



Business Innovation Observatory



Design for Innovation

Web-based design services as a new business model in the design world

Case study 15

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Business Innovation Observatory
Contract No 190/PP/ENT/CIP/12/C/N03C01

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Coordination: Directorate-General for Enterprise and Industry, Directorate B “Sustainable Growth and EU 2020”, Unit B3 “Innovation Policy for Growth”.

European Union, February 2014.

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1. Executive summary

Web-based design services are design services offered through the web. As the possibilities of providing services online increases, and e-commerce becomes more entrenched in consumer behaviour, designers are using state-of-the-art online tools to engage with their customers in entirely new ways.

By pairing web-based design services with advanced manufacturing systems (e.g. 3D printing), innovative entrepreneurs have developed business models that allow for manufacturing in a less capital intensive way, lowering total cost of delivery, and offering clients a far higher degree of flexibility, combined with easy to understand user interfaces that are compelling to work with. Web-based design companies play an important role in prototyping and liaising between innovation and marketing of new products. Moreover, distributed or decentralised manufacturing of online designed products can greatly reduce transport movements, while computer-guided manufacturing systems can greatly cut back on manufacturing waste.

Although it is hard to put a number on the market potential for web-based design services, entrepreneurs active in the segment believe it to be very promising. Web-based design can engage demand from any market, as companies currently are already servicing dental specialists, civil engineers, application developers and household consumers. In the area of design, Europe already has an internationally recognised leadership position, with over 400,000 designers generating an annual turnover of more than EUR 45 billion.

The socio-economic impact of web-based design is significant and positively influences future economic growth. As web-based design companies grow and flourish, they generate high-quality jobs in design, technology and sales. Also, four-year long, paid apprenticeships can be observed that introduce school leavers to the web-based design business. Looking at the near future, web-based designers expect a labour-market transformation that places even more emphasis on creative and analytical thinking over repetition and overseeing repetition.

Web-based design services can be expected to benefit the environment, as their online tools and processes dramatically reduce the need for travel related to physical meetings between designers and clients. Also, the use of advanced manufacturing systems greatly reduces the need for transportation and subsequently generates fewer emissions.

The ability of Europe to realise this potential is currently challenged by a limited public awareness and understanding of web-based design and the advantages it can bring, as well as a conservative attitude of European consumers in general towards new products and service offerings.

The drivers and obstacles for the development of web-based design services have been analysed on the basis of five companies within this trend. When asked about the biggest driving factor for web-based design, the founders of the companies all pointed at the market potential of web-based design together with the appeal of working on something that will revolutionise the world of manufacturing and design. Besides obstacles that are typical for beginning business enterprises, such as accessing finance, web-based design companies encounter hurdles that relate to public awareness and conservatism among consumers.

In order to engage the obstacles brought forward, policy recommendations have been formulated. They propose data-driven econometric analysis of the effects of tax holidays and of co-financing and guarantee schemes, and that propose macro-level studies of the relationship between innovation, design and economic performance. Also, recommendations propose harmonisation and standardisation of nationally collected data sets and current and future studies on the topic, to improve comparability of findings. Furthermore, recommendations propose attention for the question as to if and how public policy can help the web-based design segment to increase both public awareness and public understanding of their existence and their advantages. Finally, recommendations propose more attention for the difficulties that SMEs and start-ups encounter in terms of bureaucracy and the complexity of policy schemes aimed to help them, and the positive impact intermediary organisations can have for these companies.



2. Understanding the trend of web-based design services

With the ever-rising possibilities of online service provision and the still-increasing popularity of e-commerce, designers have started to take their services to the web. Using sophisticated online tools, they are reaching out to their customers in new ways that shake up business models and introduce new relationships between designers, producers and consumers.

The companies in this report show that web-based design services can have three distinctive benefits for users:

- Web-based design can significantly speed up concept-to-design processes and design-to-manufacturing processes, as well as the design process in itself.
- Web-based design allows for design try-outs and easy fabrication of mock-ups, as well as rapid prototyping of designs, lowering the financial barriers and time constraints associated with object design and prototyping.
- Web-based design improves the access of users, consumers, and designers to design tools and manufacturing solutions that would otherwise be out of their reach or non-existent.

Web-based design services are often provided in tandem with advanced manufacturing systems, such as 3D printing and computer numerical control routing (CNC routing), which allows distributed or decentralised manufacturing of designs that have been developed fully online.

The concept of design is often associated with the extent to which an object is pleasing to look at. In reality, the application of design has a much broader scope, taking place at the crowded intersection of functionality, efficiency, usability, recognisability and aesthetics.¹ A product's design, just as the way a service is presented, has great influence on the market uptake of that product or service, as well as on

the extent to which the product or service is able to deliver on its promise. Obviously, a well-designed product has a greater chance of success than a poorly-designed one.

The trend towards web-based design is driven by technological advancement in ICT, the increasing use of the internet by the general public, and the rapidly emerging willingness of consumers to purchase goods and services online. It is important to distinguish web-based design services from web-design services or web-related design services. Web-design services are services that focus on the design of websites or online applications. Web-based design services are 'regular' design service offered through the web, such as an interior decorator providing decorating advice online, receiving pictures and sketches from clients through a web application and delivering advice and design documentation to the client's email inbox.

