvas for each stakeholder (Osterwalder *et al.* 2014).

A critique of the Value Proposition Canvas is that the product proposition side isn't grounded enough in marketing, branding and persuasion techniques – it doesn't guide the user towards creative thinking and honest self-evaluation, while the customer side isn't grounded enough in behavioural psychology or customer behaviour research – it doesn't guide the user into deep empathy for their customers or draw out enough new insights. An alternative canvas has been proposed which draws on behavioural economics and choice psychology, and contains questions and sections that manoeuvre users of the canvas into thinking through the end user experience (Thomson 2013; Figure 28). The product section of the canvas uses the widely accepted marketing syntax of features and benefits, with the addition of a box for 'experience':

- **Features** – A feature is a factual description of how your product works. The features are the functioning attributes of your product. The features also provide the 'reasons to believe'. For technology products and innovative new services; the features on offer are an important part of your value proposition.
- **Benefits** – A benefit is what your product does for the customer. The benefits are the ways that the features make your customer's life easier by increasing their pleasure or decreasing their pain. The benefits of your product are the core of your value proposition. The best way to list out the benefits of your product on the canvas is to imagine all the ways that your product makes your customer's life better.
- **Experience** – The product experience is the way that owning your product makes the customer feel. It is the sum total of the combined features and benefits. Product experience is different to features and benefits because it is more about the emotional reasons why people buy your product and what it means for them in their own lives. The product experience is the kernel that will help identify the market positioning and brand essence that is usually built out of the value proposition.

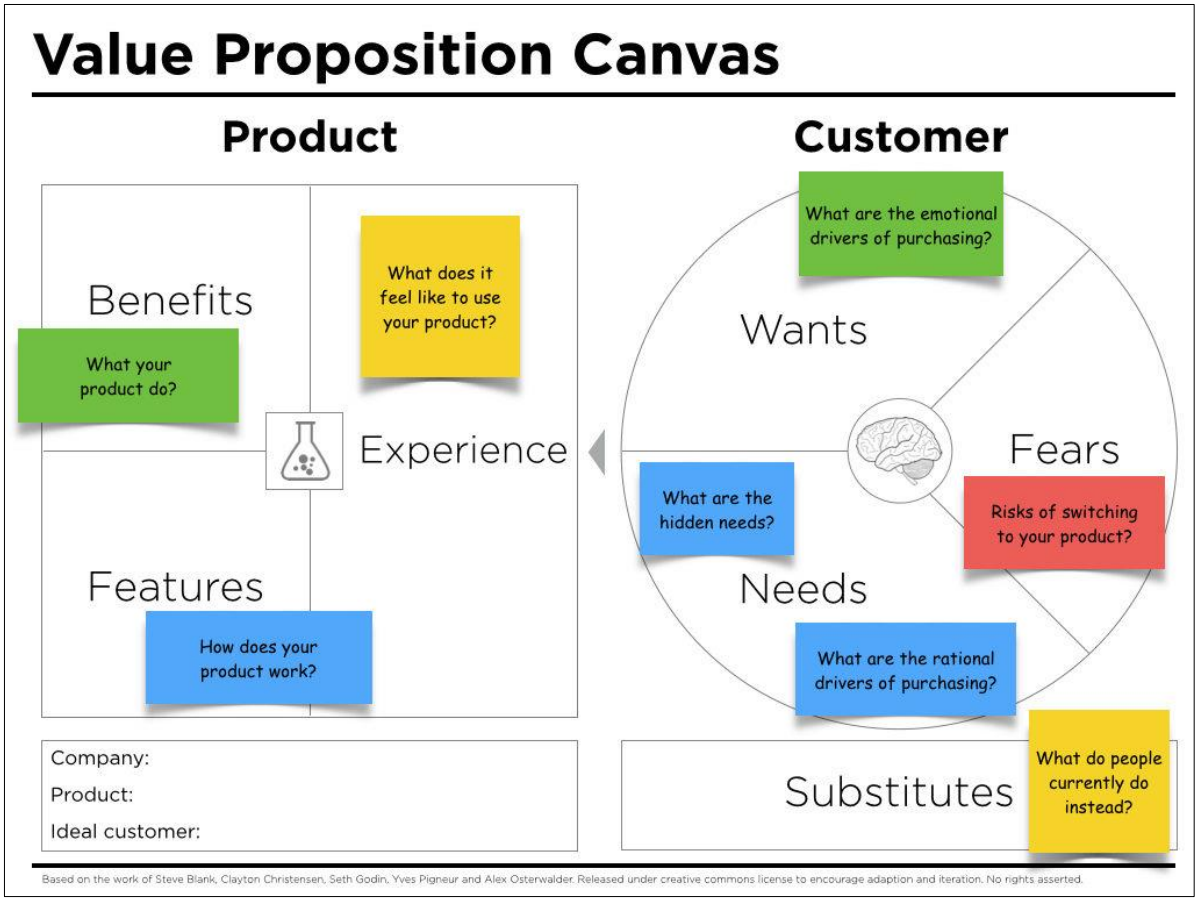

Figure 28: Value Proposition Canvas (Thomson 2013)

The customer section draws on neuro-lingusitic programming and psychology research into motivation and choice architecture. It focuses less on 'pains' and 'gains' because people can be motivated by both pains and gains in different ways. The customer empathy sections include:

- **Wants** – The emotional drivers of decision making are things that we want to be, do or have. Our wants are usually conscious (but aspirational) thoughts about how we would like to improve our lives. They sometimes seem like daydreams but they can be powerful motivators of action. The wants speak more to the pull of our hearts and our emotions.

- **Needs** – The customer's needs are the rational things that the customer needs to get done. Interestingly, needs are not always conscious. Customers can have needs that they may not know about yet. Designers call these 'latent needs'. The needs speak more to the pull of our heads and rational motivations.

- **Fears** – The dark side of making a decision is that it often carries a fear of giving up optionality: fear of making a mistake, fear of missing out, fear of loss, and dozens of other related fears. Fears can be a strong driver of purchasing behaviour and can be the hidden source of wants and needs. Customer fears are often the secret reason that no one is buying your widget. For any product there is a secret 'pain of switching'. Even if your product is better than that of the competition, it might not be a big enough improvement to overcome the inertia of the status quo.

