Tutorpoly - A Real-time e-Learning Marketplace

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Abstract

In this project we describe a new platform that corresponds to a real-time e-Learning marketplace. By using our solution students are able to find an online tutor capable of providing immediate assistance, regarding the specific academic problems they are facing, using real-time e-Learning components such as, video conferencing and collaborative documents. The motivation behind this platform resides in a series of identified unmet customer needs that, nowadays, might be solved by integrating into a single platform various market-validated working-principles and by exploring recent technological possibilities.

In order to allow a reasonable assessment of the platform’s viability, we study how general business concepts apply to the Internet industry, as well as, existing e-Learning platforms and the related technological state-of-the-art.

Finally, we lay the grounds for implementing and evaluating our platform, by analyzing and defining the major elements upon which early-stage business plans are built. Furthermore, we present the system’s Software Requirements Specification using the modern RSLingo Requirements Engineering framework and subsequently define our system’s architecture and major underlying technologies.

The elements shaped during this project serve as a basis for the future developments necessary to implement and launch the platform.

Keywords

E-Learning; online marketplace; real-time; online businesses; business plan; WebRTC;
Resumo

Neste projecto, descremos uma plataforma que consiste num mercado online de e-Learning em tempo-real. Utilizando a nossa solução, os estudantes podem encontrar tutores online capazes de facultarem assistência imediata, relativamente aos seus problemas académicos, utilizando ferramentas de e-Learning em tempo-real como videoconferência ou documentos colaborativos. A motivação subjacente a esta plataforma reside na identificação de um conjunto de necessidades por suprir e que, hoje em dia, podem ser resolvidas integrado numa única plataforma múltiplos princípios já validados assim como tecnologias recentes.

De modo a permitir uma avaliação realística da viabilidade da plataforma, estudámos a forma como conceitos gerais de negócio se aplicam à industria da Internet, assim como, plataformas de e-Learning já existentes e o estado-da-arte das tecnologias associadas.

Por último, desenvolvemos os alicerces para a implementação e avaliação da plataforma, analisando e definindo os principais elementos que compõe um plano de negócios inicial. Adicionalmente, apresentamos a especificação de requisitos de software do sistema através da abordagem RSLingo, uma framework moderna de Engenharia de Requisitos e, subsequentemente, definimos a arquitectura do sistema e as principais tecnologias subjacentes.

Os elementos desenvolvidos no decurso deste projecto servem como base aos desenvolvimentos futuros necessários para implementar e lançar a plataforma no mercado.

Palavras-Chave

E-Learning; Mercado online; tempo real; negócios online; plano de negócios; WebRTC;
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LIST OF ACRONYMS

ARPU  Average Revenue Per User
B2B   Business-to-Business
B2C   Business-to-Customer
BM    Business Model
BMC   Business Model Canvas

B-Learning  Blended Learning
CAC   Customer Acquisition Cost
C2C   Customer-to-Customer
CPA   Cost-per-Action
CPC   Cost-per-Click
CPM   Cost-per-Mille (thousand impressions)
CSV   Customer Value Proposition
CTR   Click-Through-Ratio
EU    European Union
ICT   Information and Communications technology
LMS   Learning Management System
LTV   Customer Life-time Value
OECD  Organisation for Economic Co-operation and Development
Q&A   Question & Answer
RE    Requirements Engineering
RSL   Requirements Specification Language
RSL-IL  RSLingo’s Intermediate Language
RSL-PL  RSLingo’s Pattern Language
SAM   Serviceable Available Market
SOM   Serviceable Obtainable Market
SWOT  Strengths, Weaknesses, Opportunities and Threats
TAM   Total Available Market
UML   Unified Modeling Language
USP   Unique Selling Proposition
UVP   Unique Value Proposition
VC    Venture Capital
VP    Value Proposition
1 INTRODUCTION

This chapter outlines our work by describing its context, the corresponding problems and a possible solution, as well as, the resultant objectives. In its end, we describe the research method and the structure of this document.

1.1 Context

e-Learning is a concept whose meaning is not entirely well-defined. A broad study concerning the possible interpretations of this term resulted in the following definition [1]: “E-Learning is an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning”.

This is an inclusive definition closely related to other terms – often used interchangeably – such as Technology Enhanced Learning or Educational Technology [2]. In this project, our usage of the term is restricted to the meaning of Distance Learning, that is, educational activities that do not require physical proximity. In this context, there are two major types of e-Learning scenarios: Asynchronous and Synchronous. In the former, teaching and the corresponding learning activities can take place at distinct moments, while in the latter, both teachers and learners have to interact simultaneously.

There is a multitude of tools and platforms that support asynchronous e-Learning activities, such as, Learning Management Systems (LMS) and Online Courses. If we also consider Ad-hoc e-Learning activities, we may include Search Engines (often leading to document repositories or collaborative content websites\(^1\)), Q&A websites, among others\(^2\).

Regarding synchronous learning activities, there are also several tools available, such as, Web Conferencing software or general communication tools that might be used for this purpose\(^3\). These are often used in a context where there is already a relation between teachers and learners, which led to the arrangement of an e-Learning session.

When there is no previous relation with a teacher, that is, when a learner has an unforeseen and immediate need, most existing tools do not provide a solution. Due to this perception of gap, the remaining of this work is focused on this scenario: Tools for Synchronous Spontaneous e-Learning activities.

1.2 Problem

When a learner faces a concrete problem it often resorts to all sorts of learning materials. However, when the problem is not an issue of mere information recollection but instead, knowledge understanding and application, passive learning methods are often ineffective. This fact is emphasized in fields whose topics are hardly independent, such as natural and exact sciences, because the root of a student’s difficulty may reside in a fragile comprehension of methods taught and organized under a distinct topic or even another subject (e.g. physics dependency of mathematics). In such context,

\(^1\) e.g. Wikipedia (wikipedia.org)
\(^2\) e.g. YouTube (and, as a particular example, youtube.com/channels/science_education);
\(^3\) e.g. Skype
interactive learning methods are highly effective due to tutor’s capability to quickly identify and suppress student’s limitations.

If for any reason (e.g. geographical, socioeconomic, subject specialization) the learner does not have access to an expert, it is often unable to gain the deeper understanding necessary to solve his problems in a timely manner. Therefore, the problem underlying this work is designing a platform that provides a solution to the widespread need of interactive tutoring.

1.3 Solution
For this purpose, we designed a platform - named TutorPoly - that is intended to solve the aforementioned problem through the following features:

- Facilitate matching of users with complementary goals and needs (e.g. private tutoring supply and demand);
- Allow real-time interactive communication among users, with tools highly suited to e-Learning contexts;
- Allow payment exchange between parties;
- Fostering cheap prices.

It is noteworthy to mention that these user-centered issues must be approached in a way compatible with a viable business model.

1.4 Research Goals
In light of the aforementioned problem, our research goals can be summarized as follows:

- **G1**: In-depth study of Web-based businesses. Our analysis will focus on a non-technical perspective, such as, problems and solutions, markets, business models or marketing strategies;
- **G2**: Identification and analysis of competitors;
- **G3**: Development and description of the most important issues of TutorPoly’s Business plan;
- **G4**: Software Requirements Specification of the corresponding product;
- **G5**: Completion of the first iterations of the prototype’s software development process, namely, design and component testing.

The results of this project are the basis for an early-stage business plan and prototype which, in turn, are indispensable elements to capture the investment necessary to develop a market-ready product.

1.5 Research Method
The activities planned in order to accomplish the desired goals can be divided into two main categories, namely: business development and prototype development:

The business development activities comprise the required steps to evaluate a business opportunity and subsequently implement it, namely:

- Business research and analysis, mainly from a marketing and business model (i.e. monetization) perspective, and with a special focus on the best-practices and key factors for success of Internet industry businesses;
• Competition survey, including the analysis of value propositions, market, and the business model of both indirect and direct competitors;

• Identification of unsatisfied needs or problems as well as the definition of a possible solution. This description shall include the most important constituents of a business plan such as market quantification and business model definition.

Although this methodology matches the traditional business development approach, the principles underlying its implementation incorporate aspects from the Lean Startup Methodology [3], particularly by limiting over-planning and constructing a flexible structure capable of learning and adapting, particularly expressed in the early development of contingency plans.

In turn, the activities related to the platform’s prototype development include:

• Software Requirements Specification following RSLingo’s Requirements Engineering approach;

• Design of the major architectural aspects underlying the system’s implementation;

• Implementation and testing of components identified as critical success factors and whose technical capabilities might influence decisions at the business level.

It is important to note that although these activities are in sync with Agile methodologies, the first iterations are in some way equivalent to Waterfall development models.

Finally, given that at the current stage Requirement Engineering activities are of utmost important, we give added emphasis to the RSLingo’s approach, which consists in two distinct levels:

• Business-level: Where concerns such as the business’ glossary, stakeholders, goals and processes are defined and described;

• System-level: That covers the system’s domain model, actors, requirements and use-cases.

It is noteworthy to mention that the design of RSLingo provides a bridge between the aforementioned business and software development dimensions a capability that further justified the adoption of an additional level of detail in this regard.

1.6 Dissertation structure

The organization of this document matches the aforementioned methodology. Specifically, it obeys to the following structure: Chapter 2 conducts a survey of internet businesses and mentions some paradigmatic case-studies; in Chapter 3 we survey existing e-Learning platforms and tools; Chapter 4 describes TutorPoly e-Learning platform and its distinguishing characteristics, whereas in Chapter 5 we detail its specification and, in Chapter 6, we outline the technological architecture to implement it; Finally, in Chapter 7 and 8 we discuss and relate several aspects of our work and present the major conclusions of this project.
2 INTERNET BUSINESSES

To accurately assess a business opportunity and subsequently develop a grounded business plan it is fundamental to comprehend the main concepts involved, the differences between the various strategies that can be followed to approach specific parts of the business (e.g., business models, marketing plans) and a general understanding of the environment (e.g., socioeconomic, technological) surrounding the endeavor.

In this chapter, we explore the main questions that must be answered when planning a business and compare possible alternatives concerning each business strategy and planning decision, with a special focus on the internet industry.

2.1 Opportunities assessment

The preliminary step in a business endeavor is evaluating the business opportunity. Although this activity must take into consideration several vectors, such as, idea evaluation, the market size and its characteristics, the competition, among others, here we focus on the assessment of the business idea, that is, how reasonable and promising it is from the point of view of its conceptual characteristics.

Put simply, a business idea or concept corresponds to a solution to an identified problem. This problem is connected to a need that is either unmet or could be solved in a way that offers greater value to end customers. Moreover, a viable business opportunity might be rooted at several different circumstances, for instance:

- Technological opportunity (e.g., smartphones);
- Side-effect of other changes (e.g., selfie stick, microwave cover);
- Competitive Advantage (e.g., cheaper or closer sushi restaurant);
- Market change (e.g., demographics change)

Although an idea can be evaluated by all its repercussions (e.g., we might evaluate an idea negatively if its implementation is considered unfeasible), here we focus on evaluating the relationship between the problem and the solution. This relationship might be analyzed according to several related concepts and criteria that, collectively, provide a framework for a primary definition and evaluation of a business. In the following subsections we present the most commonly used, including some frequently studied in a Marketing context, but of particular importance in the general early assessment of a business opportunity.

2.2 Value Proposition

In simple terms, the Value Proposition is the set of reasons why target customers should buy a product or service. Therefore, the value proposition defines how a business provides a solution to a particular problem of interest to the market (a need). While a strong value proposition is of paramount importance and is highly connected to the positioning of a business, this concept has several variations that foster the consideration of different perspectives.

FAB (Feature, Advantage, Benefit). This framework analyses how each feature of an offer conveys an advantage that, in turn, represents a benefit. For instance, a car that features a hybrid engine has the advantage of occasionally running with electricity which leads to the benefit of decreased pollution and money expenditure.
Although FAB is highly similar to the plain Value Proposition definition, there are some variations with considerable different meanings, namely, customer value proposition and unique value proposition.

**Customer Value Proposition.** The Customer Value Proposition (CVP) emphasizes the role of customer’s perception. That is, instead of taking into account benefits as a whole, it only considers those that customers recognize as such. In this context, it can be argued that it also includes virtual benefits, that is, advantages solely derived from the beliefs of the user and his surroundings and not intrinsic to the product or service itself. Improvements in social status and reputation are paradigmatic examples of this phenomenon and are highly explored in marketing and communication strategies.

**Unique Value Proposition.** The Unique Value Proposition (UVP) is focused on original benefits that the product or service provides to customers. Frequently, ideas are evaluated solely based on their novelty. This tendency is even more prominent when the evaluation is carried by nonprofessionals or when it is considered that the promoters lack the means to compete with existing players.

A quick consideration of other aspects that influence a business potential shows that the importance of novelty is overestimated. As long as a business presents a competitive advantage over competitors, it has the potential to guarantee a market-share that sustains its viability. This fact is grounded by multiple examples of successful business that were not completely innovative regarding the major characteristics of their business concept (e.g. Google, Facebook, YouTube) and the corresponding downfall of extant players (e.g. Altavista, Hi5, Metacafe).

As a last note, the UVP is closely related to the POP-POD (Points of Parity, Points of Difference) concept. Using this perspective leads to a systematic listing of the similarities and differences in relation to competitors, leading to a fine-grained understanding of a product's or service novelty.

### 2.2.1 Unique Selling Proposition

The Unique Selling Proposition (USP) captures the qualities a business has that make it a favorable choice over alternatives, taking into account the potential customer's behavior and decision-process has a whole. This way, it is distinct from VP (and related concepts) since a business might offer the same value for a customer, but constitute nevertheless a favorable choice for other reasons.

Some examples include the proximity resulting from targeting specific markets, the convenience of swift distribution channels, and the satisfaction from a responsive customer service or from extremely simple usage. From these illustrations, it is clear that the Unique Selling Proposition is highly influential in the planning of marketing strategies.

### 2.2.2 Competitive Advantage and competitors

Finally, the umbrella term of Competitive Advantage encompasses all the factors that influence customers’ decisions. Therefore, it has two major vectors: differentiation and price. The former can be adequately described by the aforementioned Value Proposition while the latter constitutes an alternative way of gaining overall strength in the absence of a UVP or USP.

The analysis of the competitive advantage is closely connected to the assessment of competition. In this context, we underline the three types of competitors that cannot be underestimated:

- **Direct competitors:** Those that offer a comparable product or service;
- **Indirect competitors:** Those who target the same need using a significantly different approach;
- **Future competitors:** The hypothetical set of competitors that might appear as a result of novel initiatives or changes in previously unrelated players. This set is frequently ignored but it constitutes a serious threat, particular in business whose differentiating features to not present significant barriers-to-entry.
Finally, the most common method of competition assessment takes the form of a Customer value analysis, defined as, a report of the company’s strengths and weaknesses relative to various competitors [4].

2.2.3 Novelty

From the above reflections, it is clear that a product or service must have a good value proposition but it does not necessarily have to be unique. Therefore, we can divide business ideas into three categories:

- **Disruptive**: Developing an innovative product or service, by exploring a Unique Value Proposition;
- **Disruptive-Incremental**: Implementing an existing product or service in a specific market (e.g. geographically), by providing an Unique Selling Proposition;
- **Incremental**: Compete with an existing product / service, by trying to establish a competitive advantage.

A holistic evaluation implies that neither type is sufficient to either guarantee success or failure, because it does not take into consideration other factors that might lead to a viable market-share.