This has the potential to fully eliminate the need for commutes, physical meetings and busy schedules. The designers work with clients via the web to develop innovative design concepts, choose colour schemes and fabrics, select and purchase materials and accessories, hire contractors, and more. Web-based design services allow customers to get access to experienced designers across the globe, and to explore more versatile options for design services that fit any budget and any schedule. Web-based design solutions thus allow for saving time and money, which are crucial factors in today's economy, where resources for design and other non-technological drivers for innovation are scarce.

As such, web-based design services, especially when combined with advanced manufacturing technologies, can reshape the relationship between designer, producer and consumer, offering opportunities for the development of new business models in which the designer has a pivotal role in providing products and services that are highly customised, and that accurately focus on user needs by employing online co-design methods.²



3. Socio-economic relevance

3.1. The market potential of the trend

By putting the user of a product or service at the centre of its activities, design acts as a bridge between scientific progress, technological development and the consumer or end user.³ As such, design is a tool for innovation both in emerging and in mature markets. Design can kick-start markets where technological developments bring only marginal improvements to end-users, increasing revenues and margins through product or service differentiation, or simply by making products and services more attractive or appealing.⁴

Due to lack of (comparable) data, few studies exist on the economic potential of the design sector.⁵ Considered part of the creative industries or the experience industries, growing attention is paid to the economic importance of these industries, as theories on the spill-over effects of these industries on the broader society have gained traction.⁶ Nonetheless, during the recent years, these assumptions have been criticised by the same authors that put them forward.⁷

Still, Europe has a leadership position in design that is internationally recognised, with over 400,000 professionally trained designers that generate an annual turnover of more than EUR 35 billion,⁸ which adds approximately 5% to the knowledge-intensive service sector in the European Union.⁹ However, lack of commonly agreed definitions and available data prevent inter-country comparisons. Also, a lack of reliable statistical evidence disallows a clear demonstration of design's return on investment or its contribution of design to GDP.¹⁰ The studies that have attempted to shed light on the benefits of design have highlighted a positive correlation between the use of design by a company and its stock-market performance, its financial situation (in terms of profitability, solvency and liquidity), and its growth in revenue, employment and export.¹¹

As such, the market potential for design, and web-based design in particular, is hard to quantify. The most recent figures for the European Union show that in 2011 nearly 150,000 companies were active in the specialised design industry, together generating a turnover of more than EUR 19 billion.¹² Table 1 shows these and other figures for the sector.

Table 1: 2011 figures for the specialised design services industry in the EU

2011 figures for the specialised design services industry in the EU

Number of enterprises	143.029
Turnover or gross premiums written	EUR 19.3 billion
Production value	EUR 17.7 billion
Value added at factor cost	EUR 8.8 billion
Gross operating surplus	EUR 5.1 billion

Source: Eurostat, November 2013

Although these figures cover an industry of which companies offering web-based design services likely make out only a fraction, these figures do not cover companies benefitting from web-based design services or deploying web-based design services within their organisation. The main studies on the impact of design on company performance suggest this impact to be both positive and significant.¹³

Entrepreneurs that venture into web-based design are in agreement: Web-based design is currently a niche market, yet they all expect the market potential to be enormous. Even the innovators that are currently producing spare parts for old mobiles, the design specifications of which are long lost, know that they will be front-and-center when market demand for customized, 3d-printed cars emerges. They believe that as the technology advances and becomes cheaper, the rationale for their business will start to make more and more sense, eventually leading to huge revenues.

Similarly, the processes employed by these companies are expected to suit demand for design from any industry. The practice of collecting initial CAD data by laser scanning an old photograph or even a hand-sketched depiction is something that works for classic cars, medical devices, dental aides, or even civil engineering works. Moreover, the down-to-earth and easy-to-use interfaces used by companies working on web-based design, allow almost anyone to get involved in design. The audience of users often turns out to be far more broad than originally envisaged when the service was conceptualised.

As such, the market potential of the trend is significant to say the least, and enormous as far as web-based designers are concerned. What would make this trend really take off is if the possibilities of web-based design would be better understood by the general public at large.



3.2. The socio-economic effect of web-based design services

As stated in the Europe 2020 Flagship Initiative, design is recognised as a key discipline and an important activity through which to bring ideas to market.¹⁴ As such, design is expected to drive revenue and spur innovation, generating economic growth and improving employment opportunities throughout the labour force. Consequently, web-based design can be expected to contribute to this overall trend.

The socio-economic effect of a proliferation of web-based design services can be assessed both at a micro, organisational level and at a macro level. Micro-level studies show that companies that invest time, money and effort in design tend to be more innovative, more profitable, and tend to grow faster than those that do not.¹⁵ On average, businesses that invest in design have 50% better long-term financial performance compared to businesses that do not.¹⁶

Macro-level studies show a very strong correlation between the competitiveness of a country and the use of design within that country.¹⁷ However, the underlying causality has not yet been determined. It is reasoned that, since the impact of design on the performance of individual companies is positive, this positive impact also holds on a macro-economic level.

