Success Factors in Leveraging Freelance Marketplaces in Software Development Projects

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Thesis submitted in partial fulfillment of the requirements for the degree of Masters of Science in e-Business Technologies

University of Ottawa
September 2013

Abstract

The purpose of this research is to explore project success factors and freelance marketplace characteristics that are critical to the success of software development projects on freelance marketplaces, while identifying important metrics to measure the success of software development projects on freelance marketplaces. This exploratory study is done from the point of view of the software development services buyer.

Three methodologies were developed for the purpose of this research. First, a methodology for the definition of the freelance marketplace concept and the delimitation of the field of study was followed. Second, a methodology for sourcing opinions from blogs and self-published articles was created to mine information to complement the scant specialized literature on the subject of freelance marketplace characteristics and freelance marketplace project success factors. Third, a survey methodology was used as the main data collection instrument.

The findings suggest that freelance marketplaces play the role of enabler of project success factors. The most important success factors are focused on product quality, project efficiency factors, cost control factors, and qualifications of the buyer. The most important metric to measure the success of software development projects on freelance marketplaces was quality in use.

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Chapter 1 - Introduction

For a hundred years leading up to 1960, companies usually kept all of their value creation activities internally. An example is Ford, who produced everything from the raw materials to the final assembly in house. More lately, companies have started to outsource and contract out some of its activities, especially in Information Technology (IT) (Burnett, 2008). The buyers and providers of IT services are not necessarily located near one another. The Internet has enabled businesses to find service providers from around the world.

With skilled labor available all over the world, companies can go beyond the boundaries of the firm to find workers and contractors. Some processes can be outsourced and moved outside of the firm (Carmel & Tjia, 2005), even to an offshore location. Gartner estimates worldwide IT outsourcing spending has reached $3.7 trillion in 2011 (Agarwal & Kumar, 2011).

Forrester Research (2006) and Cisco (2009) report that the IT outsourcing industry is broken (Giera & Parker, 2006; Krishnamurthy, Jegen, & Brownell, 2009). Failure rates and client dissatisfaction are high, and long term contracts hinder innovation. Research shows that only a minority of companies report their business process outsourcing venture as satisfactory (Rouse & Corbitt, 2011). Large service providers winning multi-million dollar contracts over-use mature technology, and lock customers in with restrictive contracts (Rouse & Corbitt, 2011). "Adaptive sourcing" is predicted to become the future business model trend of IT service providers: smaller and shorter contracts, newer technologies, and flexibility. Gartner (2008) also recommends flexible contracts over multiyear outsourcing deals to increase their capacity to innovate (Young et al., 2008), and refers to the shift towards multiple smaller deals as "multi-sourcing" (L. Cohen & Young, 2006).

IT services providers are prominent in developing countries such as India, Brazil, Romania, and China (Young et al., 2008). Dealing with service providers from foreign countries can be problematic (Roberts, Kossek, & Ozeki, 1998). Amongst the major challenges of managing a global workforce is the search and identification of talent.

Hiring specialized, best-of-bread vendors on project basis ("out-tasking") has advantages over retaining a single vendor, full-service provider ("outsourcing") (Krishnamurthy, Jegen, &

Brownell, 2009). For example, flexibility is increased, innovation is accelerated, control is kept within the company, and some risks can be minimized (Krishnamurthy, Jegen, & Brownell, 2009). Out-tasking encourage win-win collaboration between buyers and providers of services. Across industries in the United States (not just in IT services), out-tasking is more frequent than outsourcing (Kleeman, 1994).

Over the last decade, a number of electronic marketplaces have emerged allowing companies to source services from individuals and small companies. These marketplaces, referred to as freelance marketplaces in this study, act as the intermediary between workers and buyers of services. A freelance marketplace is a web-based e-marketplace that supports the entire process of contracting out a software development project to an independent remotely-located programmer for a fixed price or hourly rate, while offering related information, tools, and services. Freelance marketplaces are tools that facilitate the process of outsourcing and out-tasking.

Information technology projects have become the biggest work category on many of those e-marketplaces[1]. Web and software development are prominent work categories on freelance marketplaces, with providers in both developed and developing economies. Hourly wages are significantly lower in some parts of the world, which can lead to financial savings for the buyer of services. For example, the average web developer salary is much lower in Mumbai than in San Francisco (Geer, 2006).

IT projects have been reported to fail frequently (Tesch, Kloppenborg, & Frolick, 2007). In a recent study, failure rate was found to be between 26% and 34%, with an 11% to 15% cancellation rate (El Emam & Koru, 2008). Failed projects translate into loss of productivity and resources. Although it is unlikely to eliminate all failures, better understanding of success factors could help buyers of services on freelance marketplaces to lower their project failure rate.

[1] As of September 14, 2012: “Websites, IT & Software” is the category on Freelance.com with the most projects. On vWorker.com, the "Web development” category has the most projects, followed by “Tech Details” and “Software Development”. On elance.com, the skills most in demand are HTML, WordPress, PHP, and CSS (all of whom relate to web development). The “Programmers” category has the most open projects on elance.com.

IT projects fail more often when outsourced abroad. Empowered Software reports that software developed in a foreign country has 35% to 40% more bugs than the same software made in the USA (Kharif, 2003). While hourly wages can appear significantly lower, contracting out IT is full of hidden costs, such as initial search and contracting of the provider, and supervising the work (Barthelemy, 2001).

Freelance marketplaces are a relatively new occurrence. Of the top five freelance marketplaces by blog mention and self-declared volume[2], three date from 1998 and the two others were created in 2003 and 2004. There is scant academic literature on the subject, which constitutes an opportunity to expand on the body of knowledge.

Software development projects are amongst the most frequent projects posted on freelance marketplaces, and are the object of this study. We consider a software development project as a web or software development project where one of the project's tasks consists of planning, creating, modifying, or reviewing code.

More specifically, there is little knowledge about what elements contribute to the success of software development projects on freelance marketplaces. These marketplaces differentiate themselves in service offering to a point where it is unclear what characteristics are desirable to the user. This can be demonstrated by the fragmented market. To our knowledge, there exists no research on identifying factors leading to the success of software development projects done through freelance marketplaces. That is to say, which elements are sources of project success on freelance marketplaces.

1.1 Background of the Problem

Information technology and software in particular are drivers of productivity increases in businesses (Bartel, Ichniowski, & Shaw, 2007). However, IT project failure rates, particularly IT software project failure rates are significant. This hinders efficiency and productivity in organizations.

Sourcing IT services from outside the country appears to be problematic, which increases the project risk. Contracting out projects, especially outside the country, contains important risks

[2] See Chapter 5 for figures

and hidden costs (Erber & Sayed-Ahmed, 2005). Failed IT projects represent a high and wasteful cost to organizations. Offshore custom software development projects often do not successfully meet time and cost parameters (Fabriek, Brand, Brinkkemper, Harmsen, & Helms, 2008). Freelance marketplaces offer an opportunity to making the process of sourcing IT services easier and more successful, but their contribution to success has not been established.

1.2 Importance of the Problem

The understanding of success factors of software development projects on freelance marketplaces affect the success rate of IT projects. Freelance marketplaces are growing at a rapid rate, having processed a billion dollars' worth of transactions (WhichLance.com, 2010), and have helped businesses source work more efficiently while providing work for thousands of people.

This study's purpose is to increase the understanding of project success factors and freelance marketplace characteristics critical for the success of software development projects on freelance marketplaces. This type of knowledge can be used as a base for further research on the role of freelance marketplaces and of other types of e-marketplaces.

1.3 Problem Statement

In general, the problem is the high failure rate of software development projects outsourced through the intermediary of freelance marketplaces, which causes wasted resources. Projects done overseas do not always satisfactorily meet the quality, time, and budget constraints of the buyer.

As IT projects fail at a significant percentage, it is possible to formulate the hypothesis that software development projects on freelance marketplaces also suffer from a significant failure rate.

A scan of listed projects shows that some are reposts, due to the original project not being done satisfactorily, which is indicative of failed projects. While reviewing the ratings of the providers left by buyers, we noticed frequent instances of negative feedback left due to the unsatisfactorily outcome of projects.

Freelance marketplaces offer a wide range of services and features; however it is unclear what characteristics affect the success of projects completed with the use of freelance marketplaces. While freelance marketplaces are often mentioned in the professional literature and blogs, the sources of success, whether they relate to the project or the freelance marketplace, have to our knowledge never been studied in depth.

1.4 Purpose Statement

The goal of this study is to explore project success factors as well as freelance marketplace characteristics that are critical for the success of software development projects on freelance marketplaces. Success metrics associated to the success factors of software development projects on freelance marketplace will also be examined. A better understanding of success factors and metrics could lead to better decisions when selecting and using a freelance marketplace to buy or sell services, conduct business more successfully on freelance marketplaces, and help freelance marketplaces themselves determine ways to increase the odds of success on their marketplace.

1.4.1 Population

The study's population is small business owners, entrepreneurs, employees, and individuals that have used freelance marketplaces to hire out software development projects. We refer to these people as software development services buyers.

1.5 Research Question

We examine both the contribution of software development project management and the freelance marketplace to the success of the project. The research question is *"What software development project success factors and freelance marketplace characteristics are critical for the success of software development projects on freelance marketplaces?"*, which is the main research question. This leads to the second question: *"What metrics are important measures of the success of software development projects on freelance marketplaces?"* The goal is to find what elements relating to the buyer, provider, project, or freelance marketplace are important to achieve successful projects.

1.6 Research Methodologies

Given the exploratory nature of this research and scant previous research specific to freelance marketplaces, it was necessary to follow 3 methodologies to ultimately obtain answers to the research question.