In fact, one of the most common idea assessment frameworks are checklists, such as the Princeton Creative Research Business Opportunity Checklist, presented in Table 1, that includes numerous criteria in order to adequately describe the strength and potential of the business opportunity as a whole.

| Have you considered all the advantages or benefits of the idea? Is there a real need for it? |
| Have you pinpointed the exact problems or difficulties your idea is expected to solve? |
| Is your idea an original, new concept, or is it a new combination or adaptation? |
| What immediate or short-range gains or results can be anticipated? Are the projected returns adequate? |
| Are the risk factors acceptable? |
| What long-range benefits can be anticipated? |
| Have you checked the idea for faults or limitations? |
| Are there any problems the idea might create? What are the changes involved? |
| How simple or complex will the idea's execution or implementation be? |
| Could you work out several variations of the idea? Could you offer alternative ideas? |
| Does your idea have a natural sales appeal? Is the market ready for it? Can customers afford it? Will they buy it? Is there a timing factor? |
| What, if anything, is your competition doing in this area? Can your company be competitive? |
| Have you considered the possibility of user resistance or difficulties? |
| Does your idea fill a real need, or does the need have to be created through promotional and advertising efforts? |
| How soon could the idea be put into operation? |

*Table 1 - Princeton Creative Research Business Opportunity Checklist*

From this list, we can see that novelty is just a part of an idea evaluation and that conceptual innovation is not mandatory. In fact, we can consider that novelty poses an additional threat because the concept itself it not market validated to any extent.

2.3 Market

In this section, we give a brief overview of the Internet market, by presenting some statistics and considerations useful to accurately assess the potential of businesses.

One of the most important sources of viable business opportunities is market growth. That is, if the target market of a type of business is growing new players have a chance to achieve the required penetration for several reasons:
• The new customers entering that market are not committed to any competitor;
• Growth makes previously unviable segments, and therefore untargeted, become profitable;
• Existing competitors may lack the capacity or differentiation characteristics to target new customers;

In the case of the market comprised by Internet Users, it is a misconception to consider that convergence of number of users, particularly in more developed countries, renders the market less attractive.

The market is still changing considerably in multiple ways, for instance:
• The types of devices connected to the Internet and their respective bandwidth, which results in an increased ubiquity of access and different contexts of usage;
• The economic conditions of the populations that have access, with customer segments with relatively low purchasing power being more and more included;
• The Geopolitical circumstances of Internet users, with an continuously grow across different regions and cultures;
• The behavioral characteristics of users, with increased experience and comfort using Internet monetization-related tools, such as, electronic payment methods (e.g. Credit Cards, PayPal);

Due to the visible growth of mobile access, changes in respect to the access devices are widely known. Therefore, we will focus the remaining of this section on socioeconomically and behavioral changes.

2.3.1 Definitions

Quantifying the overall market of a product or service is not very useful. For several reasons, some customers are more likely to be reached than others and, unless the market is decomposed accordingly, market quantification does not bear much explanatory or predictive power.

According to one of the most common frameworks in this regard, a business’ market can be decomposed into:
• Total Available Market (TAM) - The total customers to which the product and service potentially applies;
• Serviceable Available Market (SAM) - The customers targeted by the business' propositions and in relation to which the business positioning conveys a competitive advantage;
• Serviceable Obtainable Market (SOM) - Customers that the business can actually acquire taking into account its resources and marketing strategies.

Customers are divided between the various levels (and even within them) according to the segmentation criteria that is considered most applicable and descriptive, traditionally, age brackets, geographic region, disposable income, gender, among others.

Adopting this framework contributes to a deeper understanding as it fosters adopting a higher level of detail in narrower subsets. Additionally, the fact that nowadays it is relatively widespread also eases communication among stakeholders.
2.3.2 Internet Users per Region

The following map (Figure 1) presents the average annual growth in Internet Users of key emerging economies, based on data compiled and estimated by Euromonitor International.

![Map of Internet Users per Region](image)

*Figure 1 - Annual growth of Internet users in emerging economies (2011-2020)*

It is important to note that the growth in these regions has two important consequences, namely, the growing cultural differences (e.g. language; Interests) among the populations of Internet users with a significant size and the growing capacity of Internet businesses to reach low-income customer segments;

2.3.3 Internet Payments per User

An important aspect to consider is customer behavior. Particularly, a website that relies on user payments depends on their customers’ willingness to conduct the required procedures. This is not granted even if they can be considered converted, according to the stage and conclusion of their decision-process.

One good approximation of the quantity of users that are open to online payment is given by e-commerce statistics. The map of Figure 2 shows the growth in e-commerce sales in recent years, according to eMarketer data.

To conclude, a business that somehow targets growing markets or customer segments – such as low-income people or less developed countries – has better chances to succeed, as it can leverage on a temporary lack of equilibrium between supply, that is growing, and demand, fit with previous supply levels.

Furthermore, if it relies on Internet Payments, a business that previously failed may now succeed, specifically if it targets a small niche that requires an inversely proportional high penetration and conversion rate.

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4 Source: euromonitor.com

5 Source: emarketeer.com
2.4 Marketing

According to the American Marketing Association, Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large\(^6\). Therefore, considering this definition and common related interpretations, Marketing involves a broad range of activities, frameworks and tools.

For instance, it often includes analysis and definition of core business concepts (e.g. value proposition), communication strategies (e.g. brand image), target markets (e.g. customer segments and profiles), positioning in relation to competition (e.g. unique selling proposition), pricing and distribution, among others.

Here, we will focus on the marketing channels through which customers are acquired, in particular, digital advertising and promotional channels and techniques because adequate strategies in this regard are vital for a viable Web business endeavor.

2.4.1 Advertising and Promotional channels

Given that reflections concerning offline channels also apply to online businesses, we will give emphasis to channels and techniques particularly linked to the Web, namely, Viral patterns, SEO techniques, and Advertisement networks.

**Viral Patterns.** Viral patterns may be regarded as the digital counterpart of the traditional Word-of-Mouth phenomena and are typically linked to user’s actions in social networks (e.g. liking, sharing) or ordering mechanisms based on crowd behavior (e.g. number of views, comments).

Recently, viral patterns play an increasingly central role in many startups’ marketing plan. Although proactively implementing viral tactics is certainly advantageous, virality is a highly unpredictable phenomenon and, therefore, cannot be assumed.

For instance, the assumption that whenever a business has a good value proposition virality patterns emerge might be a case of survivor bias. That is, since successful businesses are much widely disseminated than the ones that failed and that virality is both a cause and an effect of such success, the prevalence of virality might be highly overestimated.

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\(^6\) Source: American Marketing Association (ama.org/AboutAMA/Pages/Definition-of-Marketing.aspx)
In addition, by definition viral patterns bring new customers as a result of the behavior of the existing ones. Therefore, it only amplifies a customer base acquired by other means due to two reasons: Initially there are no existing customers and customers that perform dissemination actions tend to reach only socially close customers.

**Search Engine Optimization.** Search Engine Optimization refers to the activities and techniques that contribute to improving the position of a business webpages (e.g. homepage, landing pages) in search engine result pages (SERPs).

As a Marketing tool, SEO building as several major problems: the human effort required, the time it takes for actions to produce results and unpredictability concerning the outcome of those actions. While there is no Cost-per-Click (CPC) in search results, the amount of human labor required to perform the actions necessary for a good positioning is enormous. Therefore, this theoretically free channel might be practically quite expensive. Regarding time, even an effective strategy only produces results in medium to long-term. This poses a series of threats such as delaying effective market traction and break-even or giving competition a window of opportunity to compensate or cancel out our differentiation. Finally, the relation between actions and results in this type of strategy are highly unpredictable. On one hand, the ordering and classification algorithms used by search engines are quite obscure. On the other hand, it is not possible to predict forthcoming competition actions that will influence their relative score.

For these reasons, we consider that nowadays a good positioning in search is more an effect than a cause for success.

**Affiliate Marketing.** Online Affiliate marketing is a strategy that consists in providing revenue to third-parties, in a Cost-Per-Action (CPA) basis. That is, other businesses or even individuals can enroll in an Affiliate program and earn revenue whenever they are responsible for a new customer or lead to a specific action (e.g. newsletter subscription).

The main advantage of affiliate programs is the direct relation between cost and revenue. That is, since expenditure is indexed to conversions there is virtually no investment overhead. Conversely, the major disadvantages pertain to the necessity of advertising the affiliate program itself, the necessity of developing the tracking mechanisms that technically implement the affiliate program, and the possibility that the program’s moderate individual earnings do not provide enough incentive for potential partners.

**Indirect Advertising.** Indirect advertising techniques try to provide a level of visibility to a product, service, or brand, which leads potential customers to seek those offers in their distribution channels. This advertising strategy includes popular methods, such as, presence in mass media, public relationship and events, sponsorships, and content marketing.

The fact that actual customer acquisition requires a proactive behavior is the major weakness of indirect advertising. In turn, the fact that offers are communicated in a non-intrusive way increases brand-awareness while cultivating positive associations.

**Direct Advertising.** Direct advertising techniques are characterized by interacting and communicating with customers directly and providing an immediate method of purchase. Common examples include telemarketing, postal and email marketing, or direct sales.

Direct advertising is intrusive by nature which can contribute to potential customer’s dissatisfaction. However, the possibility of instant customer acquisition favors purchases by impulse and can be very effective.
Advertising Networks. Internet Advertising Networks are described separately as they can be considered a hybrid between several forms:

- The fact that Search Engines are the major context of delivery bears similarities with SEO techniques, particularly regarding the context upon which customers are exposed;
- With Affiliate programs they share the goal-oriented pricing policy, specifically since expenditure metrics typically follow the CPC or CPA model;
- As with Indirect Advertising, Internet Ads do not require their audience full attention and might even be unlinked to customer’s actions, namely, when the CPM model is adopted;
- Conversely, the direct link between Internet Ads and online distribution channels is analogous to the purchasing methods provided in Direct Advertising actions.

Advertising networks resort to proprietary (e.g. AdWords) and third-party channels (e.g. AdSense) to promote advertisers’ businesses. While implementing a strategy does not take much effort, its viability is a complex matter.

First, the cost might be incompatible with a business that displays low conversion rates or low ARPU. Secondly, not only Ad exposure is often simultaneous with competition Ads, which highly influences customer’s decision process, but the immense popularity of this method can cause overinflated prices. Finally, Ad networks associated to Search Engines Result Pages only reach proactive customers, that is, Internet users who are deliberately searching for a specific product or service. While this can significantly increase conversion rates, it is associated with a context and pattern of behavior that might not be suited to a specific offer or customer segment.

2.4.2 Market-entry

The aforementioned strategies might be applied to any stage of a business lifecycle. However, there is a moment of particular importance that deserves specific planning and thoughtfulness: Market-entry.

The targeted market of a business is often decomposed into subsets of manageable size. Frequently, the division follows a country-wise criteria due to multiple reasons, such as, cultural and language differences, legal issues, or even the potentially dense connections among customers of the same country, among others. Regardless of the decomposition policy adopted, in the moment of market-entry a business has two major choices: The Sprinkler or the Waterfall strategy.

Sprinkler strategy. The Sprinkler strategy (depicted in Figure 3) consists in trying to reach, from the beginning and simultaneously, all the markets and segments targeted. In this model, businesses try to set up marketing tactics and channels capable of reaching their market as a whole.
This strategy is simple in the sense that it does not require procedures that minimize the access of users from non-targeted countries nor an adequate response when it does happen. It can also support a fast growth, risk dispersion, a strong association of the brand-image to a global and international character, and a steepest learning curve concerning the market response of various segments.

Among the major disadvantages, we highlight the additional development cost associated to internationalization, the marketing investment needed for multimarket penetration, and the abrupt scalability requirements that can arise, taking into consideration that none of these necessities can leverage on profits resulting from previously consolidated positions.

**Waterfall strategy.** The Waterfall strategy (represented in Figure 4) tries to reach consecutively different markets or segments. Here, businesses consecutively develop the tools required to explore specific properties of different customer groups and schedule their approaches to distinct targets accordingly.
Among this strategy advantages we emphasize the fact that by targeting smaller markets at any point there is a lower capital commitment and overhead. Furthermore, the business has more time to scale and the first markets or segments targeted can contributed to a desired brand-image that, in turn, has marketing value to the remaining segments.

Conversely, the main disadvantages are issues dealing with customers from markets not targeted yet, the time required to reach the Serviceable Available Market, and risks from revealing the business’ innovation characteristics and consequently loosing first-mover advantages.

2.4.3 Summary

Regarding the promotion of Internet businesses there are frequent oversimplifications, for instance:

- Good products and services lead to viral patterns;
- Search Engine Optimization leads to a free and steady stream of new customers.
- Online Advertising Networks generate incoming traffic without great implementation efforts;
- Affiliate programs are easy to develop and have widespread adoption.

However, methods that do not have a direct cost overhead (e.g. Viral patterns, SEO, Affiliate programs) are associated to a degree of uncertainty that might jeopardize the whole business. In turn, advertising investments sustainability is highly dependent on conversion-rates. Nevertheless, the predictability of advertising renders it as the most reliable method and therefore, a business must have resources to support aggressive marketing investments in order to minimize its risks.

In this context, the Cost-per-Customer Acquisition is one of the most important metrics for the evaluation of marketing strategies. Regardless of whether a marketing tactic consists of SEO building, content marketing, social media presence, advertising, etc., it has a cost, either in external services or internal human-labor. This metric corresponds to the ratio of the cost of a marketing action by the users acquired from it.
Concerning Market-entry, since each strategy has its strengths and weaknesses, they must be considered case-by-case in the perspective of a specific business, such as, its SWOT analysis or its resources, among other characteristics.

2.5 Business Models

The “business model” concept [5] can be interpreted according to two related but distinct perspectives: On one hand, it is often understood as the method by which a business monetizes a product or service. In other words, it corresponds to its revenue sources [6]. On the other hand, it is also taken as the dynamic structure of a business as a whole namely, why and how it generates value to its customers [7]. In this latter interpretation, a business model refers to the construction targeted by a business plan and it includes aspects such as the value proposition, customer segments, key activities, cost structure, etc.

In this section, we adopt the first interpretation and analyze existing strategies regarding the monetization of businesses, particularly the ones that consist in Web platforms.

2.5.1 Monetizing Online Businesses

The monetization method of businesses that sell physical products or a service that requires significant human intervention, generally ought to belong to the category of Paid business models, due to the intrinsic production and other variable-costs. Although this general category encompasses several variants (e.g. flat fee, subscription or razor-blade), the degree of flexibility is much less than the available to many Web businesses, which are characterized by having a non-tangible offer.

For instance, platforms consisting in content organization and delivery, sharing and communication, market facilitators, among others, have a core activity that is highly scalable and, as a result, these businesses are able to serve a huge market without a significant investment. For these reasons, online businesses’ monetization methods feature much greater variability and can be conventionally divided into the following categories: Free, Paid, Mixed, Revenue Sharing.

Free services. The negligible variable costs associated with user consumption of some Internet-based businesses supports the existence for Free services [8]. When this is the case, selling Advertisement space often constitutes the major revenue source. However, this strategy often implies modest average revenues per user (ARPU) [9] and, consequently, the business must not only be targeted at a massive market but also achieve a considerable traction in order to guarantee profitability. Although the lack of barriers-to-purchase contributes to a faster growth, if the market-size is limited the low ARPU might restrain long-term sustainability.

Third-party Ads are the most common form of monetizing Free services. In the online Advertisement market, the most frequent business models are Cost-per-Click (CPC), Cost-per-Thousand impressions (CPM), and Cost-per-Action (CPA). These metrics are all mutually related. For instance, by considering the Click-through-Ratio (CTR), CPM and CPC can be expresses in terms of each other. Expressing them as CPA is slightly more complicated as it depends not only on the bounce and conversion rates of the target businesses, but also on their margins. Nevertheless, we can consider that all models are equivalent in the sense that accurate estimates using one metric should be in the same order of magnitude as the results according to another metric, taking into account that metrics furtherer apart from the advertiser goal customer behavior implicitly incorporate the statistical likelihood of the user performing the remaining necessary actions.
The size and dispersed nature of the Internet turns the calculation of Industry averages unfeasible. Nevertheless, to provide a frame of reference Table 2 presents some figures concerning the cost of Advertisement space in Facebook⁷.