Studies also demonstrate a strong relationship between design and innovation. Innovative companies are more likely than non-innovative companies to regard design as a strategy, and companies that work with design strategically or as a process are five times as likely to develop new products as compared to companies that do not work consciously with design.¹⁸ SMEs that use design have a higher propensity to engage in radical innovation compared to those that do not¹⁹, and innovative companies across the EU attribute an important role for design staff to their innovative activities. This is especially prevalent in high- and medium-tech sectors.²⁰

The companies studied in this report all show an appetite for radical innovation as opposed to incremental, and most have design staff on key positions. The only exception to this is the case of Moqups, where the entire staff exists of IT specialists. However, this can be explained by Moqups being best used for IT application design.

Although currently a rather small group of actors, web-based design-service companies show the potential to have a positive socio-economic impact over time. Already, companies can clearly demonstrate how their activities carry ecological and labour-market benefits.

Starting out very small, web-based design-service companies that become successful soon encounter the need to expand their team. Potential hires would not only concern themselves with expanding the technological base of the

company, but also be concerned with sales, accounting and facility management, generating high-quality jobs.

Also, as their operations often include a rather specific combination of ICT, advanced manufacturing, and design, these companies tend to create apprenticeships to train new hires and introduce them into the web-based design trade. As these companies both require highly talented individuals and concern themselves with specialised knowledge and insights, paid apprenticeship schemes can be observed that train school leavers for a period of four years.

In some cases, in an effort to give back to the institutions that have often served their foundation, web-based design-service companies provide part of their services free-of-charge to universities, schools and NGOs.

The success of innovative start-ups in web-based design has already started to deliver on its potential to inspire other entrepreneurial activities within their region, as creative and innovative individuals testify to the emerging success stories in their area by deciding to invest their time and personal savings in new business enterprises, slowly helping to rearrange the ecosystem towards an environment that nurtures and inspires entrepreneurs.

On a more distant notion, entrepreneurs engaging in web-based design foresee the role of workers to change. As users come to play a larger role in design, and advanced manufacturing equipment can deliver on design with increasing accuracy, job content will move further away from repetition – which can be automated – and overseeing repetition, to involve more creative and analytical thinking to define future needs and wants, and how to respond to these. This will improve the level of jobs available on the job market.

As web-based design is often deployed in tandem with advanced manufacturing solutions, significant environmental benefits can be generated. Allowing users and clients to work with online interfaces, to have them upload photos or sketches, and by using online communication technology, web-based design services dramatically reduce the need for physical meetings between users, designers and clients. As a result, little to no travel is required in the entire design process.

Contrary to traditional manufacturing machinery, advanced manufacturing equipment is hardly ever operated in a large, centralised plant or facility. Instead, it is available in decentralised production hubs, at start-up or incubator facilities, or in the garage of an enthusiast. The nature of web-based design allows manufacturing of the designed object to take place at these geographically proliferated, decentralised locations. This means that objects, designed online, can be manufactured at a manufacturing hub near the customer, through a machine at a science park, at a customer's site (e.g. on an off-shore platform), or on a



customer's desktop. This greatly reduces the need for transportation, and consequently reduces emissions and other associated negative environmental effects that transportation is known to carry.

Including the use of advanced manufacturing solutions in the business models of web-based design services can also reduce waste. Especially manufacturing solutions such as 3D printing, which only requires the raw materials that will physically be part of the final object in order to manufacture

it, can significantly reduce manufacturing waste, as no material is rendered useless during the process. This effect gains more significance when future equipment becomes capable of manufacturing objects from re-useable material. Additionally, the abilities offered by laser scanning of specific objects, deploying computer-aided design techniques, and the possibilities offered by online and physical rendering of mock-ups, greatly reduce the need for trial production runs, which can use up significant amounts of time, effort and material.

Table 2: Company case studies

Company	Location	Business innovation	Success signals
Sculpteo	France	Online rapid prototyping: 3D printing cloud engine	Sculpteo raised over € 2 million in venture capital in 2012 and has been recognised with the prestigious Innovations 2013 Design and Engineering Awards Best of Innovations by the Consumer Electronics Show.
Freedom Of Creation	Finland / Holland	Online design with 3D printing technologies	Freedom of Creation has conducted several international projects and opened up an online store.
Fluid Forms	Austria	Innovative online product-design tools for fluid forms	Fluid Forms started out as a graduation project, then was established at a science park, and now services its customers from the creative district of Graz.
Impossible Creations	United Kingdom	Online custom design and modelling service (rapid prototyping)	The portfolio of Impossible Creations displays a wide variety of clients, from dental specialists to civil engineers.
Moqups	Romania	Online design of online interfaces	Moqups can sustain itself financially without any external equity or loans.