- **Substitutes** – Some companies claim that they have no direct competitors. The substitutes on the canvas aren't just the obvious competitors; instead look for the existing behaviours and coping mechanisms. This is on the canvas because it shocks us into remembering that our customers are real people with daily lives who have made it this far in life without our product. No matter how much better your product is than that of the competition, if it isn't better than the existing solutions then you don't have a real-world value proposition.

As an example, Evernote's value proposition (Figure 29) is translated directly into their marketing materials. Evernote uses multiple landing pages to account for different products and different audiences, so that the features, benefits and experience of the product are carefully matched with the wants, needs and fears of their target audience (Thomson 2013).

5.4.4 Ethos, pathos, logos – powerful components for social media

As social media has become prevalent in most activities of daily life, social media services and their online information have generated substantial impacts on individuals and businesses. It has been determined that the information communicated in online platforms has a strong impact. As a result, it is important to understand how the online information could be influential in stimulating, persuading and inspiring people. Aristotle's appeals compose a proper framework to analyse the persuasive influence of information. According to Aristotle's appeals, interpersonal messages can be persuasive and powerful through the following three components: ethos, pathos and logos (Figure 30).

- **Ethos** is an ethical appeal that includes all of the proofs of the message sender's authority and credibility;
- **Pathos** is an emotional appeal to the recipient;
- **Logos** is a rational appeal to the recipients.

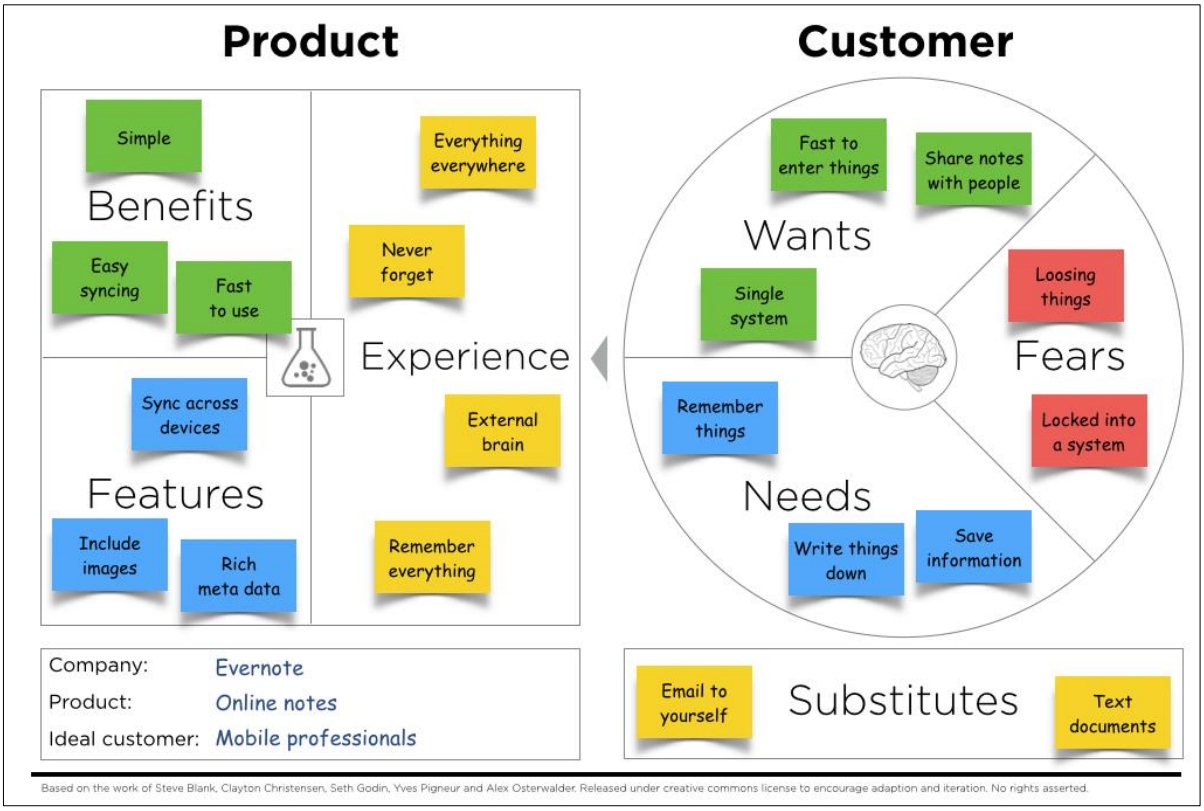

Figure 29: Example of a completed Value Proposition Canvas (Thomson 2013)

Figure 30: Ethos, pathos, and logos: facts, figures and examples are used to influence the recipients' perceptions of the messages as reasonable (http://sachighmedia.com/visual/wp-content/uploads/2012/04/04-ethospathoslogos.jpg)

5.4.5 Elaboration Likelihood Model – variables that may affect persuasion

There are two basic routes to persuasion: central, which is based on the thoughtful consideration of arguments essential to the issue; and peripheral, which is based on the simple associations. In this context, the Elaboration Likelihood Model (ELM) is useful because it attempts to identify variables that may affect persuasion. When conditions foster people's motivation and ability to engage in issue-relevant thinking, the elaboration likelihood is said to be high. This means that people are likely to attempt to access relevant associations, images, and experiences from memory. When elaboration likelihood is low, on the other hand, people will either ignore advertisements or will daydream during exposure to the advertisement, such that acceptance or rejection of the appeal is not based on careful consideration of issue-relevant information, but rather it is based on the issue or object being associated with positive or negative cues (e.g., the more arguments for a recommendation, the better it must be) (Cacioppo & Petty 1984). This means that enhancing involvement led to a significant improvement in brand name recall, but increasing involvement led to a decrement in attitude toward the brand when the arguments presented were weak. The general neglect of the information contained in a message is probably the most serious problem in persuasion. Petty et al. (1983) are convinced that the persuasiveness can be increased much more easily and dramatically by paying careful attention to its content than by manipulation of credibility and attractiveness (Figure 31).