<table>
<thead>
<tr>
<th>Sector</th>
<th>CTR</th>
<th>CPC</th>
<th>CPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecommunications</td>
<td>0.919%</td>
<td>0.34 $</td>
<td>1.39 $</td>
</tr>
<tr>
<td>General Retail</td>
<td>0.502%</td>
<td>0.31 $</td>
<td>1.39 $</td>
</tr>
<tr>
<td>Health and Beauty</td>
<td>0.433%</td>
<td>0.36 $</td>
<td>1.00 $</td>
</tr>
<tr>
<td>Publishing</td>
<td>0.790%</td>
<td>0.22 $</td>
<td>1.75 $</td>
</tr>
<tr>
<td>Entertainment</td>
<td>0.439%</td>
<td>0.26 $</td>
<td>0.78 $</td>
</tr>
<tr>
<td>Deals</td>
<td>0.165%</td>
<td>0.39 $</td>
<td>0.23 $</td>
</tr>
<tr>
<td>Dating</td>
<td>0.027%</td>
<td>0.38 $</td>
<td>0.10 $</td>
</tr>
</tbody>
</table>

Table 2 - Facebook’s Advertisement metrics across Industries

It is important to note that the actual rates applicable to a specific business’ revenue have the tendency to be lower because typical businesses do not have Facebook’s massive population of interested advertisers and are also subject to commission-fees of intermediary Ad delivery networks.

In fact, the ranges at stake – in terms of metrics such as the CPC and CPM - indicate that in order for an Ad-based website to have a profitable business model it has to achieve overwhelming adoption, retention and use. Furthermore, it has to be connected to a related but non-competing money-intensive industry, from which it indirectly capitalizes.

As examples of Web businesses whose monetization model is mainly Ad-supported we can cite some of the most popular websites such as, Facebook, Twitter, YouTube or even the Google’s Search Engine and email service (Gmail).

Finally, regarding free services, it is important to mention three alternatives to Advertisement-based revenue models: Donations, Partnerships, and Third-party investment. Donation models are typically applicable to non-profit products or services of recognized social value. In this regard, Wikipedia is one of the most known examples. Partnerships provide royalty-based revenue when, although the business model is free for end-users, it is associated to complementary commercial products or services that this way capitalize on the business at hand. Finally, third-party investment often takes the form of Venture Capital injections and is often associated to the early stages of a startup. Although technically investment does not constitute a revenue source, it does provide the capital necessary to sustain growth. In such cases, even before the business implements a direct source of revenue, the economic potential underlying a massive user-base and projections that take into account the future implementation of a monetization strategy can turn the business extremely attractive for debt or equity-based investments.

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⁷ Source: SalesForce “Here is the Facebook Data That Shows Why All Ads Need Social Context” (salesforce.com)
**Paid services.** Paid services typically correspond to a flat fee, a subscription fee, or a combination of both. In either case, it is frequent to observe the existence of trial versions, as a marketing strategy aimed at decreasing barriers-to-purchase by allowing experimentation. These versions present some sort of limitation over the complete service, such as, restricted time span for usage, less available features, among others (e.g. watermark).

Unlike free models, paid services exhibit significant barriers-to-purchase. Specifically in the case of internet businesses, where a considerable percentage of users still faces difficulties using online payment methods due to lack of means (e.g. credit card) and risk aversion (e.g. fraud and malware concerns). This is especially true if there are competitors with a similar offer adopting a Free model.

There are two main advantages of this model. Given the significant ARPU of each converted user and the order of magnitude of the markets accessible by internet, even a modest penetration rate can guarantee great profitability. In addition, some payment methods support subscriptions that must be proactively canceled by the user, thus increasing the retention rate of paying customers.

Finally, this model has several variants (e.g. flat fee, subscription, pay-as-you-go, razor blade) and, as an example of one expanding businesses successfully using a subscription-based revenue model, we cite Netflix.

**Mixed.** Mixed business models divide their offer into subsets that comply to different strategies. This way, they attempt to better explore the trade-offs between the advantages and limitations of simpler models, by varying the features or quality of service each user has access according to how much he is willing to pay. If one of the components is Free, the Paid features are complementary and are not actually necessary for the product or service usage. For this reason, the latter features can be considered Premium, and the overall business model designated as Freemium.

As an example, we can cite the popular Dropbox file storage and sharing service, where the service is fully functional for free but purchasing an account upgrade provides additional capacity, among other features.

**Revenue Sharing.** Finally, if a business acts as a market facilitator then at least one of its customer segments is using the service as a marketing, distribution or payment channel, therefore earning income from the transactions partially enabled by the service. In this case, the typical monetization method consists in a commission over the earnings of the parties that are selling their own products or services. Since their costs are frequently a small percentage of the corresponding revenue and both are usually directly linked, this model does not present the typical barriers-to-purchase.

Most open commodity marketplaces (e.g. B2B2C, C2B2C) follow revenue sharing principles. Yet, some paradigmatic examples are linked to players from the accommodation industry, for instance, Booking and Airbnb.

### 2.5.2 Pricing

**Pricing strategies.** The Pricing strategy and methodology is tightly coupled to the Business Model and it refers to the pricing policy of a product or service according to general business goals. It is important to underline that the strategy underlying setting a specific price is not necessarily connected to maximizing the direct profits from the corresponding sales. For instance, a business might choose to temporarily reduce profits in order to eliminate competitors or enter new markets, to sell a product with a low margin to increase the sales of complementary – high margin - products (razor-blade business model) or artificially increase the price of a product to suggest perceived opportunities in similar but cheaper products or signal quality.

In cases where pricing has the sole purpose of maximizing direct profits, the methods employed explore customer’s willingness to pay by maximizing the relationship between purchase likelihood and margin, which typically are inversely correlated. In this regard, the most common methods are
Competition-based, Cost-Plus-Margin, and Value-based, each with strengths and weaknesses in particular circumstances.

It is important to note that the aforementioned decisions have to take into account plenty documented phenomena regarding the impact of price in customer decisions, such as: the different price sensitivity according to the nature of goods and services (e.g. elastic vs inelastic demand); the degree of reflection in the context of purchase (i.e. thoughtful vs impulsive); the harsh psychological barriers between subtle differences (e.g. .99c barriers), among many others.

Finally, in order to be compatible with the business as the whole, in practice decisions concerning the price of a product or service are influenced by factors such as the production costs (both direct and indirect) or the expected market penetration. These place fairly rigid lower and higher bounds between which the actual price is determined by anticipating customer behavior when weighing the perceived value of an offer with its price or, more precisely, its cost.

**Customer Cost.** In the previous section we considered that customer’s purchase decisions are based on the relation between value and price. As we shall see, this is an oversimplification that might lead to an inaccurate assessment of customer behavior and, therefore, market penetration. Customers’ evaluations take into account plenty other factors (e.g. perceived timeframe of the opportunity, social pressures) from which we highlight the customer cost, when interpreted in a complete sense.

In addition to Price, customer cost also includes several other factors connected with complementary activities that have money, time, or other repercussions, namely:

- Purchase costs: Costs obtaining necessary information, accessing distribution channels, performing transactions, and carrying out further steps necessary prior to usage (e.g. transportation, assembly);
- Use costs: Operating costs such as energy or maintenance;
- Post-use costs: Costs mainly associated to product disposal.

In short, businesses have to adopt the mindset of their customers, that is, consider all customer costs and their relation to the business offers’ value.

**Payment method.** Finally, in order to materialize a purchase a transaction must occur. While in offline businesses this issue does not have significant implications – with a plethora of widely spread methods familiar to populations – in online businesses it is not as straightforward.

In fact, in Internet the purchase-cost has a major component connected to the available payment methods. This component is responsible for significant barrier-to-purchase, given that, for instance:

- A significant percentage of Internet users do not have a credit card or virtual wallets, the most common payment methods.
- Overhead and multi-step processes that are responsible for usability problems and less impulsive buying patterns;
- Security concerns, both concerning merchants and the customer devices.

This means that a customer might reject a purchase opportunity even if it would be willing to do so using an offline payment method.
2.6 Conclusions

In this chapter we described some of the major issues concerning the definition and implementation of a Business Plan for an Internet business.

The most prevalent conclusion relates to the fact that every decision has multiple consequences across the different dimensions of a business. In simple terms, monetization methods can be placed in a linear spectrum according to their price for the customers. The Free end presents high conversion rates but low ARPU whereas in the other end, the exact opposite holds. According to this framework, we can associate frequently underestimated threats to both extremes and their prevalence in each specific case can be estimated - and therefore managed - by considering the relative position of a business in the aforementioned spectrum. In this context, we will now analyze the main consequences of predominantly Free models and Paid ones.

Business Models and the variable-costs

If the ARPU is considerable low, then the variable costs inherent to providing the product or service to an additional customer must be almost negligible. Otherwise, the added revenue earned from each user does not cover the additional cost incurred. However, the fact that a business is Web-based does not necessarily that it has low variable-costs. For instance:

- Given that the technology underlying Internet seldom implies considerable infrastructure costs resulting from the average computational capacity required by each individual user, variable costs are frequently underestimated. However, this does not appropriately describe the offer of some businesses, as for example, when the product or service provided includes rich-media streaming and the corresponding high bandwidth and storage requirements.

- Furthermore, many businesses cannot be fully-automated and do require human intervention. For example, to monitor user generated content and behavior or to provide a professional and responsive customer service. Unlike technological scalability, if an increase in human labor is directly or indirectly connected to customer growth, then the business model must provide a reasonable ARPU. Regarding customer service, it is noteworthy to underline that an unsatisfying customer experience not only leads to a low retention but also prevents word-of-mouth patterns or foster negative ones.

Business Models and market penetration

To compensate for a modest ARPU, a business must be able to achieve and retain a large user-base, capable of providing a multiplicative factor that compensates fixed-costs and reaches overall profitability goals. In this regard, there are common misconceptions:

- The fact that good VPs intrinsically guarantee effective dissemination, which frequently leads to the conclusion that the business model does not have to support marketing investments. However, spontaneous dissemination phenomena in which existing customers directly or indirectly gather new clients are, in most cases, characterized by amplifying traditional marketing strategies instead of being able to replace them. This is particularly emphasized in early-stages, when the amount of existing customers is negligible.

- That when a business is targeted at the mass market even a low-penetration can guarantee viability and the often implicit assumption that low-penetration rates are easy to achieve, therefore avoiding potentially negative consequences from the inability of a Business Model to support marketing investments. Not only low penetration rates are not always easy to achieve but, additionally, in many cases the very concept of the business product or service itself is not compatible with low penetration as it happens with Web businesses that have a collaborative or social nature and, for this reason, the actual value proposition offered to each specific user is
dependent on the extension of the existing user-base and how their goals match. This way, even a platform that offers a pertinent solution to an existing problem might be useless to each new potential user simply because there are too few users.

In conclusion, the low ARPU associated to Free models frequently limits the ability of a business to invest in area such as, customer service, scalability, and marketing, being the latter particularly necessary to kick-start the significant market traction also related to Free models. Unsurprisingly, if that CAC cost is greater than the ARPU, the marketing plan and business model do not fit together.
3 E-LEARNING PLATFORMS

E-Learning refers to learning activities performed through electronic communication means and, as previously explained, is a subclass of the closely related concept of Technology Enhanced Learning. Since that there are innumerous platforms that provide e-Learning services, in this chapter we analyze the features, uses, and business models of the most important types, while exemplifying with some specific cases.

3.1 Web conference providers

There are several online platforms and applications that provide Web conferencing services and that may be retargeted to e-Learning activities in different ways. For instance, some support Webinars (e.g. WebEx) or other types of group teaching activities, while others offer general communication services which can, nevertheless, be used for e-Learning purposes (e.g. GoToMeeting, Skype).

Web conference providers distinguishing features are mostly linked to audio, video and textual communication, as well as, the associated online presence management. If a platform is targeted at learning activities, it often also includes shared whiteboards, documents or even remote screens.

Typically, the market of these platforms - in the perspective of e-Learning needs - is comprised by organizations and individuals who want to perform a teaching activity aimed at a small to moderate-sized group.

Finally, usually the business model is simply a paid service (e.g. GoToMeeting) with possible a trial period or based on Freemium features, such as, the capacity to exceed a certain amount of participants (e.g. WebEx) or interoperability related add-ons (e.g. Skype).

Figure 5 - Screenshot of Cisco WebEx 1.0.1
3.2 Learning Management Systems

Learning Management Systems (LMS), like Moodle, are platforms that allow the storage, organization and retrieval of multiple types of learning materials or other shared elements that are operationally useful in the context of an academic course.

Essentially, Learning Management Systems support the communication of educational elements between teachers and students in an asynchronous manner. These elements might be learning resources (e.g. papers, presentations) or course organization tools (e.g. calendar). Typically, these services support teacher-student email-like communication but sometimes also real-time (i.e. text, video, and audio-based) or even community boards. Concurrently, they allow both students and teachers to keep and manage their resources. This latter feature is more important for teachers, who need to handle the situation of hundreds of students, than to students, who typically only have a few disciplines.

The market of these solutions are organizations where teaching is the core activity, such as, schools and universities. Typically, LMS are not cloud-based and therefore they require deployment and configuration by a systems administrator. This fact makes these platforms either difficult to setup by organizations with short access to technical staff or expensive.

Regarding the business model, it is either a Paid one, in the case of commercial platforms, or based on royalties from vendors of associated services, in the case of open source software.

3.3 Repositories

Document and media repositories (e.g. Slideshare) include the storage, indexing, and delivery of learning materials. Usually, there is little to no interaction between the author and readers and, as in the case of web conferencing software, there are repositories entirely devoted to learning whereas others are of general use but are often used for that purpose.
Concerning repositories, the main additional features are linked to the organization, rating and commenting of materials, the market is relatively undifferentiated, and the business model is frequently based on Advertisements or in the subscription of Premium accounts for corporate users (e.g. Slideshare).

3.4 Online Courses

Online course platforms, such as Coursera or Udacity, are related with repositories but offer a more integrated approach. Instead of a material covering a particular topic, there is an organization – and possibly a chronogram - interleaving reading and practice in order to mimic traditional courses. There is also a selection of what materials are most relevant by the course manager and frequently courses are associated to tests which might even correspond to competences certification.

The market of these solutions is largely tied to individuals with professional occupations that are not compatible with some requirements of the traditional educational system or students that seek training in a different field. The most common business models are based on partnerships with the institutions that effectively implement the online course (e.g. Coursera) or on Freemium-like pricing of certain resources (e.g. some courses in Udacity) or features (e.g. certification methods).
3.5 Question & Answer Services

In Q&A websites (e.g. StackOverflow) users can submit questions or problems and then wait for answers from experts or peers, which are subsequently reviewed. Typically, these crowd-based platforms are intrinsically linked to a reputation system based on participation and ratings. It is important to note that some discussion boards (i.e. forums) fit an analogous purpose.

The Market of these solutions is composed by students and professionals facing a particular and, often isolated, problem. In turn, business models include selling Advertisement space (e.g. StackOverflow) or even complete answers (e.g. Expert Exchange).
Online tutoring

Recently, some platforms provide access to online tutors 24/7. Here, students post a question to a tutor who then attempts to answer it. The means by which problems and solutions are expressed and conveyed might be text-based and relatively asynchronous (e.g. StudyPool) or include features similar to e-Learning web conference providers (e.g. Chegg Tutors; Tutor.com), that is, real-time communication by audio, video, text, shared whiteboard, screen, documents.