1. The specialized literature does not contain any clear definitions of the freelance marketplace concept or sector of activity. A methodology for the definition of the freelance marketplace concept was developed to fill this gap.
2. While there is specialized literature about project management in IT, material specific to freelance marketplace project management is limited. A methodology for the analysis of blogs on the subject of freelance marketplaces was done to supplement candidate success factors from the specialized literature.
3. To answer the research question, a survey methodology was followed. A self-administered questionnaire will be used to gather data on each tested element. A qualitative analysis complements the quantitative results derived from the survey.

1.6.1 Overview of Methodological Steps

The first step is to define the field of freelance marketplaces. We start with a top-down approach of formulating a preliminary definition then use a bottom-up approach to classify e-marketplaces based on their characteristics. A literature review and comparisons of freelance marketplace websites were used to define the field (Chapter 2).

The next step consists of defining project success, and what metrics can be used as criteria to gauge the level of success of a software development project. A literature review was done to find criteria to evaluate the success of software development projects (Chapter 3).

The third step consists of building a pool of potential software development project factors. This was done is two parts. First, a review of the literature on IT and software development project success factors is done to find factors that relate to project management (refer to Chapter 4). Second, an analysis of opinions in online blogs and articles is conducted to find further success factors that relate to freelance marketplaces or to the outsourcing process (Chapter 5).

The potential success factors from the specialized literature and from user's assessments (blog analysis) are used to create the success measurement model, which constitutes our research model (Section 6.1).

A questionnaire was created based on the empirical research model. The data is collected both quantitatively and qualitatively, with closed and open questions. A convenience sampling will be used. The target population is people that have used freelance marketplaces to buy software development services (Chapter 6).

A quantitative analysis of the data is conducted, supplemented by a qualitative analysis (Chapter 7). The key research findings are summarized in Chapter 8.

1.6.2 Explanatory and Explained Variables

Success factors are potential explanatory variables, which means that we will test what success factors are critical for the success of projects. They include characteristics or features of freelance marketplaces and project success factors not solely linked to the freelance marketplace. The project success factors and freelance marketplace characteristics, or explanatory variables, can be related to the freelance marketplace, the buyer, provider, or the project. In order to identify potential explicative variables, a base pool of potential success predictors was compiled from two sources. An analysis of blogs, and a review of the specialized literature was done to find candidate success factors. These factors are a starting point to develop the research model, and to ultimately create the questionnaire.

An analysis of Internet blogs was done with the purpose of doing preliminary research on the opinions of users about freelance marketplaces. Blogs reviewing freelance marketplaces (Chapter 5) were analyzed to find preferences, selection criteria, common problems, and the frequency of individual freelance marketplace mentions in the blogosphere.

Based on the results of the blog analysis, additional candidate success factors were retained from preference statements and selection criteria to complement those found in the specialized literature. Preferences are elements authors find desirable in a specific freelance marketplace or while working with programmers in general. The logic for retaining those as potential success indicators is that if subjects express a preference towards those elements, it is likely because they believe they increase the chances of success. Selection criteria are elements authors use to

compare and rate different freelance marketplaces. Since authors use them to express an opinion on a freelance marketplace, it is likely that these selection criteria have a relation with the success of projects on freelance marketplaces. Thus, we retained preferences and selection criteria as elements possibly having a relation with success. Their relation with success will be tested with this study.

Project success is the explained variable. It includes project management success and product success (Annex 2). Project management success consists of the meeting of the project's time, budget, and scope criteria. Product success is the degree of attainment of a satisfactorily level of internal quality, external quality, and quality in use of the project's end product.

1.7 Research Contributions

The research provides a better understanding of factors enabling software development projects on freelance marketplaces to succeed. It attempts to identify important factors and characteristics that have a relation with success, thus giving service buyers an indication of what to look for when making the selection of a freelance marketplace. It will also attempt to identify success factors that stem from the project management process. Understanding of the success factors will help buyers of software development services to increase their project success rates.

The definition of the freelance marketplace field done in this study constitutes a research contribution. The top-down and bottom-up approach to define the fragmented and sometimes ambiguous field of freelance marketplaces provides an operational definition of the term "freelance marketplace".

The specific methodology for arriving at the definition of the freelance marketplace concept and the delimitation of the sector of activity constitutes another research contribution. The methodological steps followed could serve as an example of the process to arrive at the definition of a field of study.

Another methodological contribution is related to gathering preliminary data from atypical sources to complement the limited availability of occurrences in the specialized literature. The criteria established to judge the credibility of blogs and self-published articles applied to the context of freelance marketplaces constitute a contribution. Analysis of blogs was done to mine opinions about freelance marketplaces. Information on freelance marketplaces was gathered

by analyzing self-published articles online, while considering the content's validity and trustworthiness. This process resulted in time savings and a greater number of content than having attempted to ask respondents to write their thoughts.

1.8 Organization of the Thesis

Chapter 1 presents the research problem, the purpose statement, and an overview of the methodological steps followed.

Chapter 2 presents a methodology to arrive at an operational definition of the freelance marketplace concept and field of study.

Chapters 3, 4, and 5 will identify success factors of software development projects on freelance marketplaces. A framework of candidate success factors will be established for further testing. We proceed in 3 steps, corresponding to each of these 3 chapters.

The object of Chapter 3 is to define criteria to measure the extent of the success of a software development project on a freelance marketplace. This chapter includes a literature review of project success definitions, success measurement, and programming quality.

Chapter 4 will use a literature review in order to note factors that could potentially have an influence on the success of freelance marketplaces projects.

Chapter 5 will use opinions of freelance marketplace users expressed in blogs and other user-published online articles to formulate further potential success factors. A specific methodology was elaborated to extract supplemental success factors from these professional sources, while respecting acceptable validity requirements.

Chapter 6 presents the empirical research model, defines the survey methodology used for this research, and describes the sample.

Chapter 7 discusses the analysis of the data collected with the questionnaire, and presents the findings.

Chapter 8 is a conclusion that summarizes the research's findings and contributions, while presenting limitations and possibilities for future research.

Chapter 2 - Freelance Marketplaces

Since freelance marketplaces are a relatively new type of website, there is scant specialized literature on the subject. In our knowledge, there exists no widely used academic definition of these e-marketplaces. Attempts at identifying the concept, as seen in the academic and specialized literature, are subject to inconsistencies and contradictions.

Defining the concept of freelance marketplaces presents a "chicken and egg problem". One could first draw up a list of freelance marketplaces, then draw the characteristics to create a definition. The difficulty with this method is that the selection process of what marketplaces compose the initial list is not clear and structured. As another option, one could create a definition of the concept, and then compile a list of actual marketplaces that fit this definition. In this case, the problem is that the definition is conjured out of thin air, and does not have any solid references.

To arrive at a working definition, we will adopt the following methodological process. First, we will use the top-down approach of defining a preliminary definition of the concept. This "preliminary definition" is a description of the field intended to be studied. This will clarify what variety of marketplace websites the research aims to study. Second, starting from this definition, attempts at defining the concept will be assembled from the specialized literature or industry publications. Third, freelance marketplaces that fit the retained definitions will be identified and classified by popularity. Fourth, characteristics of the retained major freelance marketplaces will be compared. This methodological process resulted in a working definition of the freelance marketplace concept and an identification of field of study by selecting freelance marketplaces that fit the delimitations of the concept.

In order to present the preliminary definition of freelance marketplace, we will explore the terms freelance and e-marketplace.

2.1 Freelance Concept Definition

The freelance worker, sometimes called freelancer, is "a person who acts independently without being affiliated with or authorized by an organization" (Merriam-Webster, an.d.).

A freelance worker is akin to a contract worker, or a self-employed person.

In the United States, the IRS considers independent contractors and self-employed individuals synonyms (Internal Revenue Service, 2012). There are three categories of criteria to determine if a person is an independent contractor or an employee: behavioral, financial, and the type of relationship.

The behavioral criterion evaluates the degree of control an employer has over an employee. An employer will generally be able to instruct the employee on when, where, and how to work. The higher the control of the employer over the work provider, the higher the worker is likely to be considered an employee. The categories of factors for the evaluation of the degree of behavioral control are: "types of instructions given, degree of instruction, evaluation system, [and] training" (Internal Revenue Service, 2012).

Financial control of the relationship can indicate an employer-employee relationship when the employer controls financial decisions and aspects of the job. Categories of factors for determination of financial control are: "significant investment, unreimbursed expenses, opportunity for profit or loss, services available to the market, [and] method of payment" (Internal Revenue Service, 2012).

The nature of the business relationship is different for independent contractors. The factors to evaluate the type of relationship are classified in the following categories: "written contracts, employee benefits, permanency of the relationship, [and] services provided as key activities of the business" (Internal Revenue Service, 2012).

For example, an employment situation where (a) the purchaser of services has a right to control how the worker does their job, (b) expenses by the worker are reimbursed, and (c) the worker receives benefits as part of an employment contract would likely deem the worker to be an employee.

In Canada, a worker is considered self-employed as opposed to an employee if they meet criteria set by the Canadian Revenue Agency (CRA) (Canada Revenue Agency, 2011). A person can be considered self-employed if they use their own tools, provide their own workspace, have the possibility to realize a profit or a loss, markets their own services, or subcontract or assigns

some of the work. Even the Canadian Revenue Agency's criteria have some wiggle room, and in some cases the distinction between employee and self-employed can be debatable[3].

For the purpose of this study, we are interested in freelance workers who provide information technology services, specifically software development. Freelance workers are independent and hire out their time on contract.