Figure 31: The role of the colours for advertising
(https://iconvisual.com.au/about-us/news/the-psychology-of-colour-in-branding)

5.5 Pricing

Pricing means setting prices for the goods, products, services or experiences that a seller is offering. In setting a price the seller must consider the prices at which they can aquire the necessary resources, the manufacturing and distribution costs, as well as the market place, competition, market condition, brand and quality of the product. An efficient price is one that is very close to a maximum that customers are prepared to pay. Price should not be mixed with cost. Cost is the expense incurred for a good, product, service or experience (an offering) being sold by a seller (e.g. the costs of raw materials and energy needed for manufacturing, labour, equipment). The amount of costs that are needed to provide an offering have a direct impact on both the price of the offering and the profit earned from its sale.

Enrolment of experience in the economy enables better pricing of what the seller offers (Figure 32); however, setting a price for experience is more complex than pricing a product or service. There is no formula for pricing experience, because experience is unique and consequently the pricing is unique too. However, there are some guidelines of how to set a price for experiences (AirBnB 2018):

- **Defining the target audience**: a seller needs to come up with a personality of a perfect customer (characteristics, work, interests, budget)
- **Levelling up for success:** after initial promotional offerings the seller can increase the prices gradually according to a good response/review of previous customers
- **Supply and demand adjustment:** when the demand is higher (e.g. different seasons or days of the week) the prices can be higher
- **Summing up total costs to run the experience:** time to prepare, transportation costs, licenses, permits, materials, supplies, tools, venue costs, etc. Reviewing total costs also helps to consider unnecessary costs and to optimize the price
- **Feedback from guests:** it is needed not only regarding the experience but also about the price. If the guests are prepared to pay more than initial price, then the price is set well. It is important to exceed guests' expectations
- **Comparison with similar experiences:** first similar activities have to be defined – what else the guests are looking for and then to find out how much are they willing to pay for it

Figure 32: Increasing differentiation and enrolment of services and experience increases pricing

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6. FUNDING A START-UP

6.1 Introduction

Raising funding for your start-up is one of the first hurdles that a new entrepreneur may face. However, some start-ups don't need external funding if the product can be launched and generate revenue quickly, with limited sales and marketing costs. For example, if you decided to start a consulting company, your initial start-up needs would be limited: a computer, an office space, and an internet connection. Even if it takes you a few months to get your first customers, your needs should be covered by your savings. On the other hand, you may have an idea that will take you three or four years to develop into a real product, in which case you would need external funding. This is the case for most research and development intensive projects, and the questions to ask are when and from which sources to secure the cash needed to build your company. Alternatively you may, in theory, be able to fund the start-up yourself, but might consider getting external funding to drive further growth. An example could be a start-up where the upfront development cost is relatively low, such as developing a simple consumer-oriented smartphone app. The revenue model for most consumer apps is that the basic app is low priced or completely free. For your start-up to succeed you need lots of downloads and a premium version for converting some of the downloads into paying users. You therefore have two choices: either you continue on a small scale, using word of mouth, social media marketing and funding it all yourself, in which case you run the risk of your market position being overtaken by aggressive, well-funded competitors, or you seek external funding to scale your business (Nielsen 2017).

6.2 Sources of finance

According to the *EU Startup Monitor Report*, the vast majority of start-up founders use private capital to fund their operation, either in the form of their own savings (77.8%) or that of their family and friends (30.2%) (Steigertahl *et al.* 2018). The main external sources of finance are business angels, venture capital firms, start-up incubators or accelerators, public funds, crowd funding, and bank loans. Most start-ups will seek funding from different sources at different times during their evolution of their company (see van Blitterswijk *et al.* 2019 for case studies of European start-ups in different industries). To maximise the chances of your fundraising process being successful you need to understand how different types of investors and other funding sources like banks think in terms of the risk/reward profile of the investment opportunity you present to them. Start-ups have very different risk profiles and also different levels of reward if they are successful. The risk/reward profile of a start-up is best illustrated using the investor matrix model (Figure 33) which is a simple tool that investors subconsciously use when evaluating investment opportunities. Any start-up can be placed somewhere on the matrix, showing high or low return and high or low risk (Nielsen 2017):

- **Low risk/low reward**: an example would be an e-commerce website. The risk is low because you aren't inventing a new product and investing millions of euros into research and development – you are just distributing a product from another manufacturer. The rewards for the investor would also be low, since consumers will compare prices across different online retailers, and this normally results in relatively low margins and a limited market size.

- **High risk/high reward**: an example would be a biotech company developing a vaccine. If the start-up succeeds they would have a product worth billions of euros. But it would cost millions of euros in development, and the chances of commercial success are typically less than one percent.

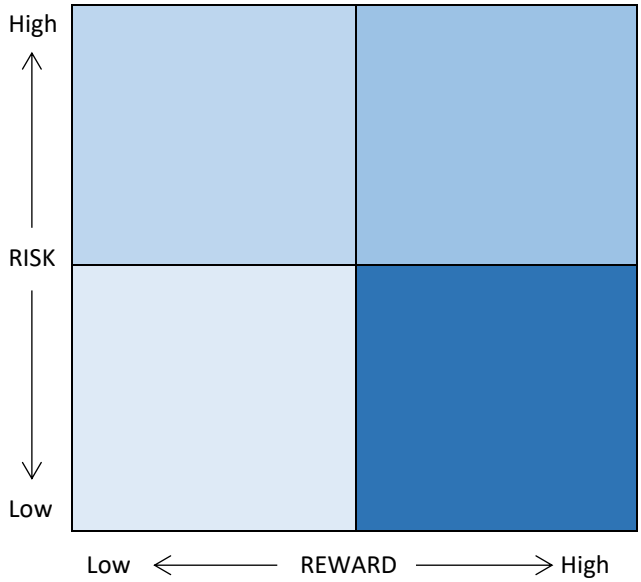

Figure 33: The investor matrix model (after Nielsen 2017)

The risk/reward profile of your start-up is determined by four key factors (Nielsen 2017):

1. **Your market**: the industry you are in and the product you will make or the service you will provide are key to determining your start-up's risk/reward profile. Some industries have a higher risk of failure than others, but at the same time a higher financial outcome if successful. Different industries therefore attract different types of investors. Consulting services and physical retail shops are low risk, while consumer apps/software and most technology-based university inventions are high risk.