Finally, the market of these solutions is comprised by students that need immediate help when facing a particular problem and the business model is based on revenue-sharing, although in the perspective of students it is a completely paid service with relatively expensive rates starting from 0.5 USD (Chegg Tutors) or 0.66 USD (Tutor.com) per minute.
Figure 10 – Screenshot of Chegg Tutors

Figure 11 – Screenshot of Tutor.com rates
4 TUTORPOLY: DEFINING A BUSINESS OPPORTUNITY

In this chapter we describe our platform from a Business-oriented perspective. For that reason, despite some organizational differences, it covers the major aspects of a typical business plan, with the exception of some topics highly dependent on a particular promoter entity and other practical circumstances.

We will begin by describing the identified opportunity and assess the corresponding market. Finally, we define the business model and outline our marketing plan.

4.1 Opportunity

4.1.1 Context

Learning activities take place in multiple contexts. For instance, they may be part of structured academic education or a result of a prompt – often professional – problem. In either case, it is widely accepted that interactive processes, such as tutoring or a conversation with a known expert, are much more effective than passive methods, such as most learning materials or even traditional teaching classes with a medium to large audience and consequently, low student participation.

Although the reasons behind this fact are out of the scope of this document, it is clear that when faced with a problem of knowledge application – as opposed to pure recollection - easy access to the applicable body of knowledge or even annotated solutions to analogous problems is by no means a replacement of private (or small-groups) interactive tutoring.

The difficulties underlying solo efforts are highly accentuated in disciplines that exhibit strong dependencies between the methods and issues covered under different topics, such as mathematics, because the difficulty may be rooted in the poor consolidation of a distinct area, which is hard to identify by the student after some chronological distance.

The influence of interactivity in learning is highly manifested in traditional education systems since that an overwhelming majority of courses is structured around live classes or other forms of learning activities that foster interaction (e.g. practical lessons). This structure is relatively constant in regard to variables such as, country, level, or subject. Nevertheless, more economically developed countries frequently feature a complementary system of private tutors, with major prominence in specific subjects and levels, which further emphasizes the major role of interactivity in the effectiveness of learning.

Finally, it is important to note that nowadays there are private tutors carrying their activity in a freelance manner, as well as, by means of a formal organizations entirely devoted to tutoring activities (commonly known as “tutoring centers”).

4.1.2 Problem

Given the aforementioned importance of interactive, real-time, tutoring, we identified several cases where the market lacks a satisfying offer. These are tightly connected to the different customer segments implied in tutoring activities, namely, students, freelance tutors and teaching organizations.

Students need Just-in-Time experts. Students face unforeseen difficulties frequently. If the student has the need to recollect previously assimilated knowledge or techniques, certainly it has access to multiple offline and online sources that can provide a solution. However, if it is a matter of knowledge comprehension and application, then it often needs dedicated and custom assistance. When this happens, a student might resort to a personal tutor or a social acquaintance with recognized expertise.
Nevertheless, typically personal tutors are only a possibility in the context of families with a relatively high income that also live in urban centers of considerable size. Additionally, expert social acquaintances are often only available in families with high academic backgrounds and regarding popular and low-level subjects.

In short, when students that do not have access to a private tutor face a specific academic problem, they do not have a way of getting help, particularly when time is of the essence.

**Freelance Tutors need channels.** For several reasons out of the scope of this document, there are a significant number of people who professionally resort to freelance tutoring activities. If the relation between supply and demand in the tutor's expertise field and geographically area meets certain conditions, the tutor might use several methods to advertise and execute his services. When any of these implied conditions does not verify, online tutoring is an alternative. If the tutor has this goal in mind, it needs to solve several problems: Advertise its services in order to find students; Prove its competences and pedagogical ability to potential customers; Carry mutually agreed transactions; Perform the Lesson activity itself.

Professionals who want to perform online tutoring activities have to successfully perform a sequence of steps throw several different services and methods. The associated complexity highly decreases conversion and retention rates.

**Training organizations need e-Learning platforms.** Nowadays, there are innumerable organizations either entirely or partially devoted to training initiatives. Moreover, a significant part of which have e-Learning as a total or complementary method (i.e. bLearning). When a training organization wants to offer e-Learning activities it has multiple tools available. However, either they are third-party hosted and, for that reason, they are not a branded channel or they are proprietary and consequently require significant investment and technical expertise to setup and maintenance. Moreover, in either case, most of these tools do not include a payment model synchronized with student enrollment and participation, which poses an additional problem with greater amplitude in pure e-Learning courses without offline interactions where the transaction could take place by conventional means.

Organizations with training activities do not have a turn-key white-label e-Learning environment at their disposal, with integrated communication and selling features.

### 4.1.3 Solution

We intend to solve the problems identified in an integrated manner, by developing a proprietary, but embeddable, real-time e-Learning environment coupled to a C2B2C crowd-reviewed private tutoring marketplace.

The live e-Learning environment includes audio, video, and text-based communication, as well as, document and screen sharing or collaborative sketchpads. This ensures Lessons are fully interactive, in consonance with our positioning. Since there are multiple moderately well-known e-Learning environments with similar characteristics, we do not further describe TutorPoly's live interaction tools for the moment. Nevertheless, an important additional and distinguishing feature is the default inclusion of a code snipped designed to allow a swift integration of the e-Learning environment into Websites of third-parties. This description is represented visually in Figure 12.
The marketplace facet is much less common. In this context, our platform provides features that allow tutors to advertise and disseminate their services and, in a complementary manner, students to find available experts. Moreover, it also provides an immediate monetization method, by enabling secure transactions between the parties involved.

The review-based system provides a degree of quality assurance to students. The effectiveness of these systems is well proven in open markets of commodities. In turn, it also allows tutors to attest their technical and, most importantly, pedagogical competences.

Because the average review given by a student is visible by potential tutors, and the latter might reject a student that apparently gives biased ratings, the former are encouraged to provide fair classifications. The soundness of this system contributes directly to reliability of the platform and overall customer satisfaction. It also opens interesting Marketing possibilities, as we will observe.

Finally, the business model from the perspective of tutors and students obeys to, at its essence, a pay-as-you-go structure, which further protects students and tutors. If for some reason a tutor does not meet a student’s expectations, the latter may leave a Lesson before incurring into additional costs. In a parallel manner, if the tutor feels it will be unable to satisfy students, he can save customers’ credits by interrupting the lesson and therefore sparing his classifications from a negative review.

The features mentioned thus far provide value to all parties involved, sometimes in a paired manner. Nevertheless, the customer value underlying certain aspects is better understood from the point of view of a specific segment, as we shall see next.

**Value Proposition for Students.** Students can use the platform to find a tutor capable to immediately assist them solving their problem in the synchronous e-Learning environment. There are multiple factors that collectively practically guarantee “Just-in-Time” expert availability:
• The global nature of the Internet, both by means of geographically distant experts in a specific field and because many countries with a significant population share the same language;

• The complementary fact that the English language continues to gain wide acceptance as a *Lingua Franca*, with effortless communication among millions and particularly those who already achieved the higher levels of education;

• The widespread availability of home-based Internet, which means users’ access is not limited to the working-hours;

• The growth in mobile access and the subsequent *Push notifications*, which means that users are *online* even when involved in *offline* activities, by means of asynchronous announcements and warnings.

As importantly, two facts highly contribute to solving the economic exclusion some students face in the context of private tutoring activities.

• Exploring the purchasing-power discrepancies among different countries. For instance, the potential match between the goals of highly trained experts from less developed countries and remote students is highly economically advantageous for both;

• The nature of our platform transparently facilitates singular lessons (i.e. “one-time”). This way, students with low resources can resort to it on an exceptional and *pay-as-you-go* basis, an arrangement “*offline*” tutors typically do not tolerate.

Collectively, these facts support the conclusion that the platform actually solves important general student’s problems and, in particular, those deprived of reasonably high economic conditions.

**Value Propositions for Tutors.** Using the platform, tutors may advertise their services and, subsequently, provide Lessons to interested students.

The decentralized nature of the platform is of particular interest when there is not sufficient demand of tutoring services in the geographical area of the expert. In this case, the services provided through our platform can function as the main or a subsidiary source of income. In this regard, it is important to mention that the complementary revenue can arise both from students acquired through the platform marked as well as from additional lessons provided to ordinary, *offline*, students (e.g. in the evening before an evaluation).

An additional important consideration concerns the region of students acquired through the platform. Although, in principle, students might be from distant locations, the platform will offer tools that allow tutors to control the visibility of their offers according to geographical criteria. This way, a tutor may offer lower rates to students in their vicinity so that, in the subset of cases where the student is retained, the Lessons might be converted to the traditional (*offline*) setting.

As a final point, the presence of a payment module guarantees the platform covers all tutor’s needs. It is important to underline that the absence of this module would posit technical difficulties that both parties would have to solve together by resorting to third-party tools, a behavior hard to achieve in practice.

**Unique Selling Proposition for teaching organizations.** The value proposition for teaching organizations is quite similar to the one presented by self-hosted or cloud-based Web conference providers or Learning Management Systems that include a conferencing module. For this reason, it is more interesting to describe our Unique Selling Proposition instead, that is, what makes our solution unique instead of what customers can achieve through its adoption.

In this regard, using an embeddable code snippet, organizations can setup an e-Learning environment in their own channels without any effort. Just like inserting a Google Map in a webpage. In turn,
customization options and a modest vendor fingerprint, allow brand-consistency and continuous end-
customer experience.

Finally, the payment module allows organizations to even delegate the enrolment and possibly associated payments to the platform, but again without their customer never leaving their own institutional website.

4.2 Market

Quantifying a global market is not trivial. Frequently, less developed countries do not follow procedures indispensable to produce reliable statistical reports and - to make things worse - most countries do not belong to organizations that study and document aggregate normalized statistics about fine-grained topics, requiring a case-by-case and practically demanding data collection. However, following the TAM, SAM and SOM division provides a framework for narrowing down potential clients sequentially, while at each step more information can be gained to aid in subsequent analysis.

As an important preliminary consideration, from the market’s perspective our platform addresses three distinct customer segments: students, private tutors and teaching organizations. At first glance, these segments would have to be quantified separately for an accurate assessment of our market’s size. However, as we shall see, the revenue captured by our business model is, directly or indirectly, tightly linked to the number of actual Lessons that take place in the platform, and more specifically, between students and private tutors. Therefore, it is more realistic to consider not the number of members of each segment but the relation between the figures of complementary segments, that is, the one that might place a bottleneck in the other. In this regard, it can be argued that there is no real bottleneck because the pricing of Lessons adjusts in such a way that supply always matches demand. Nevertheless, our value proposition for students is also based in customer cost. Therefore, if students demand more Lessons than the ones Tutors are able to satisfy, price may rise in a way that, in effect, excludes some students from our market.

As a result, we can consider that:

- The TAM is characterized by the total number of students which can potentially be our clients regardless of their capability to face price adjustments;
- The SAM is the number of students whose economic power is likely to guarantee they can cope with tutor's price;
- The SOM is the portion of SAM that our business can actually reach, according to its positioning, strengths and marketing strategies, as well as, taking into account the complementary market of available teachers required to face their needs.

4.2.1 Total Available Market

Our TAM is composed by the number of secondary and tertiary students worldwide. Table 16, in the Appendix, is based on the most recent data from UNESCO, the most complete and accurate source of information related to global educational systems.

It is important to highlight that the number of students in each country is also an useful indicator of the number of teachers in that territory, even considering the fact that the student-to-teacher ratio varies significantly among educational systems. To conclude, our TAM is summarized in the following table:

<table>
<thead>
<tr>
<th>Secondary Level</th>
<th>Tertiary Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>567.831.225</td>
<td>198.019.768</td>
<td>765.850.994</td>
</tr>
</tbody>
</table>
Table 3 – TutorPoly’s Total Available Market

It is important to note that these numbers are an underestimation of our actual TAM, because it does not include students from other levels nor professionals.

4.2.2 Serviceable Available Market

The number of students worldwide is not very meaningful to our business, given the fragile economic and human development environment of a considerable number of countries. Therefore, in order to compute our Serviceable Available Market we need additional data about the countries listed in Table 16, such as indicators connected to the economic conditions of the households that correspond to the students in each level.

Indicators that refer to the whole population, such as, the GINI index, Gross National Product per capita, Average Household Disposable Income or the percentage of population below poverty line, are certainly correlated to the percentage of students that exceed a certain purchasing power but do not provide any reasonable rationale for setting that threshold precisely. Consequently, we begin by limiting our countries to the members of Organisation for Economic Co-operation and Development (OECD). On one hand, since OECD encompasses 34 countries that typically rank very high in virtually all development criteria, such as, education, economic, and communications (e.g. Internet access penetration) and considering the dependence of our business from such factors, this reduction does not produce any considerable underestimation of our market’s size. On the other hand, there is much more detailed data about these countries, allowing us to perform more accurate estimations.

In this context, we will use an indicator of great explanatory power, namely, quintiles of gross national income (GNI) at purchasing power parity (PPP), based on WorldBank Data and presented in Table 17.

Using this information, we are able to estimate the percentage of population with economic conditions suited to our platform. We begin by excluding the 20% richest population of each country, on the grounds that those families can afford an offline private tutor. We do this regardless of the absolute value of income, because even if it is low compared to other countries, the price of private tutors should also be proportionally reduced, turning them accessible. Next, we dismiss the percentage of population whose income is less than 15.000$ per capita. Although the figure of 30.000$ per household (with the exception of mono-parental families) might seem low for affording private tutoring classes, we highlight that our platform is aimed precisely at those who cannot afford them, but can nevertheless purchase singular lessons on same specific occasions. After these considerations, the percentage of population of our Serviceable Available Market (in bold at Table 17) is shortened at the following table.

<table>
<thead>
<tr>
<th>Secondary Level</th>
<th>Tertiary Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>59.431.529</td>
<td>35.136.689</td>
<td>94.568.218</td>
</tr>
</tbody>
</table>

Table 4 – TutorPoly’s Serviceable Available Market

4.2.3 Serviceable Obtainable Market

As explained earlier, our market it tightly related to the number of students that comprise our potential clients. However, although this number is a good approximation for the purpose of computing the TAM and SAM, when computing our SOM we also analyze the number of potential private tutors and teaching organizations, leading to a better understanding of our market which, in turns, supports further decision processes concerning our business plan and the assessment of its overall viability.

Number of Students. The definition of our SOM is highly dependent on our overall strategy. In regard of the student’s customer segment, we begin by filtering our target clients according to their language, namely, to English, Spanish, and Portuguese-speaking countries. This decision is justified by several
reasons: The total size of the corresponding populations, the cultural affinity to the business-decision makers, the cost and complexity of developing a platform that supports innumerable languages, alphabets, and currencies, among others. However, one of the principal motivations results from the fact that these languages include, at the same time, countries with considerable economic power and countries with much less per capita income but, nevertheless, a great number of well-trained teachers. Additionally, when computing our SOM we also exclude the tertiary level students to narrow-down our market-entry focus, despite its enormous future interest resulted from the high specificity of subjects and familiarity with electronic payment services. As a result of this strategy, our SOM corresponds to the data presented in Table 5.

<table>
<thead>
<tr>
<th>Country</th>
<th>Secondary Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>2.384.025</td>
</tr>
<tr>
<td>Ireland</td>
<td>340.829</td>
</tr>
<tr>
<td>New Zealand</td>
<td>295.488</td>
</tr>
<tr>
<td>Portugal</td>
<td>798.925</td>
</tr>
<tr>
<td>Spain</td>
<td>3.296.359</td>
</tr>
<tr>
<td>UK</td>
<td>6.496.973</td>
</tr>
<tr>
<td>USA</td>
<td>24.095.459</td>
</tr>
<tr>
<td>Total</td>
<td>31.228.749</td>
</tr>
</tbody>
</table>

Table 5 – TutorPoly’s Serviceable Obtainable Market

It is noteworthy to mention that the fact that English is a *de facto* Lingua Franca, signifies that our SOM is highly underestimated. The portion of the SAM that speaks and understands English reasonably well can also benefit from the platform the same way countries whose official language is English.