2.2 E-marketplace Concept Definition

The traditional definition of a marketplace is "an open square or place in a town where markets or public sales are held" (Merriam-Webster, bn.d.). The community-created definition on Wikipedia of "the space, actual, virtual or metaphorical, in which a market operates" seems more fitting to the evolution of marketplaces. In practice, marketplaces are not limited to physical locations within cities where traders meet in person, but could be virtual. The Wikipedia definition captures brick and mortal, virtual online, and figurative marketplaces. In the case of freelance marketplaces, the location of the exchange of services is the Internet, while the initial contact and some other events happen on the website.

Since freelance marketplaces are strictly online, it would be more fitting to consider them as e-marketplaces. An e-marketplace, or electronic market, is "an online marketplace where buyers and sellers meet to exchange goods, services, money, or information" (Turban, King, Lee, Marshall, & McKay, 2007, p.44). In this study, we use the simplified term "freelance marketplace", where marketplace refers to this definition of e-marketplace.

2.3 A Preliminary Definition

What is intended by "freelance marketplace" as a preliminary definition of the concept is a website that supports the process of remotely hiring a freelance programmer on a temporary basis for the completion of a software development project.

[3] Under uncertainty, it is possible to request a ruling from the Canadian Revenue Agency to determine if a particular definition constitutes employment or self-employment.

This definition stems from the observation that some websites permit outsourcing of software engineering work to independent workers. These websites empower buyers of services to hire a remote worker on a temporary basis to complete a software development project, for reasons such as a lack of time or required skills. Referred to as "freelance marketplace" in this study, these e-marketplaces help buyers of software engineering services connect with providers and conduct business.

Software is defined as "instructions (computer programs) that when executed provide desired function and performance, data structures that enable the programs to adequately manipulate information, and documents that describe the operation and use of the programs." (Pressman, 2005). We consider the work a software development project when the main task is planning, creating, modifying, or reviewing a software application. Examples of categories of software applications include business software, personal computer software, and web-based software (Pressman, 2005).

Therefore, "freelance marketplace" will be used in this study in reference to websites whose raison-d'être fit our preliminary definition; "buyer" and "provider" will be used to refer to the remote employer and employee. This preliminary definition serves as a guide to find articles that relate to the freelance marketplace field in the specialized and professional literature.

2.4 Freelance Marketplaces in the Specialized Literature

Although no agreed-upon nomenclature or definition could be found in the specialized literature, the concept of freelance marketplaces is an occasional occurrence. In newspapers and industry publications, the concept is also referred to by different names (see Table 1). We found more mentions of the concept in professional publications than in the academic literature. We will first examine occurrences of the concept in the specialized literature.

Freelance marketplaces have been studied as a mean for students to cheat on assignments by contracting them out (Clarke & Lancaster, 2006; Jenkins & Helmore, 2006; Ross, 2005). It has been demonstrated that it is possible, and that it is common practice to hire out schoolwork such as computer science assignments to the lowest bidder using websites such as RentACoder.

Clarke and Lancaster (2006, p.1) refer to the site RentACoder.com (recently renamed vWorker.com) as a "contract cheating site", and describes it as a mechanism to put buyers of computer programs in contact with providers. Jenkins & Helmore (2006, p.123) describe RentACoder.com as an agency matching people requiring software with people willing to produce it. While the use of RentACoder is only presented as being for academic purposes, it can also be used in a business context.

Methods for conducting experiments and surveys using freelance marketplaces have been documented (Horton, Rand, & Zeckhauser, 2010; Kittur, Chi, & Suh, 2008; Paolacci, Chandler, & Ipeirotis, 2010). The authors suggest using workers on freelance marketplaces as participants, subjects or guinea pigs. The use of those websites is portrayed as a way to easily and cheaply find participants for scientific research. Researchers have used sites like Amazon's Mechanical Turk to find cheap respondents to answer questions, or on which to conduct experiments. Respondents do not necessary know that their work will serve for research purposes; as far as they are concerned they are completing paid work. For example, a project could be posted on a freelance marketplace offering a nominal pay for answering a list of questions. In this literature, the e-marketplaces are simply portrayed as a mean to find cheap respondents and candidate for research purposes; the marketplaces themselves are not explicitly studied.

Kittur et al. (2008, p.1) refer to Mechanical Turk as a "micro-task market", and describes it as a market where task can be posted to be completed for a price. Horton et al. (2010, p.1) name the websites "online labor markets", and give as examples oDesk, Elance, Guru, and Mechanical Turk.

Lu and Zeng (2011, p.1) call freelance marketplace websites "online service platforms", "online service vendors" and "online service marketplace". The authors also note that the terms "microsourcing" and "crowdsourcing" are used elsewhere to refer to the same concept (Lu & Zeng, 2011). The following websites are listed by Lu and Zeng as examples of online service vendors: Elance, LiveOps, RentACoder, Guru, oDesk, Mechanical Turk, GetAFreelancer, TopCoder, 99designs, and Innocentive. The authors define online service marketplace as an "online marketplace that aggregates the […] service clients and […] service providers from anywhere in the world" (Lu & Zeng, 2011).

Lu and Zeng (2011, p.3) specify a distinction between online service marketplaces (OSM) and crowdsourcing marketplaces. The difference between both types of marketplace is based on the fact that OSMs are project-based, while crowdsourcing marketplaces are "micro-task" based. Micro-tasks primarily consist of simple cognitive tasks (usually low-skill and repetitive), while projects in online service marketplaces would rather consist of more complex knowledge-based and innovation-based tasks.

Evidently, websites that could fit our preliminary definition are referred to with various names associated to different definitions and categorizations.

2.5 Freelance Marketplaces in Professional Publications and Blogs

Mentions of freelance marketplaces are far more prominent on professional sources such as newspaper articles, online industry publications, and blogs.

The Entrepreneur magazine refers to these types of websites as "online freelance marketplaces" (Puranik, 2005), and alleges that there are 110 such websites, the biggest being Guru, Elance, RentACoder, and GetAFreelancer.

A publication from smartsheet.com refers to these types of marketplaces as "paid crowdsourcing vendors" (Frei, 2009). Paid crowdsourcing is defined as "the act of outsourcing paid work of all kinds to a large, distributed group of workers using a technology intermediary that helps oversee the definition, submission, coordination, acceptance and payment for the work done" (Frei, 2009, p.2). This article also suggests that work completed on these websites can be classified according to four levels of complexity: micro tasks, macro tasks, simple projects, and complex projects. In this paper, the term paid crowdsourcing includes all types of marketplaces, regardless of the complexity of the work completed. These four categories of tasks are defined as follows:

a) Micro tasks are short, low pay, high volume tasks usually without direct communication between the buyer and provider. An example would be to associate keywords to an image.
b) Macro tasks are similar, but slightly more complicated, and could be for example to translate a page from French to English.

c) Simple projects include a buyer and a provider in direct contact, and have a short time frame.
d) Complex projects are also done between a buyer and seller and direct contact with each other, but have a longer time frame.

There are variations in the level of complexity in tasks or projects a marketplace allows to have completed. There exist a significant difference between a micro-task and a complex project, thus some marketplaces specialize in a category of tasks. Furthermore, most IT and software development projects are of a complexity level that would fall in "simple projects" at a minimum, and therefore would not be feasible on a micro or marco task marketplace.

A variety of names are used in the professional literature and blogs to refer to the type of website we have described in the preliminary definition. The two parties involved in a business transaction, the buyer of services and the provider of the services, are given different names. Table 1 provides synonyms of the concepts of freelance marketplace, buyer, and provider that are usually encountered, and thus illustrates the fragmentation of terms used. These expressions where collected from freelance marketplace websites, and from the specialized and professional literature.

Table 1 Synonyms of freelance marketplace, buyer, and provider in the literature

Concept	**Alternative expressions used by authors**
Freelance marketplace	Outsourcing marketplace, e-labour, work broker, online talent market, e-lance marketplace, online service marketplace, online service platforms, paid crowdsourcing vendors, online labor marketplace
Buyer	Employer, client
Provider	Worker, employee, remote worker, virtual worker, virtual employee, remote employee, contractors, freelancer, seller, vendor

Following a review of descriptions of freelance marketplaces from the specialized and professional literature, the next section will use a bottom-up approach to arrive at a definition.

We compared freelance marketplace websites based on their characteristics, and revisited our preliminary definition to form our operational definition of the freelance marketplace concept.

2.6 Characteristics of Freelance Marketplaces

The goal of this section is to present characteristics of the most visited freelance marketplaces. We will identify and describe the studied domain or field by looking at examples of freelance marketplaces and their characteristics. We used a bottom-up approach, starting for the characteristics of freelance marketplaces to infer the sector of activity that constitutes the field of study of this research. The adopted methodology consists of:

a) Identifying freelance marketplace websites.
b) Classifying the websites by popularity.
c) Make a comparative analysis of freelance marketplace websites.

2.6.1 Methodology for Discovery of Freelance Marketplaces

The most popular websites (according to Alexa.com rank) were retained in order to create a pertinent group. Our rationale is that a frequently visited freelance marketplace website would be representative of a typical website of the studied field. The freelance marketplace meeting our popularity requirements were compared based on their characteristics. A summary table presents whether each website contains or lacks each characteristic. To obtain the list of freelance marketplaces, we proceeded in the following way.

First, websites mentioned in the literature about the subject were added to the list (RentACoder/vWorker, guru, elance, Freelancer/GetAFreelancer).

Second, google searches where conducted with “related:” prefixed to each of the website`s domain names (ex: “related:vworker.com”). The results were used to expand the list. Websites fitting the preliminary definition of freelance marketplaces were retained.

Third, the websites were sorted by Alexa.com Rank. This search engine ranks websites in order of most visited, based on data collected from their browser add-on softwares for the last three months. For example, a rank of 1 would mean that the website is the most visited in the world (it is currently google.com). A rank of 100,000 would mean that 99,999 websites are visited

more often than the site in question. This gives an approximate indication of the popularity or prominence of each freelance marketplace, and thus of which ones may be more widely used.