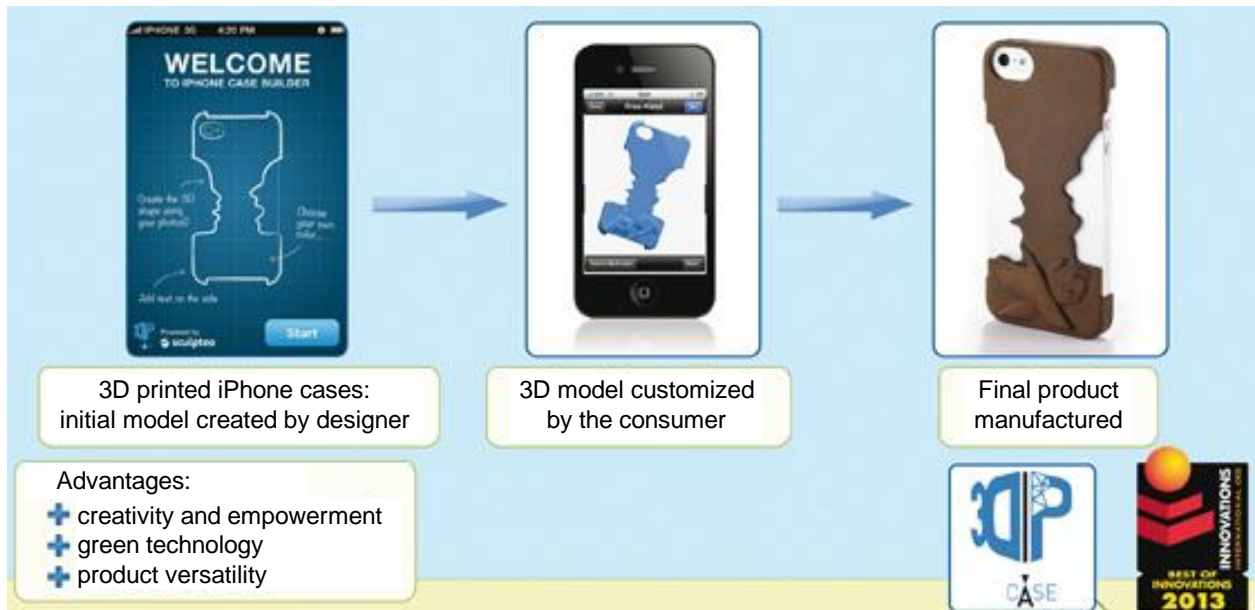
3.3. The benefits of web-based design services

The company case studies show that web-based design services can have three distinctive benefits for users:

- To significantly speed up concept-to-design processes and design-to-manufacturing processes, as well as the design process in itself.
- To allow for design try-outs and easy fabrication of mock-ups, as well as rapid prototyping of designs, lowering the financial barriers and time constraints associated with object design and prototyping.

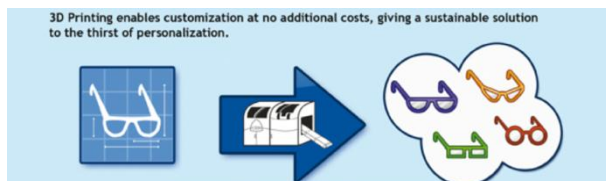
- To improve access of users, consumers, and designers to design tools and manufacturing solutions that would otherwise be out of their reach or non-existent.

Web-based design services tap into the increasing individualisation of consumer society, and engage market demand of individualized products beyond mass customization. Web-based design allows consumers to have unique, personalised products to be designed and manufactured for a market price that is far superior to a process that would feature a designer and a craftsman for a single object to be manufactured.



The online tools deployed by web-based design companies create a multidimensional online environment that helps users achieve functionality, usability, aesthetics, and economic viability, offering design possibilities that cannot lead to non-functional or non-aesthetic designs or designs that are shaped in a way that would prohibit production. This allows for the design and development of unique products with a very specific aesthetic or emotional value, as well as products that are tailored to very specific functional traits or parameters, without the associated design and production costs to become prohibitively high.

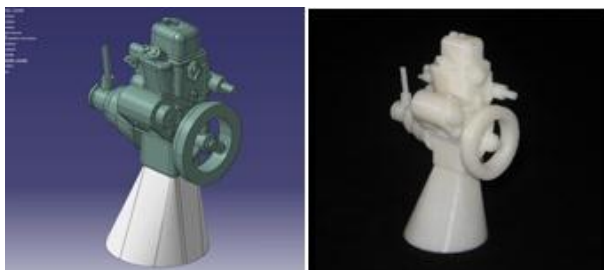
Online mock-up tools allow users with only the most limited understanding of software development and design to quickly convey software ideas. This helps users to prototype designs without requiring dozens of pages full of user-interface specifications, which significantly reduce development friction, risks, time and costs. Online mock-up tools are used by engineers, project managers, school teachers, and even medical professionals to demonstrate to developers what they want on to actually do a web portal, smartphone app, email widget or simple spreadsheet, all without understanding much of how this should be done.



Laser-scanning technology combined with computer-aided design allows for the reproduction of parts that were thought to be lost forever. Sketches-by-hand and even old photographs can serve as a basis through which for instance the design of old automobile parts can be redeveloped, allowing a spare-part to be manufactured that was thought to be unobtainable.

When incorporating advanced manufacturing in their business models, web-based design services can have a dramatic impact on a supply chain. For instance, a web-based design service provider, , can have a spare part laser-scanned at a drill manufacturer, and the generated data can then be uploaded to a web-based design platform. With the help of computer-aided design software, the design platform can analyse the manufacturing requirements and send these to a 3D printer on an off-shore oil rig, where a 3D printer will manufacture the spare part, without any travel of specialists or transport of materials or equipment, and without the associated lead time.