**Number of Teachers.** Although the number of private tutors must be analyzed in order to assure that the students in our SOM have an offer that meets their demand, the number of freelance tutors in a given region is not easy to estimate because their activity is frequently unregulated and thus untraceable. Nevertheless, several facts support the conclusion that the number of available teachers is able to satisfy students’ demand, for instance:

- The quantity of private tutors implied in studies that measure the number of students that resort to private tutoring activities [10];
- The number of teachers inferred from the teacher-student ratios [11];
- Statistics concerning teacher employment rates, since that unemployed teachers are potentially available for private tutoring activities\(^8\);
- The total working-hours of secondary level teachers with few classes, since that even considering time spent in lessons, material evaluation, administrative and other complementary tasks, it often does not reach the country’s baseline weekly working-hours.

**Number of Training Organizations.** Finally, as a strategic decision we chose not to pursue the training organizations market as a means of capturing revenue. In fact, our main goal when developing a platform that also explores the mentioned business opportunity, that is, the cost and complexity of implementing an e-Learning environment within a website, is increasing our visibility and therefore the number of customers from other segments. Nevertheless, according to OECD, 61% of EU enterprises are linked to training, 87% of which have continuous vocational activities, statistics that attest the potential value of this market.

\(^8\) According to US Labor Force Statistics, in USA there are 452.000 unemployed professionals with “Education, training, and library occupations” (June 2015).
4.3 Business Model

TutorPoly's business model, in the more precise interpretation of a monetization plan, has aspects of several different models: Revenue-Sharing, Freemium and, from our student's perspective, Pay-as-you-go. In this section, we describe how these models are implemented as well as some additional options to be considered in the future.

4.3.1 Revenue-sharing

At its essence, our platform adheres to a Revenue-Sharing business model, which fits naturally to our business framework since one of our customer segments, the tutors, may provide a paid service to the other, the students. Of the characteristics of this model (described in detail Chapter 2), we highlight the lack of barriers-to-purchase upon the customer segment that collects the revenue, because the price paid is only a small fraction of their own proportional earnings.

In short, the platform takes a small percentage (5 to 10%) of tutor’s earnings in each lesson using a proprietary credit system that guarantees its transparency over multiple currencies and, at the same time, allows flexible marketing tactics.

4.3.2 Freemium

Freemium models are characterized by having a subset of unpaid features, which materialize the main value propositions of the business, and a subset of paid features that, while not indispensable, offer added value to customers that choose to purchase the corresponding access.

The Freemium dimension from the Tutor’s perspective, is grounded in the fact that the marketplace aspect of our platform means students are able to list tutors that match a given criteria. Typically, after a certain query, web listings have an implicit ordering mechanism which can be later changed according to user’s preferences. The existence of highlighted (or sponsored) results is widespread and, for that reason, even if they do not strictly adhere to user’s ordering preferences they do not impair customer experience. Hence, in TutorPoly tutors are able to purchase ads in the form of highlighted results, which constitutes an additional revenue source based on a Freemium feature.

There are two important aspects that further characterize our implementation of this model: it is auction-based and it relies on the platform’s proprietary credit system. Being auction-based adequately captures the fact that multiple criteria such as, regions, disciplines and levels, highly influence tutors availability and therefore internal competition. The usage of the proprietary credit system allows tutors to purchase ads by capitalizing free lessons. That is, a tutor might accept to provide a lesson to a student that is unwilling to convert cash to credits in exchange for the ability to improve is visibility and subsequently gain paying customers. It is important to note, however, that credits acquired in this manner – by providing free lessons – have special rules concerning their conversion to cash, in order to maintain relatively symmetric credit-purchasing and credit-withdrawing conversion rates.

Finally, this time from student's perspective, another aspect of a Freemium business model concerns the ordering of students only interested in free lessons. Before all, we expect that the number of Tutors willing to do so is not negligible. For instance:

- The high community participation in websites such as Wikipedia and, in particular, services like StackOverflow, where people with virtually no incentive or compensation often go to great lengths to satisfy other user’s needs, providing highly complete answers that certainly implied considerable efforts;
• The aforementioned possibility of some credits provided as a reward by the platform itself, for purchasing a highlighted visibility in the system and thus an opportunity to provide more Paid lessons;

• The great reviews that can be accomplished by that process (e.g., students will be highly susceptible to provide good classifications in a free lesson scenario), hence increasing the potential rates of the Tutor’s paid lessons;

• The opportunity to acquire offline students by means of the platform’s support of geographically-based offers and matches;

• The highly likely possibility that, to ease an equilibrium between supply and demand upon market-entry, we hire a set of curate tutors who, being paid in a monthly manner by the business itself, are available to provide free lessons. It is noteworthy to mention that if these hired tutors earn, for instance, 1500 USD per month, this wage results in a 0.16 USD minute rate (based on a 40 hours per week schedule);

• The fact that the platform supports 1-to-many lessons, hence proportionally increasing the potential impact of the above free lesson incentives from tutor’s perspective.

Despite this reasons, it is nevertheless expected that the amount of “free lessons available” does not satisfy all student’s demand. However, on one hand this is actually a positive factor, as if they did Paid lessons would not take place, hence threatening our revenue-sharing model. On the other hand, the difference between supply and demand will cause a “waiting queue” where instant progress can be achieved by a Premium feature acquired by several ways (e.g., “regular client status”, credit packages, social-sharing incentives awards).

4.3.3 Pay-as-you-go

In strict terms, our business does not follow a pay-as-you-go model. Nonetheless, the platform facilitates tutor’s private businesses which, in this context, subscribe to this model.

Pay-as-you-go models have the key advantage of protecting both students and tutors. In addition, they also integrate with (recent and upcoming) micro-payment methods with very low overhead and requirements (e.g., smartphone based). This fact is of particular importance given that a significant percentage of Internet users presents barriers-to-purchase resulting from the complexity and difficulties of traditional internet payment methods (e.g., Credit Cards) and not the price of a product or service itself.

4.3.4 Additional options

Regarding users that embed our platform in their channels for interacting with their own internal customers, our platform is free. We estimate that the users acquired from this kind of dissemination, will turn the training organizations’ customer segment indirectly profitable. Nevertheless, user tracking mechanisms allows us to measure the extent of this effect and, if it does not verify, the corresponding use-case adheres naturally to Ad-supported and resource-usage based Freemium business models. As a result, we leave these alternatives as a contingency measure to face eventual scalability issues.
4.4 Marketing Plan

4.4.1 Marketing channels

Our marketing plan has two main facets: a traditional one, where we consider the common strategies used to advertise internet businesses, and an organic one, closely tied to our platform’s architecture and features.

Two of the most conventional means by which Internet businesses disseminate are Search Engine Result Pages (SERPs) and User-centered actions (e.g. social sharing, word-of-mouth patterns);

A good positioning in SERPs is hard to achieve and difficult to predict. Although it may seem like a “free” marketing channel, the human labor required to perform the actions needed for a good ranking may indicate otherwise. The keywords associated with our business match those of our indirect competitors – and even more distinct players – which makes this option unsuitable.

User behavior is also highly unpredictable before market-entry, particularly in a business that can present a social stigma against its users due to a prejudice of attributing a learning difficulty from the fact that the student needed to resort to a tutor.

Although it is not possible to conclude that these potential sources of traffic will be negligible, due to their unpredictability they are not included in our marketing plan.

Ad-networks. Ad-networks, which place ads in websites and search engines displaying related content, are characterized by a significant cost. Fortunately, the fact that our business has a direct source of revenue (in contrast to a great percentage of web business that have to rely on monetizing their content through Ads), makes it suitable for this kind of marketing strategies. The exact extent of the corresponding campaigns has to be calculated after an empirical assessment of the conversion rates and user’s lifetime value (LTV).

Embeddable platform. As previously described, the e-Learning environment of our platform features (by default) a code snippet that can be used to easily embed it in any website. That is, our platform was conceived and designed to intrinsically support this powerful usage-based dissemination method. Taking into account the market size of training organizations and our Unique Selling Proposition to that customer segment, we expect at least a moderate penetration using direct-sales methods.

In order to foster adoption and avoid perceived conflicts of interests, the embedded environment is highly independent from our brand, for instance, by using a neutral (or client customized) image and by being totally decoupled from the marketplace and review system. Nevertheless, the minimalistic “Powered by” presence should guarantee a level of exposure able to capture potential clients from each of our segments.

Virtual currency. The usage of a proprietary credit system allows us to decouple the credits from their cash equivalent to some extent. Since the conversions work in either direction, this decoupling has to be carefully analyzed to maintain an overall zero-sum property. Nevertheless, this possibility has a great ability to function as an incentive for social-sharing while maintaining the platform consistency and transparency. That is, we will reward users who share our platform in their social media and email accounts.

Content marketing. Lessons are automatically recorded so that the student can recollect and consolidate their content afterwards. In this regard, if all the participants agree, the Lesson recording is also publicly indexed which, in consonance with the content marketing paradigm, can lead to an additional channel of customer acquisition. Additionally, high-quality Lessons (e.g. measured by post-Lesson ratings, number of views) will be emphasized in querying mechanisms and might even be submitted to both specialized and general repositories (e.g. YouTube) so that the associated content
could generate an additional source of traffic (using Description fields, Links, or superimposed Watermarks).

4.4.2 Market entry

Regarding our Market entry, we will follow a waterfall strategy. This means we will approach different markets in successive stages, beginning with the English-speaking countries. This choice has several motives:

- The market-size of the students’ customer segment is significant, in part due to the contribution of the US.
- Common economic indicators (e.g. average household income, GNP per capita) show that the purchasing power of English-speaking students is noteworthy, particularly in counties such as the US, UK and Australia.
- India significant population, as well as, its educational system and economic environment, all contribute to a high number of potential tutors with relatively low fares.
- English functions as an Interlingua, particularly in the Internet, which means it is the natural language for a global website that is not meant to be targeted or associated to a particular region.
- Internet history might lead users to consider that the most successful and widespread web businesses are US-based, which can turn into an unconscious prejudice against business that clearly show a different origin.

4.4.3 Additional options

Although not a priority, we also consider one additional strategy that can yield great marketing results: Curated tutors and Direct marketing;

Curated tutors are a team of hand-picked tutors, covering some important disciplines and levels, used to guarantee the minimal critical mass required for a balance between student’s demands and tutor’s offers. The fact that these would be paid directly by a platform, will also further consolidate the implementation of social-sharing incentives consistent with the credit system properties.

Finally, we consider using a direct sales strategy to approach training organizations, which are limited and indexed in publicly available data sources. Additionally, given that there are a significant amount of websites that index offline private tutors and miscellaneous education websites where non-automated, indirect advertisement is allowed, the corresponding customer segments can also be targeted directly.
5 TUTORPOLY: SOFTWARE REQUIREMENTS SPECIFICATION

In light of the previous chapter, where the main aspects concerning a future business plan of TutorPoly were described, we now turn our attention to the platform itself, which materializes the business’ core value proposition.

Requirements specification is one primary activity – both chronologically and due to its uttermost importance – in the context of Software development processes [12] [13]. It is important to note that this activity should not be a sheer listing of the requirements the system should present, but also other attributes and models that cover aspects of the system from perspectives at distinct levels of abstraction, contributing to its general understanding.

Due to the purpose and coverage of Requirement Specification documents, these often suffer from lack of completeness, consistency and preciseness [14]. To prevent these and other problems, we will adopt RSLingo, a recent approach to Requirements Engineering that elegantly overcomes recognized limitations of previous methodologies.

5.1 The RSLingo approach

In Software Engineering an accurate and comprehensive documentation is essential for a rigorous and unambiguous communication between stakeholders and, consequentially, to guarantee a shared understanding about the system to be built without – often hard to recognize - misinterpretations. For this reason, Requirements Specification is one of the most important activities in the field of Requirements Engineering (RE).

Concerning Software Requirements Specifications (SRS), there are multiple methodologies available with different characteristics and, specifically, distinct levels of formality. On one hand, the ones with significant formality requirements allow for objective – and even automated – validity checks and transformations but, however, are hard to maintain and difficult to adopt by non-Technical stakeholders, unfamiliar with their notation. On the other hand, less formals ones often rely on Natural Language to such an extent that their usage is familiar and intuitive but preciseness and completeness are difficult to assure. For different reasons, either side of this dichotomy can give rise to poor RE practices, which in turn highly contribute to delays, additional costs and even unfulfillment of the delivered system’s goals, from the end-user perspective.

RSLingo [14] is new information extraction approach to RE that allows the transformation of requirements initially written in a Natural Language – shared by all stakeholders - to a formal representation, unambiguous and complete. This way, RSLingo’s architecture and methods avoid the disadvantages - while exploring the advantages - implied in the aforementioned formal vs. natural language tradeoff, hence improving the quality of requirements specifications.

Due to its linguistic nature and by using natural language statements as the starting representation of requirements, it guarantees expressiveness and effective communication. In parallel, by using simplified NLP techniques, RSLingo provides tools that allow an operational mapping between natural language statements and formal constructs, assuring the qualities of formal methodologies.

Specifically, RSLingo is composed by two distinct languages and a mapping between them: RSL-PL and RSL-IL. RSL-PL is an extensible pattern language that allows encoding linguistic patterns useful in the context of requirements specifications. In turn, RSL-IL [15] is an intermediate language designed to formally express issues specific to Requirement Engineering activities, which considers not only their metadata but also their semantics.
The decoupling between both languages - RSL-PL and RSL-IL - allows separating linguistic issues from RE concerns. This increases the intelligibility and productivity of the RE activity without introducing additional complexity since that, by defining a mapping between both languages, when a linguistic pattern occurs in the textual representation of requirements it can be automatically translated to a semantically equivalent formal requirement. In turn, these formal representations are suitable for automated requirements verification (e.g. consistency, completeness) and as a source language of Model-to-Model transformations, useful for validation, communication and even in the framework of Model-driven software development processes.

The RSLingo approach comprises two phases: process-level and a project-level. In the former, both RSL-PL and its mapping to RSL-IL are defined. In the latter, the natural language representation of requirements is written and - according to RE best-practices – a project-specific Glossary should be maintained. This Glossary facilitates the adoption of a consistent domain-specific vocabulary through the project and takes precedence over other general lexical resources (e.g. WordNet) used by the toolset to aid in disambiguation processes and establishing relationships between terms.

This way, RSLingo design allows coping with several frequent and time-consuming problems in RE, such as, ambiguity, communication, among others. It also fosters adhesion to best-practices and avoiding common limitations which for instance, can give rise to combinatorial effects in specifications [16].

In the next sections we describe Tutorpoly according to the RSLingo approach, in particular based on the RSL-IL language. Since that in order to address the most common RE issues, RSL-IL constructs are organized in viewpoints (Figure 13) that belong to two distinct abstraction levels: Business and System, the remaining of this chapter will follow the corresponding structure.

![Figure 13 – RSL-IL viewpoints, extracted from [15]](image)

5.2 Business level

In the Business abstraction level, RSL-IL materializes concerns that must be clearly documented in order to assure the system’s fitness-for-purpose, which in turn are divided in several viewpoints, namely: Glossary, Stakeholders, Goals and Business Process.