Forth, we retained the top 15 websites by Alexa Rank. The rank jumps from 26,960 to 44,917 between the 15th and 16th website, indicating a large discrepancy in popularity. The large difference in popularity suggests that the 15 first websites are more important than the following, and is the basis for our cut-off of the in-depth analysis of their characteristics.

Sixth, characteristics of each freelance marketplace were compiled for comparison. Features and traits that compose or differentiate freelance marketplaces are presented in a table.

2.6.2 Identification of Characteristics

We proceeded to the definition of each of the following observed characteristics. A lot of these characteristics or binary or "Booleans": they either have it or they don't. We retained the following parameters for comparison:

- *Page Rank:* this is Google`s 0 to 10 scale of website importance, primarily calculated from the number and quality of links pointing to the website. The site`s PageRanks were obtained through the Google Toolbar. It serves as an indication of the freelance marketplace`s popularity.
- *Year founded*: The year the freelance marketplace first came into existence. It is often found on the website, frequently in the "about us page". When no such information was offered, two methods were used to determine the site`s creation year. First, the Wayback Machine at www.archive.org was used to browse previous cached versions of the website. The time where the website first appears in its current form was recorded as the year of foundation. When not available, a whois lookup[4] of the domain was conducted, and the registration date of the domain was assumed to be the year the freelance marketplace was created.
- *Type of marketplace:* The marketplace was classified in four categories based on the following criteria:
    - *Microtask:* When task completed on the marketplace are low-skill cognitive tasks, with low remuneration per task, ranging for a couple pennies to a few dollars.

[4] Whois lookups were done with domaintools.com

    - *Outsourcing:* When projects represent more complex tasks than microtask marketplaces, with project values typically in the hundreds to thousands of dollars.
    - *Crowdsourcing:* When more than one provider completes the same task, and only the winner or the winners are paid for their work.
    - *Job board:* Where there is no escrow payment escrow process, no rating system for providers, no arbitration services, and only hourly rate based jobs. This type of site can barely be considered a marketplace, because although it is a meeting place of providers and buyers of services, the actual business transaction is done outside the website.

- *Reported volume:* This represents unaudited self-reported total value of work completed on the freelance marketplace. Since the data could be old, or fail to count all work and progress and completed projects, it is very likely the marketplaces have in fact processed a higher volume. This parameter can therefore be considered as a low estimate of transaction volume. The data was in same cases displayed on the marketplace`s website itself. In other cases, the marketplaces were asked via email to provide this value. And in other cases, the data was found in a publication by SmartSheet.com (Frei, 2009).
- *Slogan:* This is the website's catchphrase, slogan, or pitch. The goal of this data point is to compare each marketplace's short statement of their value proposition.
- *Transaction fees:* This represents the base transaction fee, or commission fee charged by the marketplace on completed projects. It represents the minimum cost of using the marketplace. Many marketplaces also offer other satellite services at additional cost, such as promoting the project posting within the marketplace to gain prominence and attract more bids from providers.
- *Work completion process:* The typical process to complete a software development project on the freelance marketplace.
- *Fixed price projects:* Whether it is possible to post a project, while paying the provider a flat rate for its completion, regardless of the actual amount of time and effort spent by the provider.

- *Hourly rate projects:* Whether it is possible to post a project and pay the provider by the hour, as opposed to a flat rate for the entire project.
- *Search tools:* Whether the marketplace include functionality to search for projects or providers based or criteria such as keywords, project amount, etc.
- *Provider skill tests:* Whether the marketplace offers standardized tests or exams to providers to assess their skills, and make it easier for buyers to find competent providers.
- *Reputation system:* Whether the marketplace includes a rating system for buyers or providers. When this feature is present, buyers can leave a rating and feedback on the provider after the project`s completion, in the goal to help future customers choose the appropriate provider. In some cases, feedback on the buyer is also left by the provider.
- *Communication tool:* Whether it is possible for buyers and providers to communicate on the marketplace with the use of a private messaging system.
- *Payment processing and escrow.* Whether the marketplace holds the buyer`s payment in trust until the project has been confirmed as completed, or the agreed-upon milestones are met. If the buyer must pay the provider directly, it would be indicative of an absence of an escrow system.
- *Arbitration:* Whether the marketplace provides a system or process to resolve disputes between buyers and providers.
- *Project manager available:* Whether it is possible to hire a project manager, in addition the provider, to personally help with the outsourcing process. For example, the project manager could help write the initial requirements, chose a provider, and make sure the work is done correctly.

2.6.3 Comparative Analysis of Freelance Marketplaces Characteristics

Based on the adopted methodology, Table 2 presents the value of the parameters for the 15 retained websites.

Table 2 Comparative analysis of freelance marketplace characteristics

(Table 2 on next page)

													Information		Tools				Services		
Name	**URL**	**Alexa Rank**	**Google PageRank**	**Year Founded**	**Type of marketplace**	**Project categories**	**Reported volume**	**Slogan**	**Transaction fees**	**Work completion process**	**Fixed price projects**	**Hourly rate projects**	**Online community and information**	**Search tools**	**Provider skill tests**	**Reputation system**	**Communication tools**	**Work monitoring tools**	**Payment processing and escrow**	**Arbitration**	**Project manager available**
Fiverr	www.fiverr.com	327	5	2010	Microtask	Design, marketing, programming, business, …		The world's largest marketplace for small services, starting at $5	20%	Provider post tasks they are willing to do for 5$, buyers post tasks they are willing to pay 5$ for	yes	no	no	yes	no	yes	yes	no	yes	yes	no
Elance	www.elance.com	330	6	1998	Outsourcing	Programming, design, marketing, writing, admin, business	$ 513,857,775	Instant Access to Great Talent	6.75% - 8.75%	Reverse auction, private auction	yes	yes	Elance University	yes	yes	yes	Yes	Yes, Work View	yes	yes	no
oDesk	www.odesk.com	334	7	2003	Outsourcing	Programming, writing, admin, design, business, …	$ 90,000,000	Changing How the World Works	10%	Reverse auction, direct solicitation with provider	yes	yes	Forum and articles	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Freelancer (GetA-Freelancer)	www.freelancer.com	350	6	2004	Outsourcing, crowdsourcing	Programming, writing, admin, design, engineering, business, …	$ 122,637,581	Hire online for a fraction of the cost!	3%, min 3$	Reverse auction, contest, service offer	yes	yes	Forum and articles	yes	yes	yes	Yes	no	yes	yes	no
Amazon Mechanical Turk	www.mturk.com	1,800	6	2005	Microtask, crowdsourcing	Small cognitive tasks		Artificial Artificial Intelligence	10%, min $0.005 per task	Buyer posts task and prize, multiple users complete the task	yes	no	Forum and articles	Yes	Yes	No	No	No	Yes	Somewhat, work can be rejected and rejections can be contested	No
99designs	www.99designs.com	2,124	6	2008	Crowdsourcing	Design	$ 32,027,629	Design Done Differently	20%	Buyer post requirements, multiple providers submit work, only the chosen product is paid for	yes	no	no	yes	no	no	yes	no	yes	no	yes, design consultation
vWorker (formerly RentACoder)	www.vworker.com	2,164	3	1998	Outsourcing, crowdsourcing	Admin, business, programming, design, writing, …		How work gets done. Guaranteed!	6.5% - 15%	Reverse auction, direct provider offer (private auction)	yes	yes	Articles	Yes	No	Yes	Yes	Yes, AccuTimeCard	Yes	Yes	Yes, Sherpa
Guru	www.guru.com	2,354	6	1998	Outsourcing	Programming, technology, design, business, …	$ 100,000,000	Hire Freelancers & manage projects online.	4.5% - 9%	Reverse auction, direct solicitation with provider	yes	yes	Articles	yes	yes	yes	yes	no	yes	yes	no
ScriptLance	www.scriptlance.com	2,853	4	2001	Outsourcing	Programming, design, writing, and marketing		Connecting business with programmers	5%, min 5$	Reverse auction, contest, private auction	yes	no	Forum and articles	yes	no	yes	yes	no	yes	yes	no
PeoplePerHour	www.peopleperhour.com	3,880	5	2007	Outsourcing	Programming, design, admin, business, writing, marketing	$ 71,008,510	The smarter way of working!	4.5% - 10%	Reverse auction	yes	yes	Articles	yes	no	yes	yes	no	yes	yes	no
iFreelance	www.ifreelance.com	23,142	5	1998	Outsourcing	Business, design, programming, engineering, …		Hire freelance experts without the middleman	Memberships only	Reverse auction	yes	no	no	yes	no	yes	no	no	no	no	no

													Information		Tools				Services		
Name	**URL**	**Alexa Rank**	**Google PageRank**	**Year Founded**	**Type of marketplace**	**Project categories**	**Reported volume**	**Slogan**	**Transaction fees**	**Work completion process**	**Fixed price projects**	**Hourly rate projects**	**Online community and information**	**Search tools**	**Provider skill tests**	**Reputation system**	**Communication tools**	**Work monitoring tools**	**Payment processing and escrow**	**Arbitration**	**Project manager available**
GetACoder	www.getacoder.com	23,509	4	2004	Outsourcing	Programming, writing, deisng, marketing, admin, …		Easy-to-Implement Outsourcing Solutions	10% + 5$	Reverse auction	yes	yes	Articles	yes	no	yes	yes	no	yes	yes	no
SoloGig	www.sologig.com	25,745	6	2001	Job board	Programming, engineering		Where seasoned professionals find jobs	Posting fee	Job listings only	no	yes	no	yes	no	no	no	no	no	no, can only complain directly to fiverr's staff	no
TaskCity	www.taskcity.com	26,960	5	2007	Outsourcing	Programming		Outsourcing Redefined	Free to post, paid services extra	Reverse auction	yes	no	Forum	yes	no	yes	yes	yes, work diary	yes	yes	yes
TopCoder	www.topcoder.com	28,692	6	2001	Crowdsourcing	Programming	$ 7,000,000	a place to create	Non transparent pricing (awaiting email from support)	Contest, chosen coders are paid. Multiple coders are part of the finished process	yes	no	Collaboration, events, forums	yes	no	yes	yes	no	yes	no	yes, copilot

2.6.4 Other Websites Included in the Field of Study

Table 3 lists other freelance marketplaces, with higher Alex Ranks. The websites did not fit our popularity criteria, but are presented for informational purposes. These 19 websites did not fit our popularity threshold, but are nonetheless considered part of the field of freelance marketplaces.