Volvo Penta Engine CAD model. Designed by Impossible Creations from scratch from customer photographs.



Problem 1 - Online rapid prototyping: 3D printing cloud engine. Designers looking to respond to market-demand that stems from an increasingly individualistic, design-oriented consumer culture encounter demand for specific, tailored design objects for prices similar to those of mass-produced objects. Developing a suitable business model can prove difficult, especially considering the fact that manufacturing small volumes of detailed objects is expensive and finding a manufacturer willing and able to manufacture small batches to design can be time consuming.



Innovative solution 1 – Sculpteo joins a movement of companies aiming to revolutionise mass production by giving designers the tools to produce their wares using an inexpensive, scalable single process. The company is moving far beyond its original mission of enabling individual consumers to design, upload, and order personalised merchandise. Sculpteo offers soup-to-nuts object design for do-it-yourself (DIY) manufacturers, along with an array of customisable collections, but it has shifted its emphasis to the technical challenges of creating a cloud-based engine that enables any business to offer 3D-printing services on its own website.

Founded in 2009, Sculpteo is located in France (Paris) and runs a website Sculpteo.com.



Problem 2 - Online design with 3D printing technologies. Product lifespans are constantly decreasing, while the amount of new products pushed into the market is ever increasing. Most of these products are generically tailored for a large mass of initially unidentified or only roughly defined customers. This “push into market” development approach limits the value of the design for individual consumers and can lead to waste through overproduction and swift discarding of products.

Innovative solution 2a – Freedom Of Creation is a pioneering product design company, specialised in creating and commercialising 3D-printed design products. The concept is based on Janne Kyttanen’s project for graduation at the Gerrit Rietveld Academy in Amsterdam in 2000. The project explored the possibilities of using 3D-printing technology and Augmented Reality as viable technologies when changing production and distribution logistics on a global scale. The project looked into the possibilities of people being able to upload virtual information into their living rooms after which they could then interact with the designs, change certain features in them, and when finished, the products could be produced by 3D printing.

Founded in 2000 in Helsinki, Freedom Of Creation is located in The Netherlands (Amsterdam) since 2006 and runs a website freedomofcreation.com.



Innovative solution 2b – Fluid Forms invites its customers to discover a variety of innovative product-design tools and use them to design their own personal collection of fluid forms. At Fluid Forms, customers use online design tools provided by Fluid Forms to design the product they have in mind. Fluid Forms then manufactures that product using computer-controlled design processes, and delivers it to the customer’s door within fourteen days. In 2005, situated in a science park, Fluid Forms launched its first website and presented its first prototype – a vase, the first item to be designed individually. They started to present the company on fairs in European cities such as in Milan, Frankfurt and Zürich. Through presentations in European cities and the development of their online product-design tools, the company gained traction and managed to grow and move out of the science park and into the creative district of Graz.

Founded in a science park in Graz (Austria) in 2005, Fluid Forms moved into the creative district of Graz in 2008.



Problem 3 - Online custom design and modelling service (rapid prototyping). Custom design, modelling and prototyping is a time-consuming and costly ordeal, wherein small mistakes can be lead to very expensive revisits. Especially for small or young businesses, this means thinking long and hard before moving from concept to design and prototyping. Large companies need to include relatively long waiting time in their planning, and significant contingency sums in their development budgets. Both instances negatively influence a company’s appetite for innovation and development.

Innovative solution 3 – Impossible Creations Ltd. offers a ground-breaking custom design and modelling service made possible by the UK’s next generation of rapid prototyping 3D printers. Their leading industry designer, with more than thirty years of experience in product design in the automotive industry, can now bring these skills to a wider audience and offer a ‘design and build’ custom modelling service. Unique computer aided design (CAD) and rapid prototyping technology brings customer’s concepts and ideas to life within hours and not weeks. Impossible Creations works with laser scanning technology to gather data on the design and its intended use environment, which they feed into their CAD software. They can do similar data gathering on photos and hand sketches of objects. Then they digitally review and alter the design, after which they use 3D-printing technology to create prototypes and real-scale mock-ups that serve to test the initial design, allowing imperfections to be noticed before expensive investments are made. Moreover, this technology allows the entire process to be completed in only a fraction of the time normally required.



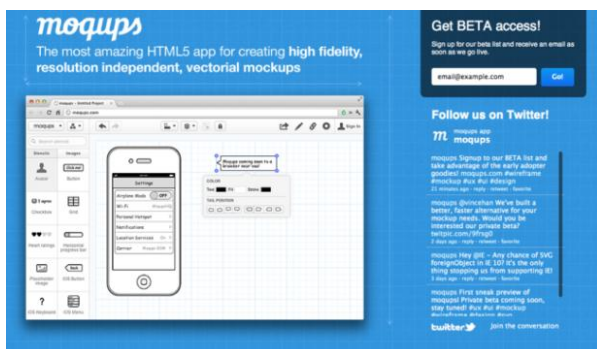
Impossible Creations Ltd is located in Essex, United Kingdom and offers a ground-breaking custom scan, design and modelling service



Problem 4 - Online design of online interfaces. Design of online applications occurs through a creative process that involves conceptual thinkers, graphic designers, interaction designers, web or app developers and others. Such a process can be time consuming as it often requires teams of people to physically meet up several times during the design of the application. In many cases, individuals from different organisations are involved, that sometimes need to travel significant distances to be present at such meetings. For small companies and start-ups, this implies a large up-front investment in time and energy for the development of any online application. For large companies, application design processes such as these can be counted among their most inefficient processes.