5.2.1 Glossary

The Glossary corresponds to the terms used in the domain of the application and that might have a domain-specific interpretation (i.e. business jargon). The constructs of this viewpoint also have attributes that allow matching the defined terms with the entries of general lexical reports, in order to facilitate the extraction of information.
In the case of TutorPoly, our glossary is comprised by the elements of the following table, annotated with the corresponding WordNet Synset in case where our definition is entirely compatible.

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Description</th>
<th>Class</th>
<th>Synset</th>
<th>POS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Tutor</td>
<td>Entity (e.g. private tutor, school teacher) that provides help and knowledge in the context of a learning/teaching activity</td>
<td>Stakeholder; Actor; Entity</td>
<td>Tutor.n.01</td>
<td>Noun</td>
</tr>
<tr>
<td>T2</td>
<td>Student</td>
<td>Entity (e.g. student, trainee) that learns and acquires knowledge in the context of a learning/teaching activity</td>
<td>Stakeholder; Actor; Entity</td>
<td>Student.n.01</td>
<td>Noun</td>
</tr>
<tr>
<td>T3</td>
<td>Participant</td>
<td>Any person that has a role in a learning/teaching activity, namely, tutors or students</td>
<td>Stakeholder; Actor; Entity</td>
<td>Participant.n.01</td>
<td>Noun</td>
</tr>
<tr>
<td>T3</td>
<td>Lesson</td>
<td>A learning/teaching activity, associated to a specific timeframe and communication environment</td>
<td>Entity</td>
<td>Lesson.n.01</td>
<td>Noun</td>
</tr>
<tr>
<td>T4</td>
<td>Session</td>
<td>Timeframe and state of a user logged in the System</td>
<td>Entity</td>
<td>NA</td>
<td>Noun</td>
</tr>
<tr>
<td>T5</td>
<td>Manager</td>
<td>A user with special privileges to monitor and administer the system</td>
<td>Stakeholder; Actor; Entity</td>
<td>Manager.n.01</td>
<td>Noun</td>
</tr>
<tr>
<td>T6</td>
<td>Video Conference</td>
<td>Real-time Uni or Bi-directional Video-based communication between at least two parties.</td>
<td>Entity</td>
<td>NA</td>
<td>Noun</td>
</tr>
<tr>
<td>T7</td>
<td>Voice Call</td>
<td>Real-time Uni or Bi-directional Audio-based communication between at least two parties</td>
<td>Entity</td>
<td>NA</td>
<td>Noun</td>
</tr>
<tr>
<td>T8</td>
<td>Presentation</td>
<td>Uneditable electronic document with a sequence of slides or pages with text and/or graphics.</td>
<td>Entity</td>
<td>NA</td>
<td>Noun</td>
</tr>
<tr>
<td>T9</td>
<td>Whiteboard</td>
<td>Electronic canvas, editable by graphical (e.g. lines, arrows, shapes) and textual tools</td>
<td>Entity</td>
<td>NA</td>
<td>Noun</td>
</tr>
<tr>
<td>T10</td>
<td>Remote Desktop</td>
<td>Real-time Screen content of a remote digital device with display</td>
<td>Entity</td>
<td>NA</td>
<td>Noun</td>
</tr>
<tr>
<td>T11</td>
<td>Credit</td>
<td>Unit of the proprietary cash-convertible system, used to measure tutor’s and student’s activities</td>
<td>Entity</td>
<td>NA</td>
<td>Noun</td>
</tr>
<tr>
<td>T12</td>
<td>Transaction</td>
<td>Operations that convert credits to the user’s currency and vice-versa</td>
<td>Entity</td>
<td>Transaction.n.01</td>
<td>Noun</td>
</tr>
<tr>
<td>T13</td>
<td>Review</td>
<td>A participant statement concerning the quality of his experience (e.g. rating, comment)</td>
<td>Entity</td>
<td>NA</td>
<td>Noun</td>
</tr>
</tbody>
</table>

*Table 6 – TutorPoly’s Business Glossary*

The Glossary presented covers terms used extensively throughout the remaining RE documentation, both at the Business and System levels. This model facilitates the consistent usage of terms and also provides a tool stakeholders can resort to, when facing any interpretation difficulty.
5.2.2 Stakeholders

Stakeholders are the entities that have an interest in the system development. These correspond both to the parties that must communicate about the system design, because they are responsible for its development, as well as, the different types of end-users.

The following table presents the stakeholders of TutorPoly.

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Description</th>
<th>Class</th>
<th>Role (category)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Tutor</td>
<td>A tutor that, using the system, provides lessons remotely to any interested student</td>
<td>Individual.person</td>
<td>Use system (business.user.direct)</td>
</tr>
<tr>
<td>S2</td>
<td>Student</td>
<td>An individual that uses the system in order to take a lesson</td>
<td>Individual.person</td>
<td>Use system (business.user.direct)</td>
</tr>
<tr>
<td>S3</td>
<td>Manager</td>
<td>An employee responsible for monitoring and managing the system</td>
<td>Individual.person</td>
<td>Manager (business.user.direct)</td>
</tr>
<tr>
<td>S4</td>
<td>Enterprise</td>
<td>The company responsible for the system</td>
<td>Group.organization</td>
<td>Self enterprise (technical)</td>
</tr>
</tbody>
</table>

*Table 7 – TutorPoly's Business Stakeholders*

It is noteworthy to mention that both types of stakeholders constitute sources of requirements. Internal stakeholders (i.e. Manager, Enterprise) generate requirements they consider appropriate according to the identified business opportunity, the envisioned solution, and its implementation plan. External stakeholders (end-users such as students and tutors), originate requirement by spontaneous feedback or as a result of formal techniques (e.g. surveys, interviews).

5.2.3 Goals

This viewpoint is fundamental to clarify the purpose of the system and how that purpose translates into specific goals whose fulfillment can be tracked. It also helps assuring that the goals are aligned to the sequence of specific requirements defined in the corresponding viewpoint, this way connecting the system’s features to the business opportunity.

Table 8 lists some major mandatory (requires) and supplementary (supports) goals of Tutorpoly. Here, the IDs have more meaning than in previous tables, as they implicitly reflect the decomposition of goals into sub-objectives.

In the case of the Tutorpoly Business Plan, whose main elements were described in the previous chapter, the online platform entirely embodies its offer and added-value. It also corresponds to the only distribution channel and is one of the most important marketing channels, contributing both to its dissemination, brand-image and customer experience. In other words, the online platform is at the core of the business, considered in all the dimensions, and for that reason, most strategies and objectives defined at the Business Planning stage map directly or indirectly to these Business-level Goals, in the context of Requirements Engineering.

Furthermore, since the Business Plan, explicitly or implicitly, also includes best-practices described in Chapter 2 corresponding to the chosen models, some general aspects of the Internet Business Models also have consequences in this viewpoint.
<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Source</th>
<th>Criticality</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>The system needs to provide an e-Learning service</td>
<td>S1;S2;S4</td>
<td>Very High</td>
<td>requires</td>
</tr>
<tr>
<td>G1.1</td>
<td>The system needs to provide real-time media communication</td>
<td>S1;S2;S4</td>
<td>Very High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.1.1</td>
<td>The system needs to operate without plugins</td>
<td>S1;S2;S4</td>
<td>Very High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.1.2</td>
<td>The system needs to manage online presence of participants</td>
<td>S1;S2;S4</td>
<td>Very High</td>
<td>requires</td>
</tr>
<tr>
<td>G1.1.3</td>
<td>The system needs to provide voice-based communication</td>
<td>S1;S2;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.1.4</td>
<td>The system needs to provide video-based communication</td>
<td>S1;S2;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.1.5</td>
<td>The system needs to provide text-based communication</td>
<td>S1;S2;S4</td>
<td>High</td>
<td>requires</td>
</tr>
<tr>
<td>G1.1.6</td>
<td>The system needs to support screen-sharing</td>
<td>S1;S2;S4</td>
<td>Medium</td>
<td>supports</td>
</tr>
<tr>
<td>G1.1.7</td>
<td>The system needs to support document-sharing</td>
<td>S1;S2;S4</td>
<td>Medium</td>
<td>supports</td>
</tr>
<tr>
<td>G1.1.8</td>
<td>The system needs to provide collaborative sketchpads</td>
<td>S1;S2;S4</td>
<td>Medium</td>
<td>supports</td>
</tr>
<tr>
<td>G1.1.9</td>
<td>The system needs to support session recording</td>
<td>S1;S2;S4</td>
<td>Low</td>
<td>supports</td>
</tr>
<tr>
<td>G1.2</td>
<td>The system needs to provide an live tutoring marketplace</td>
<td>S1;S2;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.2.1</td>
<td>The system needs to provide marketplace service registration</td>
<td>S1;S2;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.2.2</td>
<td>The system needs to provide marketplace service discovery</td>
<td>S1;S2;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.2.3</td>
<td>The system needs to provide marketplace transactions</td>
<td>S1;S2;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.2.4</td>
<td>The system needs to provide marketplace reviews</td>
<td>S1;S2;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.3</td>
<td>The system needs to provide an embeddable environment</td>
<td>S1;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.3.1</td>
<td>The system needs to provide an embeddable code snippet</td>
<td>S1;S4</td>
<td>High</td>
<td>supports</td>
</tr>
<tr>
<td>G1.3.2</td>
<td>The system needs to provide rebranding tools</td>
<td>S1;S4</td>
<td>Medium</td>
<td>supports</td>
</tr>
<tr>
<td>G1.3.3</td>
<td>The system needs to provide statistics and analytical reports</td>
<td>S4</td>
<td>Low</td>
<td>supports</td>
</tr>
<tr>
<td>G1.4</td>
<td>The system needs to have general auxiliary low-level features</td>
<td>S4</td>
<td>Very High</td>
<td>requires</td>
</tr>
<tr>
<td>G1.4.1</td>
<td>The system needs to Authenticate and Authorize users</td>
<td>S4</td>
<td>Very High</td>
<td>requires</td>
</tr>
<tr>
<td>G1.4.2</td>
<td>The system needs to store and retrieve data</td>
<td>S4</td>
<td>Very High</td>
<td>requires</td>
</tr>
<tr>
<td>G1.5</td>
<td>The system must implement usability best-practices</td>
<td>S1;S2;S4</td>
<td>Medium</td>
<td>requires</td>
</tr>
<tr>
<td>G1.5.1</td>
<td>The system needs to have help resources (e.g. FAQ, helpdesk)</td>
<td>S1;S2;S4</td>
<td>Medium</td>
<td>requires</td>
</tr>
<tr>
<td>G1.5.2</td>
<td>The system should use intuitive organization and workflows</td>
<td>S1;S2;S4</td>
<td>Medium</td>
<td>supports</td>
</tr>
<tr>
<td>G1.6</td>
<td>The system needs to foster dissemination and retention tactics</td>
<td>S1;S2;S4</td>
<td>Medium</td>
<td>supports</td>
</tr>
<tr>
<td>G1.6.1</td>
<td>The system needs to have newsletter management</td>
<td>S1;S2;S4</td>
<td>Medium</td>
<td>supports</td>
</tr>
<tr>
<td>G1.6.2</td>
<td>The system needs to index recorded public sessions</td>
<td>S1;S2;S4</td>
<td>Low</td>
<td>supports</td>
</tr>
<tr>
<td>G1.6.3</td>
<td>The system needs to provide a multi-tier affiliate program</td>
<td>S1;S2;S4</td>
<td>Low</td>
<td>supports</td>
</tr>
</tbody>
</table>

**Table 8 – TutorPoly’s Business Goals**

5.2.4 Business Process

Finally, RSL-IL also covers the actual business processes and work-flows that consubstantiates the business’ value proposition and upon which goals can be accomplished. In this regard, Figure 14 presents a general depiction of the major processes involved.

![Business Processes overview](image)

*Figure 14 – TutorPoly’s Business Processes overview*

In this context, the Slot Reservation process is one of the less trivial procedures and, for this reason, is represented in more detail in Figure 15, using BPMN (Business Process Model and Notation).
5.3 System level

The System-level view encompasses more fine-grained and technical requirements, which are organized in the following viewpoints: Architectural, Requirements, Structural, Behavioral and Business Rules. In turn, these viewpoints are divided into several models and constructs. In the remaining of this section we present a selection of those models, chosen according to the level of abstraction of this document.

5.3.1 Domain model

Domain models depict and describe important relationships between the entities of the system, as well as, some of their attributes of particular relevance.

From Figure 16, we can observe that there are different types of users of the system: Tutors, Students, and Managers. Their internal structure is relatively standard and, for this reason, it is omitted. However, it is important to note that this diagram effectively guides the future development of data structures and database design.
Figure 17 – Domain model of the Lesson entity

Figure 17 effectively represents the Lesson entity. On one hand, it is the environment that simultaneously connects Tutors and Students. One the other hand, it achieves that purpose by a series of synchronous multimedia components.

Figure 18 – Domain model of the Schedule entity
Finally, Figure 18 illustrates the entities and architecture that allows Students to arrange Lessons with Tutors. This is achieved by a Tutor’s schedule that comprises multiple slots that can be in a series of states.

5.3.2 Actors

The Actors model belongs to the Behavioral viewpoint. Actors are System-level entities that correspond to the Business-level Stakeholders. In other words, an Actor denotes a role taken by a Stakeholder that uses the system.

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Responsibilities</th>
<th>Stakeholder</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Tutor</td>
<td>An entity that provides lessons</td>
<td>S1</td>
</tr>
<tr>
<td>A2</td>
<td>Student</td>
<td>A person that is taught lessons</td>
<td>S2</td>
</tr>
<tr>
<td>A3</td>
<td>Manager</td>
<td>A team that administers the platform</td>
<td>S3</td>
</tr>
</tbody>
</table>

Table 9 – TutorPoly’s System Actors

From the above table and Figure 16 (which presented the Users Domain Model), we can observe that there are 3 different types of users of the system:

- Managers, who belong to the internal staff of the company, have extended permissions in order to monitor the system usage (by other types of users), its performance, the effectiveness of marketing initiatives, among others;
- Students comprise one of the business customers segments and use the platform to find help concerning a certain academic problem;
- Tutors have goals complementary to Students’ ones and encompass two customer segments: Individual Freelance Tutors and teaching organizations, given that the latter may have additional objectives connected to the integration of TutorPoly with their own institutional channels.

5.3.3 Requirements

Most RE approaches include the definition of functional (FR) and non-functional (NFR) requirements. Although RSLingo is no exception, given the abstraction level of this document and the evident implicit relations with other viewpoints already described, we will only present a brief and overall description of these viewpoints.

*Functional requirements.* The essential concern of this viewpoint is closely related to the traditional *ad-hoc* informal requirements documentation practices. The Requirements roughly correspond to statements the system should satisfy and – among other important constructs - include attributes that further define them or facilitate their management. It is important to note that this viewpoint provides a link between both levels of the RSL-IL approach, due to its fundamental connection to the Goals viewpoint of the Business-level.

In the case of TutorPoly, the functional requirements pertain to the following general concerns:

- Real-time communication methods of interest in the context of interactive e-Learning;
- e-Learning Marketplace that facilitates collaboration and exchanges between tutors and students;
- Tools that contribute to the business dissemination, such as, embeddable lesson environments, social sharing incentives or affiliate programs.

In a complete definition, there would be other categories linked to domain-independent requirements (e.g. account and session management, tracking and analytical tools). Moreover, the aforementioned
general statements would be further divided and such decomposition would increase their integration with the chosen Software development paradigm.

**Non-functional requirements.** NFRs support the definition of quality attributes that must be satisfied by the system as a whole or one of its features. As with FR, we only present some preliminary and general groups of NFR, specifically:

- **Performance:** Smooth and clear rich-media communication between parties, with reduced noise, staggering, echo, and other common defects;
- **Scalability:** Constant performance levels – as perceived by individual users – as concurrent user activity increases;
- **Usability:** Easy to use, by adhering to minimalistic principles, easy to use technology, and widespread design practices;
- **Security:** Protection of user’s privacy, by implementing reasonable security policies and safeguards against documented security-holes in the underlying technologies.