2. **Your business model**: you can develop different business models that significantly affect the risk/reward levels, as well as use different business models to attract different types of investors. For example, a consultancy service is low risk/low reward, since the business model doesn't involve putting any money into physical stock or upfront development work, but the company's income is limited because it is directly linked to the number of hours it invoices. A start-up making and selling a product, on the other hand, is high risk/high reward. It is likely to require months or years of development work before it gets its first customer, but the potential for the company to own the rights to a product means that the potential reward is much greater. Your own appetite for risk versus reward is the key factor in determining which business model is best for you.

3. **You and your team**: the strength and quality of your team has a huge impact on the perceived risk and reward in the mind of the investor. So before approaching investors you have to gather as strong a team as possible.

4. **Your progress/traction**: in other words, how far along you are in the process. Most start-ups are high risk/low reward at the ideas stage, but progress (or traction) can move it into a different quadrant of the investor matrix. Results from real products/users beat every type of forecast. The main reason that entrepreneurs are not able to attract investors is not because of 'bad' ideas, but because they contact investors too early in the project when the risk is much higher than the perceived rewards.

Your risk/reward profile determines what type of investor will invest and when. Many entrepreneurs make the mistake of thinking that all investors are looking for high risk/return start-ups, but there are just as many financing options available for low risk/low reward start-ups. Different types of investors can be placed in the investor matrix according to the risk/reward projects they are normally interested in (Figure 34).

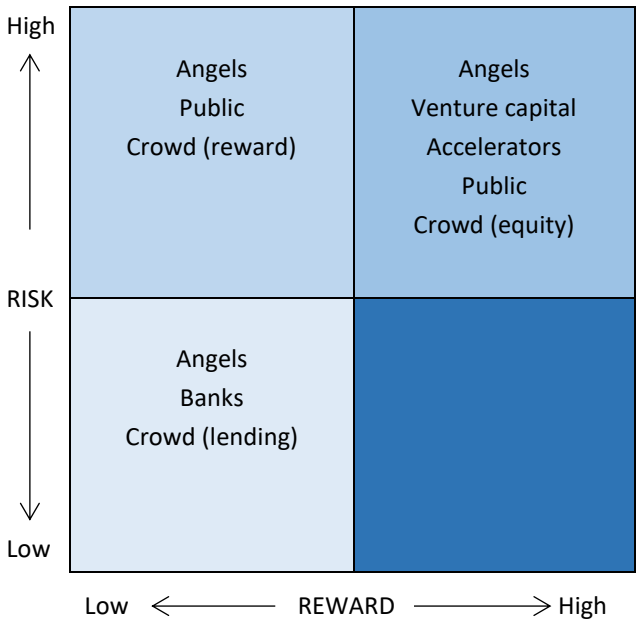

Figure 34: The risk/reward strategies of different investors (after Nielsen 2017)

6.2.1 Business angels

Business angels (or angel investors) are wealthy individuals who provide initial funding to a start-up in return for equity, either on their own or as part of an angel network or syndicate. In addition, they may also provide valuable experience and guidance. Some angels specialize in specific sectors, such as fintech and digital start-ups, while others have a more diversified portfolio. For example, Riku Asikainen, who has invested in more than thirty Finnish and international companies, targets health care, industrial production, and food security. Morten Lund is a Copenhagen-based serial entrepreneur, who has invested in more than 115 high-tech start-ups in the last 15 years, including Skype. Christian Vollman is another serial entrepreneur and one of the most active angel investors in Germany, and also an advisor on start-up policy to the German Minister of Economics (Trajvovska 2017). While business angels are typically the first investors in start-ups, they still want to see some traction before they invest. This doesn't need to be real revenue, but ideally means that the company has already gathered a talented team which has built the first beta product. The reason why business angels are willing to take higher risks than other types of investors by investing earlier

in the processes can be explained by looking at the reasons they get involved in start-ups (Nielsen 2017):

- **For their own benefit**: to make money, have fun, be involved in something interesting, be entrepreneurial;
- **For the benefit of the world**: locally or globally, they want to get involved in something that has an impact, for example in education, health or the environment;
- **For your benefit**: they may remember how difficult it was when they started out, and they want to help you.

Because getting rich is rarely the main motivation, business angels invest in start-ups that are perceived to be low risk/low reward, high risk/low reward, and high risk/high reward. There are three types of business angel (Nielsen 2017):

- **Business angel networks**: some business angels prefer to invest in collaboration with other angels. The networks are made up of a broad range of people – typically senior executives, lawyers, accountants, bankers, entrepreneurs – who are likely to be looking for a good financial return of typically at least three to five times the money they invest in the start-up. One angel often acts as lead and is very active, while the other investors are more passive. The investment size varies, but it typically ranges from €100,000 to €500,000, invested by between 2 and 5 angels. To locate a business angel network, go to the website of the European Trade Association for Business Angels, Seed Funds and Early Stage Market Players and search for members in your home country.

- **Super angels**: these are high net worth individuals who have typically earned their money via their own ventures and decided to invest a significant portion of their proceeds in new start-ups. They often invest in the same industries in which they made their own money, and play an active role in using their own network and personal brand to help make the start-up a success. The investment size varies, but it typically ranges from €100,000 to €250,000.