Innovative solution 4 – Moqups has created an online HTML5 application that allows users to design a rough concept for a user interface for a website or application, allowing users to unleash their creativity on ‘stencils’ – responsive digital sketching paper that mimics user-interface elements, without requiring programming skills or in-depth knowledge of HTML5. Moqups is designed to allow for online collaboration in real time and from multiple geographical locations simultaneously.

Moqups was founded in Cluj in Romania in 2012, and attracted more than 10.000 users within one month after its release. The company communicates with its rapidly growing community of users through its weblog and its social media channels.



3.4. Client side drivers for the uptake

Web-based design services leverage the combination of increasing possibilities that online tools offer and continuing development of advanced manufacturing systems in a way that can benefit industrial users as well as household consumers. Uptake of web-based design is not without its challenges however. This section will attempt to shed light on the perspectives and challenges related to the uptake of web-based design.

Important drivers for the uptake of web-based design can be found in the less capital intensive manufacturing process it entails, which allows for a lower total cost of delivery. Also, a highly flexible operational system, user designs that are compelling to work with, and the environmental advantages brought forward by their business models are important factors that improve uptake of these products and services.

An important driver for the uptake of web-based design is that it allows for manufacturing in a **less capital intensive** way. It does not require a large upfront investment for manufacturing tooling. Production can break even in much smaller batches, and smaller batches require less storage room. This allows web-based designers to have a **lower total cost of delivery** compared to their more traditional counterparts.

Web-based design companies can offer their clients a far higher degree of **flexibility** than their competitors, which is attributable to the way their business models combine innovative user interfaces and online tools with advanced manufacturing solutions. Web-based design companies spend a significant amount of their time and energy making sure their user interfaces are **easy to understand and compelling to work with** on an emotional level.

The **environmental benefits** offered to clients and the positive association it brings for companies are also a client side driver for the uptake. Distributed or decentralized manufacturing of online designed products can greatly reduce transport movements, while computer-guided manufacturing systems can greatly cut back on manufacturing waste.

Some web-based design companies offer their online tools and services free of charge to universities, schools, non-profit organisations and organisations working predominantly with open-source software. This helps to spread the awareness of the existence of these tools and services and allows groups of users to experience the advantages they have to offer, generating positive word-of-mouth within a tech-savvy community that has an online presence.



3.5. Client side barriers to uptake

Being able to provide great product or service is one thing, but having this product or service take off on the market is quite another. Many entrepreneurs have pointed out how important it is for the public to become aware of their offerings, believing that once the public understands the advantages they have to offer, business success is only a matter of time. This issue comprises public awareness of new products and services, public understanding of the benefits these products and services can offer them, and a willingness among potential users to adopt a new role as a consumer.

Public awareness of the offerings of web-based design companies is important, as consumers cannot look for or interact with something they do not know exists. On this matter, web-based design entrepreneurs gauge an important role for the media to cover their developments and offerings.

A second matter is generating public understanding of their offerings. Especially when the delivery models of web-based design companies are concerned, which can seem a bit complex at first glance, it is important to highlight to potential users the new design-to-manufacture logic as well as the benefits it conveys to users.

To this end, entrepreneurs tour conferences to demonstrate their products and services, host webinars to explain their user interfaces, and provide easy-to-understand video clips on their websites and through social-media channels. Moqups even went as far to skip any explanation and have their online visitors land directly into the online application, much like Google lands visitors directly at the search bar, to achieve a learning-by-doing effect.

“Our secret sauce is, we’re not good at marketing. So we’ve turned our weakness into strength and made our landing page go straight into the app” – Moqups

The matter of willingness amongst potential users to embrace a new consumer role pertains specifically to individual consumers and less to business consumers. Most often, the latter group can be convinced with relative ease of the benefits of web-based design products and services. However, when ordinary consumers are concerned, entrepreneurs point to a mismatch between a rather conservative European consumer culture and the novel, engaged role that consumers play in web-based design. The entrepreneurs worry that European consumers at times are not overly curious or keen to try out something new. Only once something has already been on the market for a while (e.g. in the United States) and preferably had some exposure in popular culture, will European consumers be ready to adopt new products or services in their lives.

4. Drivers and obstacles for solution providers

A number of specific factors can encourage the development of web-based design services. At the same time, other factors can present obstacles to business success of these services. This section presents these success drivers and obstacles.

4.1. Access to finance is vital for scaling up

Access to finance is a very important critical success factor for the past and future development plans of the entrepreneurs featured in this case study. Personal savings, build up from money set aside from less-satisfying daytime jobs, seed capital through business angels and bank loans have been the most common ways to raise funds for the companies in their start up phases.