These requirements are of uttermost importance due to the fact that services that include Web-based video-conferencing features are often characterized by achieving low Usability and Performance standards. To face this challenges – and regardless of the implemented architecture – it is indispensable to define more fine-grained non-functional requirements and performance metrics that support subsequent extensive testing procedures.

### 5.3.4 Use Cases

As with the Actors model already presented, the Use Cases model is also a part of the Behavioral viewpoint. It allows specifying elaborate functional requirements pertaining to a specific scenario diagrams that obey to a particular UML standard notation.

![System Actor's Hierarchy](image_url)

**Figure 19 – System Actor’s Hierarchy**

Figure 19 presents the hierarchy of the system’s actors, which will be used in feature-oriented use-cases.
Figure 20 represents relatively domain-independent functionally. The Actors that correspond to our customers, namely Tutors and Students, need to Register in the platform to access its core features. Subsequently, they have the ability to manage their account (including its removal) as long as they adequately logged in. Table 10 further describes this use-case, although important aspects such as the participating actors and certain relationships (e.g. includes, extended by) are omitted given their clear representation in the diagram.

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Description</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>Register</td>
<td>Users can register in the platform, using their email address or other federated identity management systems. Although not captured in the diagram of this use-case, Users of the type Managers need special permissions. Additionally, fundamental data such as the email address must be confirmed by the system.</td>
<td>G1.2.1</td>
</tr>
<tr>
<td>U2</td>
<td>Manage Account</td>
<td>Any registered user may configure several settings concerning their account (e.g. newsletter subscriptions, push notifications, privacy options).</td>
<td>G1.2.1</td>
</tr>
<tr>
<td>U3</td>
<td>Edit Profile</td>
<td>As one of the available account management options, users might change their data, for instance, the information supplied in the process of registration. Additionally, User’s Profile is of special importance in the case of Tutors, as it includes the description of their competences and skills.</td>
<td>G1.2.1</td>
</tr>
<tr>
<td>U4</td>
<td>Remove Account</td>
<td>A final option relating to account management, corresponds to the possibility of complete account removal.</td>
<td>G1.4</td>
</tr>
<tr>
<td>U5</td>
<td>Login</td>
<td>Once Users terminate the session started upon their registration, they can Login using the corresponding credentials in multiple devices.</td>
<td>G1.4.1</td>
</tr>
</tbody>
</table>

**Table 10 - Description of the User Registration Use-Case**

In Figure 21 we can observe how both Tutors and Students can join Lessons that provide the functionalities for their interaction. These cover a multitude of methods, highly pertinent to an e-Learning environment.
Table 11 further details this use-case. In this regard, we highlight the optional character of each individual e-Learning interactive component. Finally, although not represented in the diagram, Tutors can also manage the participants in each session, including their presence or the kind of data they can broadcast to others (e.g. mute participants sending high background noise).
<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Description</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>U6</td>
<td>Initiate Lesson</td>
<td>Tutors and Students can both initiate scheduled lessons, that is, launch the e-Learning real-time interactive environment.</td>
<td>G1.1</td>
</tr>
<tr>
<td>U7</td>
<td>Use Video</td>
<td>Each participant can stream video using its own web camera as its source. Due to the associated high bandwidth requirements, receivers can opt to discard particular incoming streams.</td>
<td>G1.1.3</td>
</tr>
<tr>
<td>U8</td>
<td>Use Audio</td>
<td>The Audio channel signal has its source in the user’s microphone and can be used independently of the video component. Incoming audio streams can also be ignored, this time not only due to bandwidth concerns but also because low audio quality is highly pervasive leading to a negative user experience.</td>
<td>G1.1.4</td>
</tr>
<tr>
<td>U9</td>
<td>Use Chat</td>
<td>The Chat widget is always available. The most important peculiarity of this channel is the ability to send messages to all users as well as to specific participants.</td>
<td>G1.1.5</td>
</tr>
<tr>
<td>U10</td>
<td>Share Screen</td>
<td>Any participant can remotely share the contents of their display devices. The specificities of this channel are similar to the video component.</td>
<td>G1.1.6</td>
</tr>
<tr>
<td>U11</td>
<td>Share Documents</td>
<td>Participants may share documents in the most common formats (e.g. pdf, ppt). They also have the option to adopt a master-slave setting, where a user controls the navigation within the document and the others, synchronously and passively, share it.</td>
<td>G1.1.7</td>
</tr>
<tr>
<td>U12</td>
<td>Use Sketchpad</td>
<td>Sketchpad’s contents are also synchronized among participants. This component is inspired in whiteboards and includes tools to draw geometric shapes, type text, and insert mathematical formulas, among other forms of scientific notation. It also has the capability to import pictures, on top of which the aforementioned artifacts can be drawn.</td>
<td>G1.1.8</td>
</tr>
<tr>
<td>U13</td>
<td>Finish Lesson</td>
<td>Lessons may be finished at any time by each user. However, unless the tutor or all students leave, the lesson continues to the remaining participants.</td>
<td>G1.1</td>
</tr>
<tr>
<td>U14</td>
<td>Review Participant</td>
<td>When a user finishes a Lesson, it is encouraged to review other participants, in by rating, commenting or even reporting their behavior.</td>
<td>G1.2.4</td>
</tr>
</tbody>
</table>

Table 11 – Description of the Lesson Environment Use-case

Finally, Figure 22 illustrates the features of the Marketplace subsystem.

![Figure 22 – Diagram of the Marketplace Use-Case](image-url)
As detailed in Table 12, these correspond to the definition of the Tutors’ offers (i.e. availability, credits) and the Students’ demands (i.e. problems). It also includes the actions that materialize the mutual agreement necessary to initiate a Lesson, as well as, the ones required for the upcoming exchange of credits.

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Description</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>U15</td>
<td>Define competences</td>
<td>Tutors must define their competences and skillset, namely, the scientific fields and respective academic levels in which they are proficient.</td>
<td>G1.2.1</td>
</tr>
<tr>
<td>U16</td>
<td>Manage Schedule Requests</td>
<td>Each Tutor can state its short to medium-term availability, in order to allow students to book lessons even if it is not currently online.</td>
<td>G1.2</td>
</tr>
<tr>
<td>U17</td>
<td>Analyze Requests</td>
<td>Tutors analyze student’s requests in order to check if their learning needs are suited to the tutor’s capacities and intentions.</td>
<td>G1.2</td>
</tr>
<tr>
<td>U18</td>
<td>Accept Student</td>
<td>Once Tutors consider student’s requests, they communicate their decision to students or incur in further negotiations, for instance, asking or providing additional details, when applicable (e.g. rescheduling).</td>
<td>G1.2.2</td>
</tr>
<tr>
<td>U19</td>
<td>Cash-out Credits</td>
<td>Tutors may transfer credits to their electronic wallets. These credits are transparently converted to the user’s currency along the process.</td>
<td>G1.2.3</td>
</tr>
<tr>
<td>U20</td>
<td>Search Tutor</td>
<td>Students may search for Tutors using several criteria, such as, competences, price, and general availability (e.g. immediate vs eventual)</td>
<td>G1.2.2</td>
</tr>
<tr>
<td>U21</td>
<td>Select Tutor</td>
<td>Once Students find a potential Tutor, they may select and view additional information, such as, previous ratings and user comments or a detailed availability schedule.</td>
<td>G1.2.2</td>
</tr>
<tr>
<td>U22</td>
<td>Reserve Slot</td>
<td>Subsequently, Students may reserve a scheduled Slot according to their preferences.</td>
<td>G1.2</td>
</tr>
<tr>
<td>U23</td>
<td>Confirm Lesson</td>
<td>Since that Tutors may impose minor changes in Student’s requests (e.g. rescheduling), Student’s need to confirm their acceptance of Tutor’s terms.</td>
<td>G1.2</td>
</tr>
<tr>
<td>U24</td>
<td>Cash-In Credits</td>
<td>At any moment, Student’s may purchase Credits by electronic payment processes, thus supplying their account balance.</td>
<td>G1.2.3</td>
</tr>
</tbody>
</table>

Table 12 – Description of the Marketplace Use-Case
6 TUTORPOLY: SYSTEM DESIGN

6.1 Technologies

The technologies that support the deployment and execution of a specific Internet platform are organized into a stack where each layer has different responsibilities. For instance, a common solution corresponds to the LAMP stack, which comprises: a Linux distribution as the Operating System, Apache as a HTTP Web server, MySQL as the database engine; PHP as the scripting language. The consequences of decisions at this level are well-known and relatively domain-independent and, for these reasons, will not be explored in this document.

In contrast, the implementation of the TutorPoly’s requirements connected to real-time communication imposes a series of complex issues resulting from two main reasons: On one hand, the implementation and performance dependence on the characteristics of the client-side device (e.g. browser, installed plugins, available bandwidth). On the other hand, the possible server-side bottleneck from naïve implementations of real-time multimedia communication, since it comprises a considerable data transfer that grows significantly with the corresponding spatial and temporal resolution as well as the number of concurrent users.

Since that these factors can easily limit the usability, performance, and scalability of the platform, we performed a deep analysis of the technological alternatives concerning the implementation of real-time communication and the associated trade-offs.

WebRTC. We began by limiting the scope of the technologies considered to the ones built upon WebRTC. WebRTC [17] is a recent technology that supports several forms of plugin-free P2P real-time secure communication between browsers.

While Internet Real-time communication is not new, since that there are Desktop-based applications (e.g. NetMeeting, Skype) and even browser-based (mainly using Flash technology) solutions for many years, WebRTC’s media engine native support – and Javascript API integrated with the HTML5 DOM (Document Object Model) - open exciting novel possibilities due to a seamless incorporation in Web 2.0 business processes.

The major advantages of WebRTC architecture, depicted in Figure 23, are the end-user usability, the device-agnostic interoperability, and its black-box character, of particular importance in requirements subject to multiple complexities such as, endpoint’s heterogeneity and transcoding.

WebRTC is becoming more and more supported by major browsers and there are WebRTC plugins that provide WebRTC-based functionality to clients whose browsers do not support it, a scenario whose prevalence continuously decreases. Regarding mobile operating system, WebRTC is supported by Chrome in Android while several SDKs allow its integration with native Apps (including in iOS).

While WebRTC encapsulates many technical issues concerning real-time communication, it still leaves out some important communication requirements that it does not specify, for instance:

- The signaling protocol, that is, the actual method that allows peers to discover, connect and maintain a session between each other. In this context, open implementation likes SIP (Session Initiation Protocol) or proprietary standards, over technologies such as WebSockets, must be used.
- How to deal with some firewalls and NAT (Network Address Translation) configurations, that hide client’s address in a way not discoverable by ICE (Interactive Connectivity Establishment), a framework integrated in WebRTC. To accommodate different network topologies, STUN (Session
Traversal Utilities for NAT) or TURN (Traversal Using Relays around NAT) servers may be necessary.

- How to implement one-to-many and many-to-many communication scenarios in a broadcast-like fashion - without demanding a proportional number of connections in each client (full mesh topology) – that is, resorting to a MCU (Multipoint Control Unit) or SFU (Selective Forwarding Unit).

![WebRTC Architecture and ICE negotiation](image)

*Figure 23 – WebRTC Architecture and ICE negotiation (fallback path represented as a dashed line)*

WebRTC defines standards and protocols but it does not provide an high-level implementation. Therefore, to efficiently leverage on WebRTC, developers should resort to tools that provide the functionality inherent to WebRTC specification, avoiding the complex and costly alternative self-development. These solutions have varying degrees of abstraction and support different requirements, according to the challenges they face.

In particular, the various possibilities range from open source tools (e.g. easyRTC, PeerJS OpenWebRTC) or fully-featured media servers (e.g. Kurento, Licode) to commercial SDKs and even WebRTC PaaS vendors (e.g. openTok, Bistri, ooVoo, PubNub).

Considering the implementation, testing and maintenance cost of each of these alternatives, we chose to base our rich-media communication requirements on top of a WebRTC service and infrastructure provider. In particular, given that resorting to the fallback TURN server depends on the end-points’ networks, a moderate percentage of users will pose enormous scalability and quality assurance (e.g. jittering, echo-cancelation, lip synching) difficulties for a company with moderate resources.

After comparing the features, stability, and business model of each provider, we elected ooVoo as our backend WebRTC service and infrastructure vendor, thus encapsulating most of the aforementioned technical issues.
6.2 Technical Architecture

From a functional standpoint, our system architecture encompasses 3 stacked layers and a transversal one with distinct capabilities and responsibilities, as depicted in Figure 24.

**Presentation.** The Presentation layer comprises the local run-time of the application and, in addition to the standard UI elements (e.g. HTML5 markup, CSS stylesheets) and controllers (Javascript/JQuery libraries), is responsible for managing the routing of media streams directly to other users through the WebRTC API and the server-mediated established connections.

The major challenge concerning this layer is the implementation of the Sketchpad UI component, since it must seamlessly support synchronized drawing of vector graphics consisting in geometric shapes, mathematical and natural sciences notation, among others, a requirement without any available satisfying browser-supported base elements or toolkits.

**Business Layer.** The Business layer is accountable for the two main domain-specific modules of the platform, namely, the Marketplace and the e-Learning environment. And the corresponding responsibilities have a direct parallel to the requirements specified in Chapter 5. Regarding this layer, it is important to note that some tasks are linked to both modules, specifically, the scheduling of lessons and the credit expenditure measurement.

**Data & Services Layer.** This layer is responsible for providing required domain-independent functionalities to the Business layer. Specifically, it establishes connections to third-party engines or services and subsequently mediates the exchange of data between them and the Business layer. It does so in an encapsulated manner, by providing an abstraction layer independent of the peculiarities of the various vendors (e.g. database engines, WebRTC PaaS providers, Internet Payment Processing companies).

**Middleware.** This layer provides functionalities of general interest. For instance, low-level security control and resource usage monitoring are common to all server-side layers since that, most of the times, they are deployed in the same machine. On the other hand, joint high-level security control and configuration is fundamental to instrument communication and shared session states between layers.

![Figure 24 – TutorPoly’s Layered System Architecture](image-url)
This layer is particularly important in the case of a platform with computationally heavy tasks, by the necessity of devising strategies to guarantee scaling (e.g. on-demand additional machines, load-balancing).

Finally, it is important to note that, although in a different level of abstraction, our architecture encourages software design patterns that match the MVC (model-view-controller) paradigm and, in particular, the front-controller Website architectural patterns, which eases the implementation of human-readable URLs, following DRY principles (e.g. not repeating session management calls), among other advantages.

### 6.3 Layout and UI organization

Finally, we end the presentation of our system's design by depicting the webpages of the most important modules, a view that is highly descriptive of the overall system.

The e-Learning Lesson webpage integrates all the interactive components, as represented in Figure 25. In this regard, it is important to note the inclusion – by default – of the code snippet necessary to embed the environment in a third-party webpage, as exemplified in Figure 26.

![Figure 25 - Mockup of the Lesson environment](image)
Finally, the Marketplace module (Figure 27) allows students to find tutors with the desired competences. Here we highlight the presence of some specific use-cases, namely, that training organizations may choose to index their sessions in the marketplace (to increase the visibility of their offers) and some tutors might only accept certain students (e.g. their own offline students).

Other views, such as the enumeration of all the webpages and their connections to each requirement, are omitted since they are easily deduced from the artifacts already presented in this document.
7 DISCUSSION

7.1 Business aspects

The most vital aspect concerning the discussion of the present work from a business perspective is the relation of our platform to the ones of our competitors. Understanding the competition of the products and services offered by a business is of vital importance because without a realistic assessment of the customer’s options, it is not possible to reason about their behavior and decision processes, an activity necessary to make reliable forecasts and to derive strategies that effectively capture the percentage of the market required to make the business profitable.