- **New angels**: these are people who don't perceive themselves as business angels, and are therefore not members of business angel networks or other trade associations. Their role is normally passive, but they may want to be involved on an ad hoc basis. Unlike members of business angel networks who typically have invested in between five and ten companies, new angels may have only invested in one or two. In most cases they invest smaller sums than the other types of angel, typically less than €50,000. You can normally find new angels via your extended personal network. LinkedIn is a good starting point: look up people you know either directly or with mutual friends, who you know have money to invest (based on their corporate career and/or own companies) and who you believe are interested in entrepreneurship (they have started or invested in other companies). There are more new angels than there are members of business angel networks.

Personal trust is one of the most important factors which determines whether a business angel wants to invest. Angels that you know already, or who know the industry, will be more comfortable analysing the risk/reward of your start-up. This is exemplified by Springworks Farm which in 2018 received $1.6 million from a business angel network to finance the expansion of their aquaponic system in Maine, USA. This was the second round of funds that the start-up has received since its

inception in 2014. The network was made up of about 20 investors from across the country, many of whom had learned of the farm through summer visits to the area. Springworks Farm produces organic lettuce which is sold to wholesale customers who then supply restaurants and grocery stores across New England. Since 97% of the lettuce produced in the USA is grown in the southwest, in Arizona and southern California, the business model of Springworks Farm is focused on making the supply chain more efficient, by providing a year-round source of fresh, local produce. The farm employs 25 people and grows 1 million heads of lettuce a year.

A number of aquaponic start-ups in Europe have managed to attract angel funding, including UrbanFarmers, Building Integrated GreenHouses and Myfood.

6.2.2 Venture capital

A venture capital (VC) fund is an investment fund made up of contributions from wealthy individuals or companies, who give their money to a VC firm to mange their investment portfolio for them and to invest in high-risk start-ups in exchange for equity. They are looking for extremely high rewards, and are typically looking to invest in companies that can be resold for hundreds of millions of euros within a few years, but they are also willing to take high risks. In return for their investment, the VC funds will typically want a stake in the company of between 20% and 30% (Nielsen 2017). As part of the investment contract, many investors will also have additional requirements. For example, they may want to sit on the board of directors or be involved in certain recruitment practices. Besides investments, VC firms can also provide support services, such as in-house marketing, and legal, technical and recruitment teams. Often experienced entrepreneurs themselves, investors or partners in venture capital funds should have a wealth of contacts that your business should be able to tap into, as well as much needed insight into international markets, potential new clients and even exit opportunities (Donnelly n.d.).

Very few start-ups fit the criteria for venture capital investment. VCs are only interested in investments that can grow at least 10-fold in value in just a few years, so a new start-up has to be able to demonstrate that it will be able to gain a large market share, by offering a product or service that is revolutionary and scalable. Businesses that allow a company to grow fast are typically characterised by a high degree of automation, such as software, while those that are difficult to scale tend to be human or capital asset intensive, such as consulting companies or restaurants. In addition, the market that the start-up operates in needs to be large enough to allow a highly valuable company to grow quickly. Most VC funds specialise in investments in start-ups at specific stages of development (Nielsen 2017):

- **Seed round**: many start-ups get angel funding to go and build their product, and then use seed round funding to fine-tune their business model and find experienced business partners. Investments are typically in the range of €1 to €2 million.
- **Series A**: at this stage the start-up will have a working product, customers and real revenue, but needs investment to demonstrate that it can be scaled up. The capital is typically used for sales and marketing. Investments are in the range of €2 to €10 million, but differ significantly from company to company.

- **Series B**: at this stage the company needs to demonstrate that it can become the (global) market leader. Investments are typically greater than €10 million.

A handful of aquaponic start-ups in Europe have managed to attract venture capital funds. For example, Myfood raised €1.8 million in a seed round, GrowUp Urban Farms received €1.3 million of Series A funding, and Aquaponic Management Project Group raised €4.5 million of Series B funds.

6.2.3 Incubators and accelerators

Start-up founders looking to start off on the right foot often turn to a start-up accelerator or start-up incubator for help, since they both offer entrepreneurs good opportunities early on. Founders get help to quickly grow their business and they often improve their chances of attracting a top business angel or venture capital firm to invest in their start-up at a later point (Forrest 2018). The terms 'accelerator' and 'incubator' are often assumed to represent the same thing. However, there are a few key distinctions that first-time founders should be aware of if they are planning on signing up. The programs are different frameworks for start-up success:

- **Accelerators** 'accelerate' growth of an existing company
- **Incubators** 'incubate' disruptive ideas with the hope of building out a business model and company

So, accelerators focus on scaling a business while incubators are often more focused on innovation. While both types of programs were popularized in start-up hubs like Silicon Valley, nowadays they can be found all over the world, and although many people associate these programs with tech start-ups, most of them accept companies from a wide range of sectors (Forrest 2018). One of the big differences between accelerators and incubators is in how the individual programs are structured:

- **Accelerator programs** usually have a set timeframe in which individual companies spend anywhere from a few weeks to a few months working with a group of mentors to build out their business. Y Combinator, Techstars, and the Brandery are some of the most well-known accelerators. Accelerators go for high risk/high reward start-ups, and look for candidates that can become big very fast, so most opt for technology-based start-ups. Accelerators start with an application process, but the top companies are typically very selective. Y Combinator accepts about 2% of the applications it receives, while Techstars usually has to fill its 10 spots from around 1000 applications. Early stage companies are typically given a small seed investment (€10 to €25,000), and access to a large mentorship network, in exchange for a small amount of equity (3% to 8%). The mentor network, which is typically composed of start-up executives, venture capitalists, industry experts, and other outside investors, is often the biggest value for prospective companies. Some accelerators offer a co-working space, but most provide companies with private office space or let them find it on their own. Besides Techstars, the most renowned accelerator programmes in the EU are Startupbootcamp, Seedcamp, 500 Startups, MassChallenge and Accelerace (Forrest 2018; Nielsen 2017).
- **Start-up incubators** begin with companies (or even single entrepreneurs) that may be earlier in the process and they do not operate on a set schedule. While there are some independent incubators, they can also be sponsored or run by venture capital firms, angel investors, government entities, and major corporations, among others. Some incubators have an application process, but others only work with companies and ideas that they come in

contact with through trusted partners. A good example of an incubator is Idealab. Depending on the sponsoring party, an incubator can be focused on a specific market. For example, an incubator sponsored by a hospital may only be looking for health technology start-ups. In most cases, start-ups accepted into incubator programs relocate to a specific geographic area to work with other companies in the incubator. Within the incubator, a company will refine its idea, build out its business model, work on product-market fit, identify intellectual property issues, and network in the start-up ecosystem. A typical incubator has shared space in a co-working environment, a month-to-month lease program, additional mentoring, and some connection to the local community (Forrest 2018).