Some of the firms benefitted from financial subsidies, grants or business competition awards (Table 3). This depended on the regions they were located in and the policy schemes present.

Table 3: Source of funding for company cases

Company	Source of funding
Sculpteo	A combination of venture capital and angel investments
Freedom Of Creation	Initial development took place within a graduation project at the Gerrit Rietveld academy in Amsterdam, after which mezzanine funding was acquired from angel investors
Fluid Forms	Personal savings of the founder and a government grant
Impossible Creations	The development was financed through revenue from existing operations
Moqups	Personal savings of the founders set aside from pay checks of a daytime job, and currently a first stream of revenue from operations



For many of the entrepreneurs, access to finance and the associated costs have at times been a source of frustration. They are concerned with the perceived mismatch between their investment needs, venture capital preferences, and European corporate culture. Also, they feel that governments, local, national, and at European level, could do more to aid their cause.

The mismatch between their investment needs and the preferences of venture capital pertains largely to the well-described 'valley of death' that growing companies face when trying to mature from an innovative start-up company to an established company with solid market base. The other mismatch entrepreneurs point to however has to do with a European cultural trait that is not friendly to entrepreneurs that fail on their first try. Contrary to the United States, where a failed enterprise is often seen as a learning experience, in Europe a failed business venture often seems to damage the reputation of an entrepreneur to the extent that he or she will find it difficult to be taken serious in any following venture.

Concerning the role of government, web-based design entrepreneurs feel that start-up companies could do with

"Don't tax me too early, when my turnover is below a €100.000. The 10k we'd save would allow us to hire another developer to expand our business. Come back later to collect a higher tax amount when our turnover hits 1 million" – Moqups

less taxation, while at the same time could benefit from support for capital expenditure and increased possibilities for start-ups and small companies to obtain European funds in Horizon 2020. Entrepreneurs argue the case that a tax holiday for small start-ups could accelerate their growth, which would benefit future tax revenues.

Similarly, entrepreneurs point out that help from the government in acquiring the financial means necessary to make capital investments required to grow and expand.

4.2. Market potential and innovation as driving forces

When asked about the driving forces behind the development of web-based design services, each of the

"It was my personal motivation, this new world coming up that is changing so much, as well as the market potential" – Fluid Forms

entrepreneurs refers to both the market potential of this type of service, which they believe is enormous, and the appeal of working on something that will revolutionise the world of

manufacturing and design. The long-term prospect of being one of the first in an emerging market that is expected to grow immensely is an important driver for these entrepreneurs to forego current earnings or luxuries and invest significant amounts of time, effort and resources in the development of their products and services. Similarly, the idea of reshaping the design and manufacturing industry as well as revolutionising the way in which consumers relate to

consumer products serves as an important motivator for entrepreneurs.

4.3. The importance of technological, educational framework conditions and inspiring environments

Web-based design-service companies rely on both the availability of high-quality technological infrastructure and the presence of an institutional framework that benefits education and research. As these companies operate web-based, high-quality internet connectivity is paramount to their service delivery. Not only do they exchange very large data files with their users and supply-chain actors, many of their tools are based on online user interfaces that collect input in real time from a user's computer and provide instant feedback based on data processing through cloud computing. This requires an uninterrupted, high-bandwidth data stream. Moreover, as these companies continue to explore synergy with mobile services and devices, the availability of mobile data networks that allow for 3G and 4G connectivity becomes ever more crucial.

A good share of the companies in this case study have benefitted from a science park, university grant, or graduation course that focusses on real-world application. Fluid Forms was founded on a science park before moving to a creative district, and made use of the available office space and receiving feedback and advice on their business plan. Also, the entrepreneurs pointed at the importance of the highly educated new or potential hires and apprentices in their area, which can be attributed to local universities and higher education institutions.

The entrepreneurs also pointed at the importance of an inspirational environment to enhance creativity. The geographic clustering of creative enterprises in a specific district, or the refurbishment of an old factory or warehouse to provide office space and ateliers, can allow these creative entrepreneurs to interact with one-another in a manner that inspires them and allows them to spot synergies. Where these conditions are not present, entrepreneurs try to create or mimic them, as they are convinced that such an environment benefits their enterprises.

4.4. Bureaucracy

Web-based design entrepreneurs point out that government bureaucracy can be a serious hindrance to them. They point out that creative individuals can feel stifled when they need to spend two weeks trying to figure out what forms to fill out and who to speak to in order to set up a company. Entrepreneurs get frustrated when governments on the one hand adopt policy arrangements designed to help innovative start-ups financially, while on the other hand implement these policies in a way that makes it very difficult for



entrepreneurs to understand them and that severely limits the accessibility of these policy programmes for precisely the people it targets. Indeed, venturing into this mission would be in most of the cases not worthwhile without third-party assistance.

Instead, entrepreneurs would expect governments to be a role model for the rest of society. In order to inspire an entrepreneurial attitude, governments should approach innovative start-ups with the same curiosity, open-

mindfulness and risk-taking mind-set that it aims to encourage. One of the entrepreneurs has pointed to the British initiative called Business Link as a source of help and inspiration coming from the government in an attempt to improve government-start up interaction. Business Link provides broad knowledge of local and national policies relevant to start-ups, and can offer professionalised help and support for start-ups that struggle with formalisation of their organisation or formulating sustainable business plans.