Table 3 Other websites included in the field of study

Name	URL	Alexa Rank	Google PageRank	Year Founded
Click Worker	www.clickworker.com	44,917	4	2005
Project4hire	www.project4hire.com	53,710	4	2006
Live Ops	www.liveops.com	54,887	6	2000
uTest	www.uTest.com	64,275	5	2007
Innocentive	www.innocentive.com	84,420	8	2001
CastingWords	www.castingwords.com	202,140	6	2006
Design Outpost	www.designoutpost.com	223,055	4	2002
Net4manpower	www.net4manpower.com	291,055	4	2005
Vois	www.vois.com	453,758	4	2007
BizReef	www.bizreef.com	463,217	5	2007
SmarterWork	www.smarterwork.com	1,305,214	5	1999
LeadVine	www.leadvine.com	1,353,308	4	2008
ProjectSpring.com	www.projectspring.com	1,416,726	3	2007
Ki Work	www.ki-work.com	2,722,481	3	2007
GFXContests	www.gfxcontests.com	2,914,227	3	2006
Serebra connect	www.serebraconnect.com	3,820,747	4	2007
Crowdsifter	www.crowdsifter.com	4,359,561	4	2008
CreateAd	www.creatad.com	9,148,378	4	2009
Colspark	www.colspark.com	11,029,478	3	2009

2.7 Operational Definition of Freelance Marketplaces

We added the following constraints to formulate our operational definition of freelance marketplaces:

a) Since the purpose is to study success factors of software development projects on freelance marketplaces, we limit the list to marketplaces allowing the completion of software development projects. Since some marketplaces do not allow software development projects to

be completed, they are considered outside the scope of the research. For example, marketplaces such as 99designs, which focuses on design projects, would be excluded.

b) Some marketplaces allow only micro tasks, which cannot consist of software development projects. They are tasks of low cognitive level not requiring any specialized skills or knowledge of programming to complete. For example, it is not reasonably feasible to complete software development projects on Mechanical Turk. The completion of a software development project of average complexity requires numerous hours of work, and therefore a remuneration of pennies or a few dollars is never appropriate. Microsourcing marketplaces such as fiverr and clickworker are for this reason excluded from the study.

c) As the preliminary definition outlines, we are interested in the outsourcing or out-tasking process between a single buyer and a provider. Some marketplaces operate in a contest model, where a buyer posts project requirements, multiple providers submit finished products, and the provider's whose work is selected receives payment. As a result, marketplaces where multiple providers compete or collaborate to complete the work fall outside of the preliminary definition. Crowdsourcing marketplaces, where the outsourcing process is akin to a contest, such as topcoder and 99designs would therefore be considered outside the definition of the type of freelance marketplaces we intend to study.

d) Marketplaces that serve as job boards, such as SoloGig, do not fit in the preliminary definition. Although buyers and providers meet on the marketplace, the actual work and payment processes are conducted outside the marketplace. Job boards only support the initial search phase of the hiring process – not its entirety.

Considering these aspects, we are now able to improve our preliminary definition. This leads of the operational definition of freelance marketplace. This operational definition represents the retained definition which will be used as part of this research.

A freelance marketplace is a web-based e-marketplace that supports the entire process of contracting out a software development project to a single independent remotely-located programmer for a fixed price or hourly rate, while offering related information, tools, and services.

The following high-ranking websites fit the definition: elance, odesk, freelancer, vworker, guru, scriptlance, peopleperhour, ifreelance, and getacoder.

2.8 Software Development Projects on Freelance Marketplaces

Following our definition and to specify the field of study, it is important to explain the typical process of completing a software development project on a freelance marketplace. The process described consists of the development of a software program through a software development project by a buyer and a provider on a freelance marketplace.

2.8.1 Parties Involved in the Software Development Project

This study focuses on the relationship between the buyer and the finished product during the software development project development process. We are interested in the perspective of success of projects from the point of view of the buyer. Freelance marketplaces are not scrutinized based on the quality of their design and utility, but are however an integral part of the successful software development project completion.

The decision and selection processes of the marketplace are not considered in this research. The process we are concerned about begins after the selection of a freelance marketplace.

The goal of the study is to explore success factors of software development projects completed with the use of a freelance marketplace. These factors could stem from the buyer, the provider, the freelance marketplace, or the nature of the project. The following diagram depicts the relationships between the three parties, and the end product that results from the software development project.

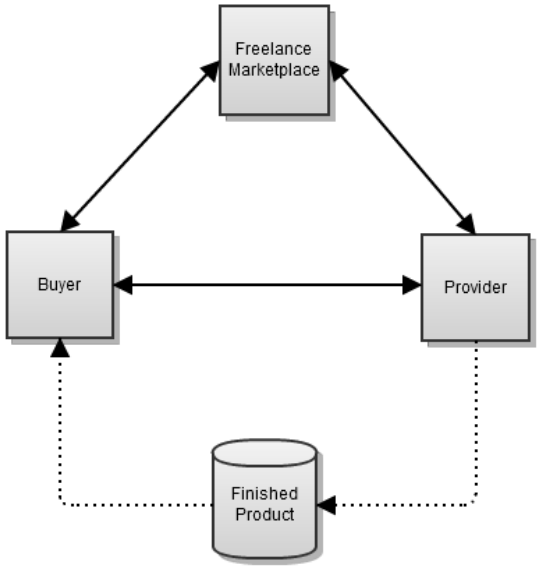

Figure 1 Relationships between parties on freelance marketplaces

We consider a software development project as a goal-driven undertaking where the work required constitutes computer programming, and where the outcome of the process is a software program. As programming, which relates to computer sciences, is a subpart of Information Technology (IT), a software development project is a subtype of IT projects.

Software development is the creation of software applications, which fall into different categories such as personal computer software, business software, and web-based software (Pressman, 2005). Some software development projects are upgrades or modifications to an existing software application, resulting in a new version of an existing software application. We can note that a software development project includes some work that cannot be considered computer programming but is necessary to the completion of the project. For example, the creation of an iPhone app may require source code to be written (programming) as well as a user interface to be designed (user interface design). As another example, in the case of a web application it is possible the provider will need to install the software on the buyer's server and make modifications to the server's configuration. Whether these actions are considered programming is debatable, they would nonetheless be considered part of the software development project in this study.

The decision of the buyer and the provider to work together on a freelance marketplace to complete the buyer's requirements creates a software development project. At the completion of the software

development project, the provider delivers a finished product to the buyer, which is a software application.

2.8.2 Project Completion Process on Freelance Marketplaces

This section illustrates the typical process of commissioning and overseeing a software development project on a freelance marketplace, from the drafting of requirements until the delivery of the software development project.

The process of hiring a remote programmer for the completion of a software development project is similar on all freelance marketplaces. All marketplaces that fit our definition of freelance marketplace follow this process. As previously stated, the selection process of the freelance marketplace by the buyer is outside the scope of this research. We shall only consider the process that starts after the buyer has chosen a suitable freelance marketplace for his requirements. In a global view, the key aspects of the process are the following:

1. The buyer posts his requirements on the freelance marketplace. A detailed description of what is needed is posted, sometimes with accompanying documents, wireframes, diagrams, etc. The requirements can range to being very specific to being very broad and high-level. It can range from the case where a specific programming language is dictated and the exact process of each function of the software is already planned, to a case where the requirements is simply a high-level overview of the goal of the software with the choice of technologies left to the discretion of the provider. The bidding period length and the project completion dates are set by the buyer.
2. Candidate providers bid on the project, after asking clarification questions if necessary. The buyer can communicate with the candidates to inquire about their qualifications, or ask questions about their bid proposal. Providers either find the project while browsing on the freelance marketplace, or could have been specifically invited by the buyer to submit a bid. Through communication between the buyer and the providers, the price, timeframe, and scope can be negotiated.
3. The buyer selects a provider amongst the submitted bids to work on the project. This acceptance of the provider's proposal constitutes a legally binding contract, as per the freelance marketplace's terms.

4. The buyer deposits funds with the freelance marketplace to be held in escrow until the agree-upon milestones are met. Payment schedule is specified in the requirements. It could consist of partial payments after predefined milestones, or payment in full after the entire project is completed.
5. The provider is notified of the funds deposit in the escrow account, and starts to work on the project. There is a grace period during which the provider can abandon the project.
6. Except for small projects whose simplicity does not warrant back and forth communication between the buyer and provider, the provider will provide progress reports to the buyer. The buyer has the opportunity to inspect the work as it is done, and provide feedback to the provider. Modifications requests are sent to the provider until the work is satisfactory to the buyer. The communication can be done using the freelance marketplace's messaging system, in order to retain evidence in case of dispute. When communication occurs outside the marketplace, it is recommended that a summary of each communication be posted on the marketplace, and agreed upon in writing by both parties.
7. The final project is delivered. The buyer accepts the work as being finished. When mutual agreement cannot be met, the issue is escalated to the arbitration team who will decide how the money is distributed and who retains ownership of the intellectual property of the work.
8. The freelance marketplace releases the funds to the provider, less its fees.
9. The buyer and provider rate each other, effectively helping other users gauge the skills and trustworthiness of each party. This step occurs after the work is completed and is optional, though it is highly encouraged by the freelance marketplace.