The innumerous e-Learning platforms can be divided into Desktop and Web-based applications. Trends in the Internet industry and customers’ behavior show that desktop-based products are subject to threats that are swiftly becoming serious weaknesses. In turn, the increasing variety of Web-based platforms is divided into On-premises and Vendor-hosted solutions. The former are highly inaccessible as they exclude non-IT SMEs or individuals (e.g. private, often ad-hoc, tutors). From the latter we differentiate by multiple actual reasons. Without reckoning examples, the fact is the market of e-Learning IT enablers is highly fragmented and by analyzing real players’ BMC (some technologically obsolete), we arrived at solid conclusions that give rise to multiple advantages of our idea.

A potential customer may choose a similar and comparable offer or a completely different solution that, nevertheless, also solves his current problem. For this reason, along with direct competitors, it is indispensable to consider the indirect competitors and their strengths, from the customer’s perspective.

**Indirect Competitors.** Our indirect competition, that is, the businesses that satisfy interactive Learning needs through significant distinct products or services, is composed by two major groups: *offline* tutoring services and technological tools that can be used for real-time e-Learning purposes. The former includes both freelance tutors and organizations that offer *offline* private tutoring services. The latter comprises some platforms described in Chapter 3, namely, those that are somehow interactive (i.e. Web Conference Providers, Learning Management Systems, Question & Answer services), as well as, domain-independent communication tools (e.g. Skype).

The following tables summarize the strengths and weaknesses of our businesses in relation to our indirect competitors, from the point of view of our main customer segments.

<table>
<thead>
<tr>
<th>Type of Competitor</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
</table>
| Offline tutoring services | - We do not require any compromise in terms of quantity or frequency of lessons;  
- Availability independent of geographical circumstances;  
- Lower expected price per time invested by tutor;  
- Immediate availability, without need for pre-scheduling and independent of hour;  
- Greater inter-tutoring competition, with distinction between offers and performance highly visible;  
- Potentially greater specificity of fields covered; | - Less adequacy of remote tools for cooperative problem solving, particularly in fields with scientific or technical notations;  
- Less regular study discipline resulting from the absence of pre-scheduled lessons;  
- Inability to conduct payments using a non-electronic methods;  
- Difficulty of functional group lessons: technical issues and organization;  
- Potential less tutor’s knowledge of student’s curriculum and evaluation structure; |
Table 13 – Indirect competition comparison in relation to the Student’s customer segment

<table>
<thead>
<tr>
<th>Type of Competitor</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offline tutoring services</td>
<td>• Capability to reach geographical distinct students;</td>
<td>• Potentially lower revenue per effective lesson time;</td>
</tr>
<tr>
<td></td>
<td>• No need for physical space;</td>
<td>• Lower student retention;</td>
</tr>
<tr>
<td></td>
<td>• Lower intermediary commissions;</td>
<td>• Difficulty of functional group lessons: technical issues and organization;</td>
</tr>
<tr>
<td></td>
<td>• No payment delays or recovery difficulties;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Potential to reach highly specialized students matching tutor’s competences;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Potentially short time overhead between sessions;</td>
<td></td>
</tr>
<tr>
<td>Technological Tools</td>
<td>• Adequacy of available tools for e-Learning activities (e.g. sketchpad, collaborative editing of shared documents);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tutor discovery features;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Automated and independent accounting of expenditure;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Integrated payment methods;</td>
<td></td>
</tr>
</tbody>
</table>

Table 14 – Indirect competition comparison in relation to the Tutor’s customer segment

The above comparisons clearly elucidate several facts:

- In relation to offline tutoring services, our platform competitively is highly dependent on the specific circumstances of our customers. In fact, this dependency was already adequately captured in the definition of the part of the Total Available Market that comprises our Serviceable Available Market. Therefore, in relation to the specific customers of our SAM, those indirect competitors are highly weakened;

- In regard to the existing general e-Learning tools, our platform leverages on its specificity by offering a set of consistent and integrated features (e.g. JIT Expert Discovery, Tutor promotion, B2C2B Market, Reviews, Payment Processing) that strengthens in position in the context of online private tutoring activities.

**Direct Competitors.** Our direct competitors are platforms that provide an e-Learning environment with a series of tools that support interactive lessons and matching tutors and students, as described and exemplified in Section 3.6 of Chapter 3.

Before all, it is important to note that the market of our direct competitors is highly fragmented, as there is not any player with a consolidated widespread position. Therefore, there aren’t solid barriers-to-entry resulting from strong unchangeable brand-image associations in customers’ mental...
frameworks, and their existence actually provides a means for improving the quality of our decision-making processes and forecast accuracy, since these can be grounded on actual data.

Our differentiation in relation to our direct competitors is presented in Table 15.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>• Available languages;</td>
<td>• No first mover advantage;</td>
</tr>
<tr>
<td></td>
<td>• Full mobile support (in relation to some competitors, e.g. Chegg Tutors);</td>
<td>• Fewer tutors upon market-entry;</td>
</tr>
<tr>
<td></td>
<td>• Lower intermediary commissions;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Better usability (WebRTC);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tutor incentives that foster pro-bono lessons;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Extended interactive environment;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Support of micro and mobile payments;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pay-as-you-go model (in relation to some competitors, e.g. Tutor.com);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Social sharing rewards;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cheaper rates by promoting matches between tutors and students from countries with distinct average income levels, hired curated tutors, and tutor's free lesson incentives;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Possibility to share Lesson expenses with other students;</td>
<td></td>
</tr>
<tr>
<td>Tutors</td>
<td>• White-label integration on tutor’s channels;</td>
<td>• No first mover advantage;</td>
</tr>
<tr>
<td></td>
<td>• Student’s reviews;</td>
<td>• Fewer students upon market-entry;</td>
</tr>
<tr>
<td></td>
<td>• Offer’s visibility determined by geographical criteria;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fosters online-offline conversions;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Simplified registration process;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Possibility to attend several students at once;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Premium features (e.g. highlighted results) that can be acquired without capital expenditure (i.e. with credits collected as awards);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Push-notifications;</td>
<td></td>
</tr>
</tbody>
</table>

Table 15 - Direct competition comparison

This table clearly allows some important reflections:

• In relation to our direct competitors, we present less distinguishing features. This emerges naturally from the fact that direct competitors are, by definition, similar solutions;

• The lack of significant identified weaknesses is explained by the fact that, at development time, we are free to plan and implement any feature of our competitors that we consider a strength;

• Some of our strengths might be met by competitors in future version of their platforms;

• Although our business model is, at its essence, based on revenue-sharing. The Freemium features are responsible for its main differentiation characteristics and effectively target student’s barriers-to-purchase, the most significant weakness resulting from our competitors’ BMC.

As a natural consequence of these considerations, our strategy to ensure a competitive advantage from our direct competitors that include a marketplace-like dimension cannot be solely based on product differentiation. It has to have a price dimension, in our case implemented by the several Freemium features described. Moreover, since the market traction displayed by our competitors does not represent a considerable penetration of the corresponding markets, instead of trying to gain a
share of their clients (Red Ocean Strategy), we intend to capture potential customers that still do not resort to any comparable service (Blue Ocean Strategy).

An analysis of our strongest direct competitors allows us to conclude that most potential customers do not acknowledge their existence. In addition, they also display significant barriers-to-purchase both because student’s need to commit with a payment transaction before being able to verify the effectiveness of the service (e.g. Tutor.com) or considerable high rates (e.g. 0.50$/minute in the case of Chegg tutors). As a result, our differentiation strategy is based on our marketing plan (e.g. embeddable platform, credit convertible social sharing awards) and price (by fostering free or very cheap lessons) and a flexible business model, an approach further justified by the lack of barriers-to-entry ensuing from the high fragmentation of the market.

7.2 Technical Aspects

Regarding our software development process, we highlight the important role played by RSLingo in our project and the invaluable consequences it yields. Specifically, RSLingo provides a structured Requirements Engineering activity that fosters preciseness and completeness. In turn, these qualities allow accurate and realistic planning, unlikely to be subject to considerable implementation delays or cost underestimations.

An additional technical issue of utmost relevance is the advantages conveyed by WebRTC and, specifically, its implementation as a vendor PaaS solution. WebRTC provides real-time rich-media communication with minimal costs in areas ranging from implementation and testing to maintenance and infrastructure. These costs are closely tied to human-labor and, as a result, the same reasons that minimize them also decrease our time-to-market.

This way, our software development efforts become, to a great extent, reduced to the implementation of the marketplace features. Since these are analogous to work-flows and functionalities highly pervasive in Web 2.0 applications, they are supported by various stable open source frameworks and libraries, a fact that further minimizes costs, shortens development time, and even increases the quality of release-candidates version.

From end-user’s perspective, one of the main advantages of WebRTC concerns its native browser support and, as a consequence, the high usability standards achieved. For instance, who was never late to a webinar due to intricate tech or registration procedures? Extant platforms exhibit UX and usability challenges (e.g. plugin installation) and, consequently, an opportunity arises from the fact that most users follow "least-effort" strategies, have no time to spare and are not IT savvy (e.g. elderly), particularly using systems that do not present quasi-universal everyday usage (and therefore cannot afford a significant learning curve).

The fact that relevant use-cases correspond to a sequence of requirements (i.e. enrolment, payment, session, post-availability) that have to be materialized by independent - and therefore unsynchronized – means, means solutions that are not technically fully integrated with Web 2.0 technologies, pose extreme difficulties to customers.

Finally, WebRTC growing support also yields value to brands that have a core connection to learning (e.g. b-learning) and want to support their activities in their own institutional channels. This is a burdensome and expensive challenge given that, typically, their human resources do not include IT developers, as confirmed by multiple sources and beta-clients. The embeddable WebRTC supported by a Google maps-like code snippet, can guarantee a swift market-penetration as a result of the value it provides for organizations.
8 CONCLUSIONS

In this Chapter we briefly describe the major tasks completed and perform some final considerations. We conclude by presenting the current status of the project as well as future work activities.

8.1 Tasks completed

In light of this project’s goals, our tasks are divided into business and technical-level tasks.

Business tasks. The business-level tasks completed comprise two major activities: business planning and funding. Regarding business planning and development, the activities conducted correspond to a considerable extent to the analysis and business structure construction presented in this document. It also included some activities not described, such as, definition of the work plan, assessment of investment needs, and miscellaneous networking activities. In turn, the Funding activities encompassed the exploration of multiple opportunities, in the form of submissions to Accelerator programs, analysis of the project’s eligibility in the context of public entrepreneurship incentives, contacts with business angels, and a preliminary assessment of venture capital funds applicability.

Technical tasks. The technical tasks developed include the Software Requirements Specification, the System’s Architecture and organization definition, as well as, the experimentation of technological tools, frameworks and web services of interest. Besides the artifacts produced by the Requirements Engineering activities detailed in Chapter 5, in this context we highlight the extensive research and experimentation underlying the complex issues surrounding WebRTC-based services implementation and infrastructure.

8.2 Final considerations

In this work, we defined and developed the two intrinsic dimensions of a commercial Web platform, specifically: The business structure and the technological implementation. These levels are both fundamental as a single weakness at either of them seriously undermines and compromises the viability and sustainability of the project as a whole, particularly in such a highly competitive sector as e-Learning.

In relation to business concerns, it is fundamental to identify best-practices and trade-offs by conducting a throughout analysis of both existing and extinct businesses - in particular, their value propositions, marketing strategies, and business models - therefore reducing the multiple risks inherent to products and services in a pre-market entry stage. In this regard, our research allowed us to conclude that the sustainability of free business models, in the sense of a monetization strategy that relies on selling advertisement space, is highly questionable as it is unlikely that customer’s LTV yield a reasonable profit after accounting for the cost-structure (i.e. development, fixed, variable, and CAC), leading us to opt by a mainly revenue-sharing model.

Choosing an appropriate business model is a matter of uttermost importance and mistakes at this level can lead to unrecoverable failures. On one hand, several businesses had considerable popularity but due to their inability to monetize it properly severely limited the ability to investment in areas such as quality of service, marketing or even customer service, which ultimately led to competitive disadvantages and a subsequent failure. On the other hand, there are businesses that despite the pertinence of their value proposition and the quality of their implementation had a business model that did not match customers’ expectations and therefore actually prevented effective market penetration.
In addition, it is vital to survey both indirect and direct competitors. An understanding of their strengths, weaknesses, and performance, not only allows validating assumptions and increasing the accuracy of market-penetration but also has the potential to minimize their consequences as a threat. In fact, competition analysis is actually an important learning activity that yields a rationale for defining the positioning and differentiation of a business and, for instance, to choose between a red-ocean or blue-ocean strategy. In our case, it fostered the development of a platform whose communication strategies, features, and business model are compatible with the significant barriers-to-purchase exhibited by users (in particular, younger ones) in relation to Internet payment systems.

Thanks to the aforementioned learning activities, we were able to transform the perception of gap that initially motivated this project into a concrete business structure and strategy. The actual platform at its core was described using RSLingo RE approach, which has an intrinsic capacity to provide a bridge between the business and technical levels of the project, assuring a synchronized and compatible representation of goals and requirements in each dimension, as well as, an effective mutual contribution of the developments at each level to the implementation of the overall business strategy.

We concluded by defining some elements of TutorPoly’s system architecture, therefore initiating the activities concerning the technical implementation of the platform.

Finally, it is noteworthy to mention that our solution as a strong social impact, by reducing the educational costs and increasing the ease of use and accessibility of technology, thus reducing digital divide. It also has the potential to create jobs and foster education, hence indirectly increasing knowledge-based economy and stimulating economic growth.

8.3 Future Work

At the current stage, our project is in an advanced stage of conceptual development and the most significant exception in this regard relates to the absence of customer development interviews. Despite our relative adoption of Lean business development methodologies, due to discretion concerns we chose to compensate that missing information with contingency plans, instead of publicly describing our value proposition and business model. As a result, future developments pertain to the implementation of the actual business structure which, in turn, requires efforts to secure third-party funding.

Technologically, although from an end-user perspective our current prototype is in a preliminary stage, in terms of development effort the main challenges were already successfully approached. Specifically, experimentation with PaaS providers of real-time rich-media communication have yielded satisfying results, therefore reducing the remaining work to business-logic to a great extent analogous to other domains and whose implementation is relatively straightforward. It is important to note that since several providers are highly suited to our needs (e.g. ooVoo, PubNub) this strategy does not impose any sort of potential vendor lock-in.

In summary, professional enterprise projects require non-negligible investment (e.g. human-resources, marketing) and, for this reason, future activities are steered towards the accomplishment of this goal. Nevertheless, as those activities are subject to external agendas, the idle periods between funding calls or meetings will be devoted to the implementation of the remaining features of the prototype, thus contributing to a degree of development that in turn eases securing third-party investment.
REFERENCES


8. The Total Cost of (Non) Ownership of Web Applications in the Cloud. Varia, Jinesh. August 2012.


APPENDIX

Annex A – Market Quantification\(^9\)

<table>
<thead>
<tr>
<th>Country</th>
<th>LS</th>
<th>LT</th>
<th>Country</th>
<th>LS</th>
<th>LT</th>
<th>Country</th>
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<th>LT</th>
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\(^9\) For simplicity, we excluded countries with population less than 1 million habitants, as well as, countries with a severe lack of data (North Korea, Somalia, and Vietnam). For several reasons, both options do not have a considerable impact in our results.
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*Table 16 – Students attending secondary and tertiary levels of education (in hundred thousands)*
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Table 17 – Distribution of the Population of OECD countries across quintiles of GNI (in PPP)