In addition to the international start-up incubators and accelerators mentioned above, most countries have their own programmes, and a number of aquaponic start-ups have received investment from these. For example, Orthoponics[4], a supplier of automated systems in Italy, was funded by Italian-based Startupbootcamp FoodTech and FabriQ, while UrbanFarmers received funding from Swiss-based Venture Kick and Impact Hub Fellowship.

6.2.4 Public funding

Many start-up projects generate value for society, and public bodies – such as the EU as well as national, regional and local government bodies – want to provide financial support to start-ups in their various forms, since they recognise the gap between where a start-up hits huge costs and where a private investor will want to invest, and realise that even a failed start-up project might generate value for society in the form of innovation and knowledge. Public funding programmes change over time, since they are political projects, and therefore reflect the comings and goings of politicians and political agendas. Aside from EU funds, most are created and managed by a local municipality or local government agency, and are focused on developing specific solutions for problems relating to that region. There are three types of programme (Nielsen 2017):

- **Secure loans**: this may either be a bank loan that is partially guaranteed by the government, or a loan from the government itself. The main downside with government-backed loans is that the entrepreneur is liable for some, or all, of the amount.
- **Equity investment**: governments across the EU, and the EU itself, put public money into different investment funds in order to stimulate equity investment in start-ups. Some of the funds act, more or less, like VC funds, and are therefore looking for the next big thing and are willing to take high risks. Others are more focused on providing funding for specific industries or regions where they have identified a funding gap in the private market. In Denmark, for example, the Ministry of Higher Education and Sciences appointed a number of innovation centres such as CapNova which screen and invest on their behalf. The main downside with equity investment is that the fund has 20% to 40% ownership of the start-up, in a classic venture capital style deal.

- **Grants and co-financing**: grants are provided to help a government meet a specific societal or socio-economic goal, such as creating jobs in certain industries, or advancing clean

[4] Orthoponics went out of business in 2018, just one year after it had been founded and received accelerator/incubator funding

environment projects. A start-up needs to convince the funding body that it can help them achieve their goals, and also that it cannot continue to operate without the grant. For most public grants, the percentage of cost covered is between 50% and 75%, so supplementary funding will need to be found from other sources, which will need to be disclosed at the time of applying for the grant.

The European Institute of Innovation and Technology (EIT), an independent EU body created by the European Union in 2008 to strengthen Europe's ability to innovate, has established two Knowledge and Innovation Communities (KICs) that are relevant to aquaponics start-ups. EIT Climate focuses on cities, sustainable production systems, and sustainable land use. Their 'Accelerator' business incubation programme provides structure and assistance to start-ups over an 18-month program in the form of coaching, mentoring, technology validation and office space in 21 locations and 14 EU countries. Selected start-ups benefit from up to €95,000 in seed funding, exposure to customers, partners and investors, and access to an extensive relevant international network. Berlin-based ECF Farm Systems, which designs, constructs and operates commercial-scale aquaponic farm systems, and GrowUp Urban Farms, which ran a commercial aquaponic farm in London, both benefited from support from EIT Climate-KIC.

EIT Food is Europe's leading food innovation initiative, working to make the food system more sustainable, healthy and trusted. Their 'Seedbed Incubator' programme supports aspiring entrepreneurs to determine whether there is a market for their products or services, by providing training and mentorship in order to help them better understand the needs of their customers and validate their business model. Funding of up to €10,000 is provided, and at the end of the programme the participants pitch their idea to a panel of industry experts for the chance to secure up to €20,000 follow-on funding to help bring their product to market. The 'EIT Food Accelerator Network' programme is for early-stage agrifood start-ups who would benefit from support to boost their new business. Successful applicants receive mentoring and training over a four month period. At the end of the accelerator there is a final round of judging and the three best start-ups from all five locations are awarded financial prizes of up to €100,000 each[5]. Aquaponics Iberia, a consulting service and developed of modular systems, received funding from EIT Food in 2019.

6.2.5 Crowdfunding

Crowdfunding is a very broad term used to describe projects, companies and causes that are financed by many small 'donors' instead of a few large ones. Members of the public pool their resources to help you hit your fundraising target, investing anything from €10 each either in exchange for equity or for rewards. Crowdfunding is carried out online, mostly using a platform such as Kickstarter or Indiegogo which acts as an intermediary between the funder and the entrepreneur. The platform receives a percentage of the funding in return for hosting and marketing the campaign. Crowdfunding could be a lifeline for start-ups because it bridges the early stage funding gap of the

[5] The EIT is an integral part of the Horizon 2020 research and innovation programme (2014-2020). While EIT Climate and EIT Food will continue to operate under the Horizon Europe research and innovation programme (2021-2027), the exact details of their start-up funding and mentoring schemes may change.

company, when the project is considered too risky for professional investors and bankers. It attracts different investors at different times depending on the crowdfunding model (Nielsen 2017):

- **Reward crowdfunding**: the 'crowd' pays you up front for the product or service you intend to provide. Individuals take a risk on unproven products because they feel some kind of affinity with the company; in exchange they receive a discount or another non-financial reward. Typical donations are between €10 and €100 per backer per project, and the amounts raised vary significantly from project to project. The most successful reward-based campaigns raise €5000 to €50,000 from hundreds of backers. Reward crowdfunders normally invest quickly and for personal reasons, which means they will invest earlier than most professional investors. But they need something to get excited about, so at least a semi-functional prototype of a product is usually required. For most start-ups the market validation provided by a reward-based campaign is of more importance than the funds themselves, and many crowdfunding campaigns are in fact partly or wholly marketing stunts designed to use the PR from the campaign to generate interest from potential partners and distributors. Reward-based crowdfunding is high risk/low reward. It is harder to run a successful campaign for products and services aimed at business customers (B2B) than it is for consumer products (B2C).