The diagram in Figure 2 depicts the communication and activity flow between the involved parties:

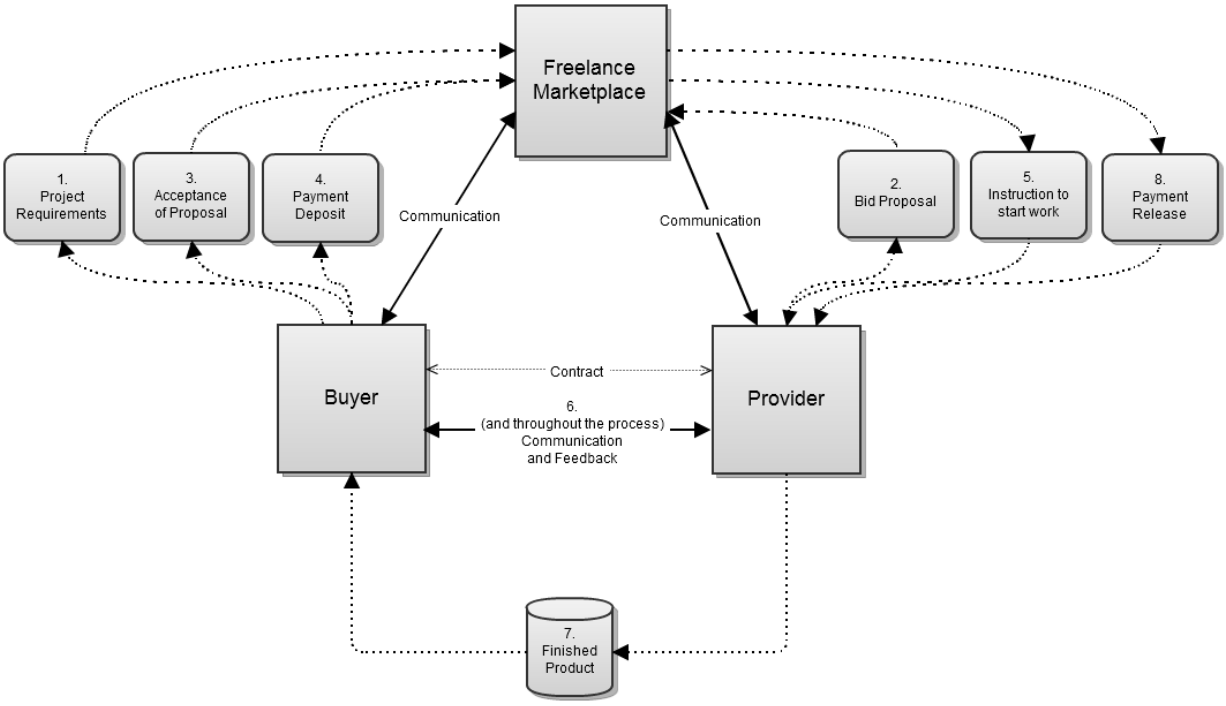

Figure 2 Communication and activity flow between parties

The following business process model and notation (BPMN) graph represents the process (Figure 3 on next page):

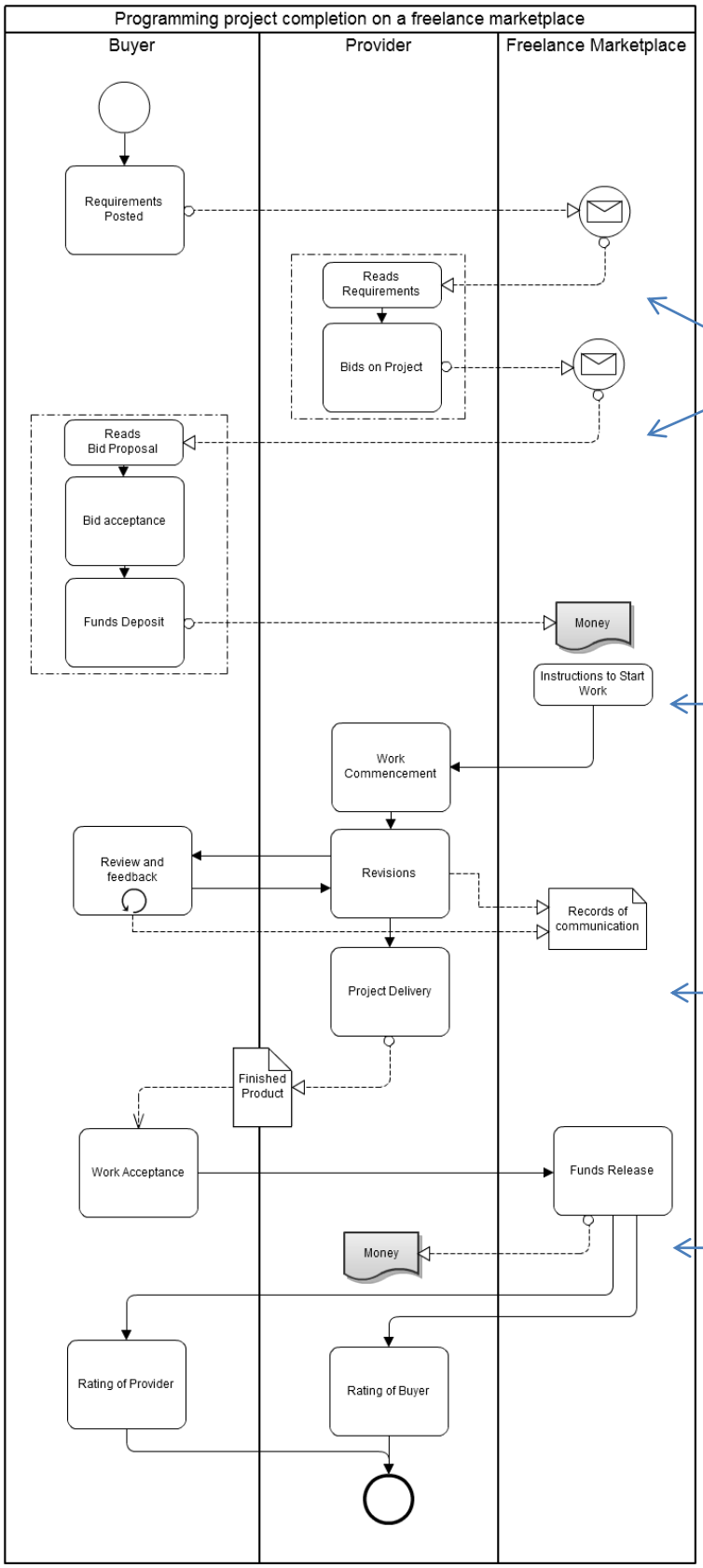

Figure 3 Simplified BPMN graphic of a software development project completion on a freelance marketplace

Represents an entry posted on the website. Typically has its own page and shows up on search results

The buyer has the choice of the payment method amongst the freelance marketplace's choices

Private messages and activity log are kept in reference to the original project

The provider choses the payment method for cashout

Chapter 3 - Software Development Project Success Metrics

In this chapter, we define programing project success as having two components: project management success and product success. Project management refers to the process of completing the project, while the product is the output created by the project (Baccarini, 1999).

We define a software development project as a web or software development project where one of the project's tasks consists of planning, creating, modifying, or reviewing source code. Software programs are executed or compiled from their source code. To arrive at criteria to measure the success the software development project's product, we will look at the specialized literature on software quality[5]. The rationale is that there is a link between product quality and product success.

3.1 Project Success Metrics

The goal of this section is to review the specialized literature to find methods and criteria to judge and evaluate the success of a project. Specifically, we are looking for elements that can be used to gauge the success of software development projects.

Criteria[6] are metrics to judge the project's success. A criterion does not imply causation, but is merely an element to judge success. Success factors, which have a link with success, are discussed in the next section.

Pinto & Slevin (1988) noted that arriving to a consensus on the measurement or the definition of success is difficult. According to Bellout (1998), project success includes the efficiency of the process and the effectiveness of the project. Process efficiency would include schedule and cost, while project effectiveness would refer to quality (Aladwani, 2002). Effectiveness is more important than efficiency (O'Shaughnessy, 1992). A project that is not effective while being efficient will rarely be considered a success. A project that is not efficient but effective could still be considered a success.

[5] Quality is defined by the American Society for Quality (American Society for Quality, n.d.) as a subjective term whose technical definition is "the characteristics of a product or service that bear on its ability to satisfy stated or implied needs" or "a product or service free of deficiencies". Software quality is composed of internal quality and external quality (McConnell, 2009).

[6] The Oxford English Dictionary (2007) defines criterion as "a test, principle, rule, canon, or standard, by which anything is judged or estimated".

For example, the Sydney Opera House is considered a project management failure: the project was completed late with severe cost overruns. However, in the end the building was completed and its visitors consider the project a success when observing the end result (Shenhar, Dvir, Levy, & Maltz, 2001). The project was not completely efficient, but effective nonetheless.

The distinction between project efficiency and effectiveness is akin to the division of project success into project management success and product success.

3.2 Project Management Success versus Product Success

According to De Wit (1988), there is a distinction between project success and project management success. A project's success is determined by meeting its objectives, while the project management success is measured by the time, cost, and quality (or scope) criteria. In the field of project management, a project is typically considered successful when the time, cost, and quality constraints are met (Ika, 2009).