5. Policy recommendations for further uptake

On the basis of the analysis performed, policy recommendations for developing a business environment conducive to the uptake of web-based design innovations are presented below.

Although the impact of design on business performance and economic growth offers some insights, the relationship between design innovation and economic performance could be investigated with far more rigor. Especially the emerging trend of web-based design deserves more research attention. Understanding the size and potential of web-based design activities can benefit the development of effective, evidence-based policies to encourage the development and uptake of these innovations. Moreover, it is important to ensure that current and future studies (e.g. through the Euro-design project and the DeEP project²¹) generate results that are comparable in order to allow for aggregated analysis.

While this case report demonstrates that awareness is one of the most important challenges to uptake of web-based design, earlier studies have already concluded that SMEs across Europe lack an awareness and understanding of the benefits of design and the tools available for integrating design into their everyday processes.

A point that resonates with innovative start-ups in general and was articulated by web-based design entrepreneurs in particular concerns government bureaucracy. Despite the adoption of the small business act in 2008 and its subsequent implementation by member states, small companies in Europe still lament the administrative burden imposed by bureaucratic measures, the limited responsiveness of government agencies, and what is perceived as the little consideration that policy makers and government workers have for small businesses and start-ups.

Intermediary organisations, whether commercial enterprises or government agencies, can play a welcome role when they help entrepreneur navigate their way through government requirements and government support, and by helping

individuals that try to start a company with guidance and advice.

Web-based design entrepreneurs have suggested ways in which governments can help accelerate their growth. They suggest making current programmes more accessible to start-ups, taking more action in accommodating capital investment, and taxing start-ups in a smarter manner.

Innovative start-ups that focus on web-based design do things out of the box. As a result, they do not fit any of the very specific calls for proposals that the European Commission launches. There is also another side to this story, as start-up entrepreneurs are not always very well informed about the possibilities that European funds can offer.

Capital investments are a typical bottleneck for start-ups that look to expand. In many cases, additional equipment, required to scale up operations, cannot be financed out of existing revenue streams or company savings. With banks still hesitant to provide credit to SMEs and start-ups in particular, and business angel or venture capital investor not always in the market, governments could attempt to kick-start a young company's growth by guaranteeing part of a loan or co-financing an investment.

Web-based design entrepreneurs suggest taxing them smarter, specifically by not taxing them too early. The rationale behind this is that a lenient tax regime for young companies and start-ups would allow more of them to grow and prosper, leading to a future increase in tax revenue that by far outweighs the current foregone tax revenue. A similar logic could apply to social security contributions and other non-discretionary non-wage labour costs.

Also, design entrepreneurs stress the importance of a creative and inspiring environment that enables them to mingle and interact, and to use their environment as source of inspiration by involving it in their creative process. Old industrial environments are specifically mentioned.



Based on these points, the following recommendations could be considered to see how they could promote the uptake of web-based design:

- The notion that foregoing a relatively small amount of current tax revenue in exchange for a larger sum once start-ups have matured could benefit from a data-driven econometric analysis. Such an analysis should also include a study into the effects of guaranteeing or co-financing capital investment, and foregoing social premiums.
- The relationship between innovation, design and economic performance should be demonstrated clearly on a macro level to enable fact-based policy making. Studies looking into part of this policy question should be set-up to allow for study results that are comparable across studies, current and future. Similarly, definitions used by national statistical agencies should be harmonized, which makes it possible to generate data sets with higher quality.
- Web-based design companies could greatly benefit from increased awareness of their advantages amongst both SMEs and the general public. A study could be proposed to uncover the most practical way in which public policy could help the sector increase this awareness.
- Implementation of the Small Business Act can reduce the bureaucratic burden that web-based design entrepreneurs experience. The SME Performance Review could be geared to focus even more on this aspect of the SBA.
- As entrepreneurs consider intermediary organisations, be they private-sector initiatives or government agencies, to be a good source of information and guidance regarding government requirements and government support. A study could be proposed to uncover what benefits, disadvantages and costs such intermediary organisations generate, and to determine if specific policy geared towards intermediary organisations could be beneficial to the development of web-based design innovations in particular or innovative start-ups in general.
- Even more attention could be paid to the role that SMEs and start-ups can play in the allocation of EU funding. A careful analysis could be proposed of the benefits in terms of their innovative capacity could outweigh the financial and continuity risks sometimes associated with participation of SMEs and start-ups in EU funding schemes.



6. Appendix

6.1. Interviews

Company	Name	Designation
Sculpteo	Jean-François Kitten	Press contact
Freedom Of Creation	Janne Kytтанen	CEO
Fluid Forms	Hannes Walter	CEO
Impossible Creations	Ian Carter	CEO
Moqups	Emil Tamas	Co-founder

6.2. Websites

Sculpteo	www.sculpteo.com
Freedom Of Creation	www.freedomofcreation.com
Fluid Forms	www.fluid-forms.com
Impossible Creations	www.impossiblecreations.co.uk
Moqups	www.moqups.com

6.3. References

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