- **Equity crowdfunding**: this attracts slightly higher investments in the hope of a large financial reward, with the risk of failure being offset by potentially having shares in 'the next big thing', so success is more likely after the first professional investment funding rounds. The size of the funding goal varies between the crowdfunding platforms, and sometimes between projects on the same platform, and the most successful campaigns are in the range of €50,000 to €500,000 from hundreds of investors. The largest equity crowdfunding platforms in Europe are Seedrs, CrowdCube, SyndicateRoom, FundedByMe and Invesdor. Most of the start-ups that use equity crowdfunding have already developed their first product and in many cases have customers and revenue to show. However, unlike reward-based crowdfunding, which gives a clear indication of public demand for your product or service, equity crowdfunding won't reassure professional investors in the same way, since they know that most of the funding comes from investors who are not experts and have not carried out due diligence on your business. Equity crowdfunding is high risk/high reward. B2B start-ups are harder to fund than B2C, though not impossible, since equity crowdfunding does attract some professional investors.

- **Crowdlending**: investors receive interest on the money lent, but play no part in the profits when the start-up succeeds. This is best considered even later in the evolution of the start-up, since most crowdlending platforms won't even accept a campaign unless the company has a stable cashflow. This traction is needed because the money is provided as a loan, similar to one from a bank, so the funders have no financial upside besides interest. For example, Funding Circle requires companies to have more than two years of filed accounts, and an annual turnover of at least €50,000. The amount raised varies from company to company, but is typically between €50,000 and €500,000 spread among hundreds of different investors. The level of interest varies, depending on the perceived risk. Besides FundingCircle, the leading crowdlending platforms in Europe are Zopa and October.

Crowdlending is low risk/low reward. Not having a B2C business is not a disadvantage, since many platforms and their lenders like B2B projects since it is often easier to evaluate their risk and potential, unlike a product that claims to be the next SnapChat.

A number of aquaponics start-ups in Europe have used the reward crowdfunding model. Aquapioneers ran a very successful campaign on Ulule, a community-backed incubator of positive impact projects, to raise funds to develop their open source digitally printed home aquaponic system. The two most popular rewards were a link to download the design files and an instruction manual for operating the aquaponic system, and a donation to enable a pilot system to be built at a school in Barcelona, both priced at only €39. The campaign therefore appealed to people who were excited enough by the product to be prepared to pay for the open source files before they became freely available, and people who were inspired by the social benefits of the product. Social enterprise Smart Greens UK achieved their target using the Crowdfunder UK platform in order to fund a programme to provide fresh local produce and to introduce aquaponics to schools, while GrowUp used the Kickstarter platform to raise the funds needed to turn a car park in central London into an urban aquaponic farm using a specially modified shipping container and greenhouse. On the other hand, WeGrow was unsuccessful in its pledge to raise the funds needed to produce domestic aquaponic systems and provide training.

6.2.6 Banks

Unlike other funding sources, banks don't provide equity but instead lend money to start-ups in return for interest. With only a very low reward potential (interest rate), they are only prepared to take very low risks, and because of this banks turn down the vast majority of entrepreneurs who request funding for their start-up project. If your start-up turns out to be a huge success, the bank does not reap any of the financial benefits. If your start-up goes bankrupt, on the other hand, the bank may end up with shares in the company as part of the liquidation process, but they don't want to own companies, unless they are forced to. Most start-ups have very limited assets that can be sold, since they often spend the loan on either R&D or sales and marketing, where the 'scrap value' of such assets is close to zero. And early-stage start-ups are inherently high risk, since they have yet to prove themselves. There are, however, instances where it is possible to get a start-up loan from a bank (Nielsen 2017):

- **Your start-up has physical assets**: while banks will still consider them high risk, the assets make a risk evaluation feasible;
- **You only want a few thousand euros**: if you have a good credit history and have been a good customer, most banks will provide some kind of credit, for which you will be personally liable;
- **You have personal assets**: a house or a car can be put up as collateral against a loan;
- **You have an established business**: if you can show that you have customers that are paying your invoices, you can get a credit line for liquidity.

6.2.7 Summary

Knowing which kinds of companies different investors are looking for, and when in the process they are interested in investing, will greatly increase your chances of conducting a successful fundraising

campaign by approaching the right investors at the right time. It is important to remember that investors don't invest in ideas; they know that what separates a successful start-up from a potential failure is the hard work done by the team in the years following the initial idea. Investors evaluate the risk/reward profile of your start-up in three areas, and when you start your project, all three types of risk are high, since you have yet to prove anything (Nielsen 2017):

1. **Market risk**: many start-ups go under because there isn't a real demand for their products or services. So, the initial analysis by investors is often centred around the following questions: is there a real demand, will enough people pay for it, and how much will they be willing to pay for it? The archetype for a start-up with a high market risk could be a company that wants to develop apps. More than a thousand new apps are launched every day, but very few of them become successful enough to support a small company. Most investors will want to see real customer data before being convinced, and by developing a beta version (a minimum viable product) of the app on a limited budget (financed by yourself or by friends and family), you can demonstrate that there is demand for your product, and thereby increase your chances of getting funding.

2. **Technical risk**: while there might be a market opportunity (demand for your intended product or service), technical challenges could prevent you from taking advantage of that opportunity. A good example is more efficient batteries. Is a start-up able to replicate positive results achieved in a laboratory into a something that can be produced on a huge scale and made commercially available worldwide? Is the technology stable and safe enough? Is it possible to produce the batteries at a cost so low that it will be commercially attractive? While the technical risk in this example is huge, the business opportunity is also huge, so many investors are prepared to take the risk.