The project management success criteria (time, cost, and quality) are often used to encompass the entire project success, with the quality characteristic loosely including product quality. In our definition of project management success, quality refers to the quality of the project management process. We divide project success into two distinct components: project management success and product success.

Baccarini (1999) proposed that project success consists of both product success and project management success. Project management success includes the fulfillment of the time, cost, and quality criteria, as well as the efficiency of the process. Product success is attained when the end result is satisfactory, meets its objectives and the strategic vision of the organization. What Baccarini (1999) refers to as "product success" is a similar concept as De Wit referred to as "project success".

Furthermore, Baccarini (1999) explained that the typical project management success measures are tangible, and can be easily measured. The time and cost criteria are the most tangible to measure. However, the soft dimensions such as satisfaction (and usefulness) are intangible, subjective, and thus harder to measure. The tendency to measure project success solely by project management success stems from the ease of measurement of the time, cost, and scope (Crawford & Pollack, 2004).

According to Baccarini (1999), project management success and product success are each comprised of three components:

- Project management success includes:

    1) The traditional time/cost/scope objectives. These three variables are often used to measure the success of a project. A successful project would be one that is done within the planned timeline, within the estimated and reasonable budget, and at a satisfactory level.
    2) The quality of the project management process. This deals with the efficiency of the process. A successful project management process typically includes things like having planned all the requirements right, staying true to the original scope, and good quality assurances practices.
    3) Successful project management satisfies the stakeholders. The provider of services and the buyer of services, in the case of freelance marketplaces, should be satisfied with the project process.

- Product success includes:

    1) The achievement of the project's objectives. The product must achieve what was intended at the start of the project.
    2) The goals that were set must be attained. The project's product must also satisfy a purpose. The project can be considered successful when it satisfies the requirements of its users. Simply put, it must be useful.
    3) As the third component, the project's product must bring satisfaction to the stakeholders. The buyer or the user of the end product must be satisfied with it. The customer's satisfaction of the product is considered a key measure of success.

There is no absolute success, only perceived success (Baker, Murphy, & Fisher, 1988). The perception of the success of a project varies depending on the point of view. Parties will have different expectations and criteria for success (Lim & Mohamed, 1999). A project can be considered a success from the point of view of one party, but a failure from the point of view of another. For example, a shopping center whose construction was severely over budget can be considered a failure by the contractor and developer, while recognized as a success by the tenants and shoppers.

To parallel freelance marketplaces, a project can be considered a success by one party and a failure by the other. A provider, after having underestimated the scale and scope of a project, could find himself having worked more hours on a project than expected. Since a fixed cost was agreed upon, the provider

went over his budgeted amount of man-hours of work for the project. This project would be considered a success by the buyer, since a very low price was achieved, but a failure by the provider.

Project success is achieved when the product management process and the final product are successful. For the purpose of this research, we will consider project success from the point of view of the buyer. The scope of this research is limited to surveying buyers of programming services on freelance marketplaces.

3.3 Software Quality

In addition to achieving project management success, a successful freelance marketplace software development project must also achieve product success. Since the principal output[7] of a software development project is source code (McConnell, 1997), this source code or finished software (i.e. a compiled version of the source code) constitutes the end product. Software quality measurement criteria have been developed to evaluate the quality of the end product, we can use.

3.3.1 Software Quality and Success

To evaluate the product success of software development projects, we will establish metrics to measure software quality.

It is possible that a software development project is considered a project management success: the time, cost, and scope were all satisfactorily met. However, project management success does not guarantee the end product is successful. While achieving project management success, a project could nonetheless be considered a failure by the buyer in the following situations (Boehm, Brown, & Lipow, 1976):

- The source is difficult to understand and modify. Badly written code could serve its intended purpose, while being difficult to comprehend. When it is the time to maintain or modify the software, low quality code can be difficult to understand by another programmer.
- The software is difficult to use. The software is not fault-tolerant. It is easy to misuse the software.
- The software has unnecessary dependencies or is hard to integrate with other software.

[7] Other outputs of a software development project could include other deliverables such as software documentation, content, design guidelines, case studies, license agreements.

A project that appears to be functional after the project completion date could have several underlying internal flaws.

Explicit requirements, such as a written project description, must be satisfied to achieve quality. In addition, implicit requirements which may not have been expressly communicated to the programmer must also be satisfied. Quality software must comply with its explicit and implicit requirements (McCall, Richards, Walters, Rome Air Development Center, & United States. Air Force. Systems Command. Electronic Systems Division, 1977). The buyer, programmer, or end user of the software may not be aware of all implicit requirements.

3.3.2 Software Quality Metrics

To establish software quality metrics, software quality is divided into two distinct sets of characteristics: internal quality and external quality (McConnell, 2009).

Internal quality, also known as direct quality and structural quality, is the quality of the software's source code. It deals with the quality of the design of the software's internal structure.

External quality, also known as indirect quality and functional quality (Pressman, 2005), is the fitness of the software to its requirements as used by the end user. Quality is assessed by observing the software's functionalities with testing or by using it. Even when considering the software as a black box, with no knowledge of its inner workings, it is possible to evaluate the software's external quality.

The IEEE Standard 1061, the Standard for a Software Quality Metrics Methodology provides a methodology to define software quality (*IEEE standard for a software quality metrics methodology*1998). Software quality is defined as a list of quality attributes that can be measured with appropriate software metrics. This standard does not present specific metrics that can be used to measure quality, but merely provides a methodology to assess quality, from the identification of metrics to the analysis of results. The "software quality metrics framework" is comprised of five steps: establishing software quality requirements, identifying software quality metrics, performing a cost-benefit analysis, implementing the software quality metrics, analyzing the software metrics results, and validating the software quality metrics.

Over the years, there have been several widely cited publications presenting a list of software quality metrics. Some models use quality characteristics, factors, or criteria.

3.3.3 Criteria for Software Quality Metrics

The objective of this section is to identify criteria components of software quality metrics. To achieve this end, we examine software quality frameworks and models found in the specialized literature in chronological order.

The software quality metrics are not always the same along the years. Characteristics are grouped and organized in different ways. The inconsistency along the years and authors suggests that it is difficult to define metrics for software quality. It is likely that respondents to our survey will not have clear and defined metrics for evaluating quality software.

3.3.3.1 Boehm et al. Software Quality Characteristics

Boehm et al. (1976) proposed a tree-based model, with the root characteristics at the top. The software quality metrics, called software source code quality characteristics, are grouped into three main criteria.

a) As-is utility: reliability, efficiency and human engineering
b) Maintainability: testability, understandability, and modifiability
c) Portability: device-independence and self-containedness

Each of these subcharacteristics branch off in further subsubcharacteristics, which results in numerous criteria to evaluate.

Additional subsubcharacteristics include accuracy, completeness, robustness/integrity, consistency, accountability, device efficiency, accessibility, communicativeness, self-descriptiveness, structuredness, conciseness, legibility, and augmentability. However, the exact meaning of each of these items is not defined.

This quality model is over 35 year old, and dates from an era when computer software was very different that today. The number of characteristics is staggering, with little explanation of each sub-characteristic.

3.3.3.2 McCall Quality Factors

McCall's (1977) quality model is based on different criteria (referred to as factors in the model). The list of factors is divided in three groups:

a) Product revision: maintainability, flexibility, testability
b) Product transition: portability, reusability, interoperability

c) Product operations: correctness, reliability, efficiency, integrity, usability

Each of these 11 factors is explained by further criteria. For example, efficiency would be measured by both storage efficiency and execution efficiency. Correctness would be measured by 3 criteria: traceability, completeness, and consistency.

This model is shorter and more concise than Boehm et al.'s characteristics. Is it divided in three product cycle phases: when it is used, when it is revised, or when it is being ported. These three root criteria are similar to Boehm's model: Product operation is similar to as-is utility, product transition to portability, and product revision to maintainability.

Based on the two quality factors model previously presented, quality software at a high level works well when used, can be modified easily, and can be transported to other environments.

3.3.3.3 HP Quality Factors

Hewlett-Packard's (Grady & Caswell, 1987) list of "FURPS" quality criteria (referred to as factors) includes: functionality, usability, reliability, performance, and supportability.

This model is even shorter than McCall's model, comprising of only 5 quality factors. Each of the five quality factors are explained with further quality subcriteria (referred to as attributes), in a manner similar than that of Boehm's quality subcharacteristics.

This model has significantly less criteria than the other two models previously discussed.

3.3.3.4 McConnell Quality Characteristics

McConnell's book Code Complete (McConnell, 2009) proposes to separate quality criteria into two distinct groups of characteristics: internal quality and external quality. Each of these two groups is decomposed in a series of subcriteria.

a) Internal quality characteristics include: maintainability, flexibility, portability, reusability, readability, testability, understandability.
b) External quality characteristics include: correctness, usability, efficiency, reliability, integrity, adaptability, accuracy, robustness.

This model splits software quality based on the angle by which they are observed. The evaluation of software criteria is either done from within the software's internal structure or source code, or from the product's effects in use. The quality criteria are either internal or external measures of software quality.

3.3.3.5 ISO/IEC 9126 Quality Model

Recently, ISO models for software quality evaluation are more relevant to the evaluation of new generation software due to their recency and applicability to the evolution of software engineering. The reputation of ISO as the largest developer of voluntary standards increases the confidence levels of its software quality models.

The ISO/IEC 9126 quality model include (Boegh, 2008): functionality, reliability, usability, efficiency, maintainability, portability as internal and external quality characteristics. The standard was created by the Consortium for IT Software Quality, which was founded by the Software Engineering Institute and the Object Management Group.