3. **Team risk**: while there might be a market opportunity (and low technical risk), there is still the risk that you and your team do not have the skills and experience required to take full advantage of this. Even with start-ups that have high market risk and/or high technology risk, team risk is seen by many investors as the biggest risk factor. You need to find co-founders who complement your competencies in order to achieve initial traction. The set of cores team competencies investors need to see are product development and sales, and start-ups which have a balanced team of both a technical founder and a business founder are more successful in the long term compared with start-ups that either have one or the other.

Before approaching potential investors, a final question to ask yourself is, do you really want their money? Most investors want something in return – a share in your company – which is called **dilution** (your share of the company is diluted by investors). Is going from 100% of a very small cake to, say, 17% of a very large cake worth it? This depends on your specific situation, and what you really want to do with your start-up. Is it more important to you to be in control of your company, even if it is a small one, than to grow into a world-leading company over which you have little control? Will the money really make a tremendous difference to your company, or could you achieve what you want without it? And if do you need external finance, at what point in the process will you need it?

6.2.8 Case studies

Most start-ups will seek funding from different sources at different times during the evolution of their company. The following case studies briefly illustrate the different funding pathways adopted by six aquaponics start-ups in Europe[6] (figure 35).

UrbanFarmers (CH)

Value proposition: Urban-grown fish and vegetables → urban-grown fish and vegetables

Customer segments: B2B → B2C

Funding pathway: UrbanFarmers started off with accelerator/incubator funding from Venture Kick, a private philanthropic initiative that provides pre-seed funding to entrepreneurs from Swiss universities. This was followed by investment by a business angel in the form of a convertible loan[7], accelerator/incubator from Impact Hub Fellowship – a Swiss one-year incubation program designed to enable early stage entrepreneurs to realise their innovations for a sustainable world and, finally, two rounds of venture capital funding.

ECF Farmsystems (DE)

Value proposition: Urban-grown fish and vegetables and farm tours + design and build of turnkey aquaponic farms for third parties

Customer segments: B2B + B2C

Funding pathway: Public funding in the form of an accelerator seed grant from EIT Climate-KIC gave ECF Farmsystems the opportunity to go to Silicon Valley in order to pitch for funding from Cleantech Open, a US accelerator. This was followed by a round of venture capital funding from IBB Beteiligungsgesellschaft which invests in Berlin-based start-ups, and a private secondary transaction[8].

GrowUp Urban Farms (UK)

Customer segments: B2B/B2C

Value proposition: Urban-grown fish and vegetables

Funding pathway: In their first year GrowUp Urban Farms raised funds for their prototype vertical farm from a variety of different sources: accelerator/incubator funding from Imperial Create Lab[9], public funding from EIT Climate-KIC, and a reward-based crowdfunding campaign on Kickstarter. Further public funding from The Agri-Tech Catalyst, a UK innovation fund tackling challenges in agriculture, was followed by Series A venture capital funding from Ignite Social Enterprise[10], an impact investment fund which invested in UK energy-related social enterprises that deliver both commercial and social outcomes focused around low carbon, social mobility and cleantech. Most recently the company received corporate investment from CO2Sense, an ethical investor in low

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6 Information on the funding histories of companies can be garnered from platforms such as Pitchbook and Crunchbase

7 A short-term loan that is converted into equity shares at a later date, which allows the investor to receive a discounted share price based on the company's future valuation

8 When a public company issues new stocks for the first time, it does so in the primary capital market. The proceeds of that sale go directly into the company. The secondary market is where securities are traded after the company has sold its offering on the primary market. The same applies to venture-backed private start-ups where, for example, early founders and employees may sell their share or parts of it to new investors

9 Imperial Create Lab is no longer active

10 In 2017 Ignite became part of a new accelerator, Centrica Innovations

carbon businesses. GrowUp Urban Farms is currently looking to raise investment in order to start a larger, more commercially viable farm.

Figure 35: Funding pathways of some aquaponics start-ups in Europe

Aquaponic Management Project Group (FR)

Value proposition: Urban-grown fish and vegetables

Customer segments: B2B/B2C

Funding pathway: The Paris-based company operates two prototype urban aquaponic farms: 80 m^2 Les Jardins du Saumonier Cherbourg and 200m^2 Les Jardins du Saumonier Asnières, both of which opened in 2018. The fish are sold to distributors as well as online to the public. Two years before the protoype aquaponic farms opened, AMP received corporate funding from fragrance products company L'Occitane to finance Olis Les Jardins du Saumonier Chartres, which will be Europe's largest

aquaponics farm when it opens in 2022, producing 1000 tonnes of trout per year. The project, which is still at the planning stage, is also backed by funding from the Alantra investment bank. A round of Series B VC funding in 2019 included an investment from Koppert Biological Systems – one of the leading providers of Integrated Pest Management products, a food processing cooperative group, and a horticultural cooperative. The total investment in the project is around €12 million. There are two curious things to highlight about AMP's funding pathway: it is very uncommon to receive corporate funding before VC funding, and in order to receive Series B venture capital funding, normally a company needs to demonstrate that it can become the global market leader.

Building Integrated GreenHouses (BE)
Value proposition: Urban-grown fish and vegetables
Customer segments: B2B/B2C
Funding pathway: BIGH was established in 2015 with the aim of creating a network of rooftop urban farms in major European cities. Their first farm – a 2000m^2 aquaponic greenhouse and 2000m^2 of outdoor growing space on top of a food hall in Brussels – opened in 2018 after the company had attracted €4.3 million in a first round of VC funding. The investors included a VC firm that specialise in investing in start-ups in Brussels – finance&invest.brussels – and a Belgian real estate investment company. This was followed by a second round the following year, and an angel investment the year after that. The produce from the greenhouse – tomatoes, aubergines, basil and striped sea bass – is sold to distributors and online to the public.

Myfood (FR)
Value proposition: Automated domestic aquaponic greenhouses
Customer segments: B2C
Funding pathway: Myfood attracted seed round funding from AngelSquare, a venture capital firm that provides seed and series A investments to companies operating in the artificial intelligence and software sectors. Public funding in the form of a grant from the European Commission's Horizon 2020 SME Instrument Start-up and scale-up initiative was followed by investment from a business angel.

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