Additional subcharacteristics include: suitability, accuracy, interoperability, security, compliance, maturity, fault tolerance, recoverability, compliance, understandability, learnability, operability, attractiveness, compliance, time behavior, resource utilization, changeability, stability, testability, adaptability, installability, co-existence, replaceability, compliance.

In addition to internal and external quality, the ISO/IEC 9126 quality model also include effectiveness as the "quality in use" quality characteristic, which includes productivity, safety, and satisfaction. Quality in use is the measure of the degree to which the software satisfies the needs and goals of the end users.

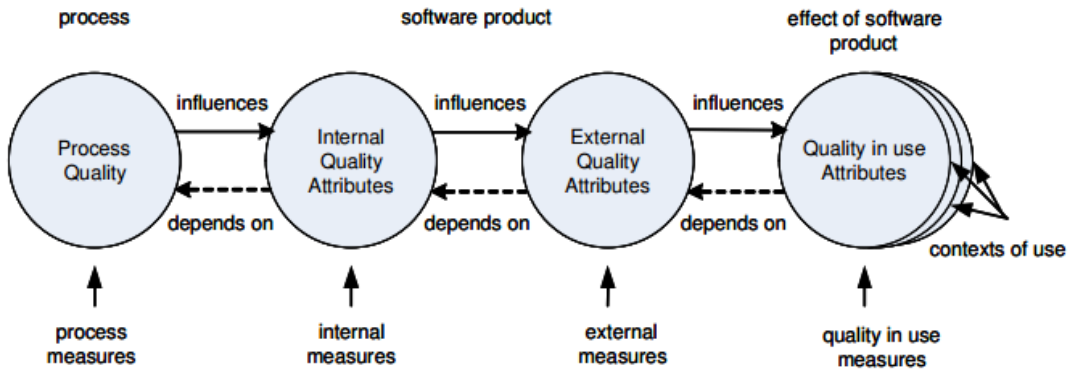

Figure 4 Quality of the software lifecycle – source: (ISO2011)

The software development process affects the internal quality of the software, such as the quality of its source code and inner workings. The internal quality can be measured with the use of internal quality metrics. The internal quality in turns affects the external quality of the software, whose quality

attributes are functionality and usability. There exist another set of measures to evaluate the external quality. The external quality of the software influences the quality of the software when it is used, throughout different contexts of use. This quality refers to how well the end-user can use the software in different situations. There exist last set of measures to assess the quality in use.

The internal and external quality attributes describe the software product itself, while the quality in use attributes describe the effects of the software product when used.

3.3.3.6 ISO/IEC 25010 Quality Model

The new ISO/IEC 25000 series of norms evolved from the ISO/IEC 9126 norms (ISO, 2011). The quality characteristics have changed slightly since ISO/IEC 9126. For example, functionality is functional suitability, and efficiency is performance efficiency.

In the refined quality model, both internal and external product quality are grouped and now named "system/software product quality". The distinction is probably not made to simplify the model.

Nevertheless, for the purpose of this research which does not concentrate solely of software quality, it is relevant to keep the characteristics divided in internal and external quality metrics. We will not ask respondents questions that drill down that specifically into the metrics of software quality, therefore it is more practical to keep metrics grouped as internal and external quality. We have retained the new quality characteristics of the ISO/IEC 25010 model, but with the grouping of the ISO/IEC 9126 model.

We have separated the system/software characteristics in internal and external quality characteristics. The quality in use characteristics were kept the same. The characteristics are grouped by internal quality, external quality, and quality in use criteria in Figure 5.

Quality characteristic	Definition
Internal quality	The quality of the software's source code
• Performance efficiency	The software minimizes resources utilization and execution time
• Compatibility	The software works with other software or in other environments
• Reliability	The software works consistency and is fault tolerant
• Security	The software adequately restricts access to users and information
• Maintainability	It is easy to identify and fix problems in the source code. The code is easy to read, and is expendable.
• Portability	The software can work in different environments, and adapt to change
External quality	The quality of the software's functions
• Functional suitability	The software provides the essential functions it was designed to do
• Usability	The software is easy to use, and easy to learn
Quality in use	The degree to which the software satisfies the needs and goals of the end users
• Effectiveness	The users' goals are accomplished
• Efficiency	Goals were reached in a manner that minimizes resources
• Satisfaction	The software satisfies their users
• Freedom from risk	The software mitigates exposure to risks, such as economic risks
• Context coverage	The software works well in different use contexts, while satisfying the other 4 quality in use characteristics in each context

Figure 5 Software quality characteristics

3.4 Success Measurement Model

The review of the specialized literature led to the creation of the software development project success model. The goal of this model is to illustrate the criteria retained to measure the success of software development projects on freelance marketplaces. We used the latest ISO software quality characteristics as a base, as it is the most evolved and up to date.

Project management success deals with the process of completing the project. To achieve a successful project from a project management point of view, the time, scope, and budget constraints must be met. Metrics for project management success are therefore time, scope, and budget.

Software development project success is comprised of the notions of project management success and product success. Overall success of the project is achieved when the project is efficient and effective. The project must be efficient in its process, and effective in its outcome. Efficiency of the project refers

to the success of the project management, while effectiveness of the project refers to the success of the end product of the project. In this research, the end results of projects are software programs.

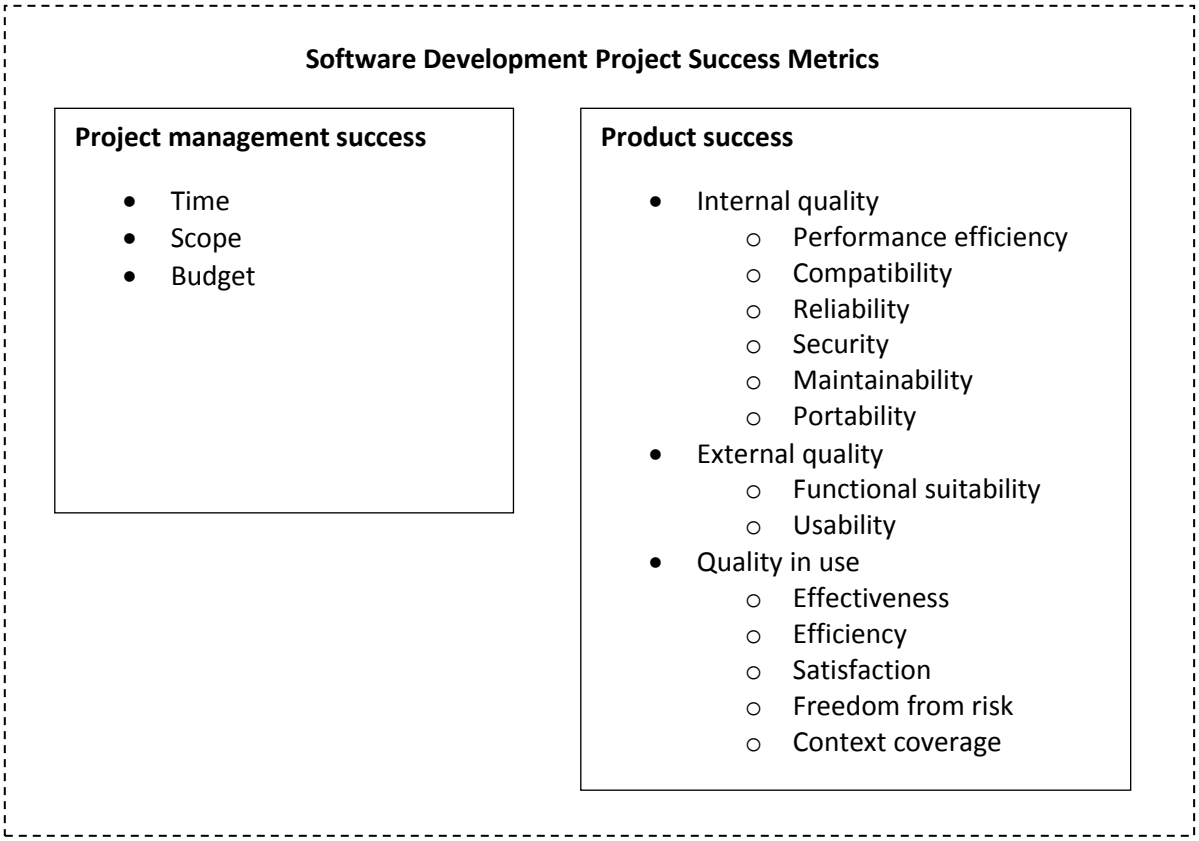

Figure 6 Software development project success metrics model

In the case of IT and software projects, "quality" is often cited as replacing the scope criterion to project management success. We used "scope" instead of "quality" as one of the project management success metrics, since quality is already a criterion for product success.

Chapter 4 - Software Development Project Success Factors

In order to compile potential success factors of software development projects on freelance marketplaces, we reviewed the specialized literature. The literature on freelance marketplaces being insufficient, we review the broader topics of IT projects and e-marketplaces. These topics are relevant because software development projects are a type of IT project, while freelance marketplaces are a type of e-marketplace.

4.1 Project Success Factors

Our goal in this section is to identify elements that influence the success of software development projects on freelance marketplaces. A usual expression for these success factors in the literature is "critical success factor".

Project success factors[8] are elements that contribute to the success of the project. Success factors have a positive or negative effect on the level of success; they can be sources of success or failure.

Pinto & Prescott's (1988, p.14) empirical research found 8 critical success factors that have a link with project success. These factors are separated by project life cycle: conceptual, planning, execution, and termination phases. The sample for this research consisted of a wide range of project types, not only software development projects. IT projects consisted of at least 10% of the sample (Pinto & Prescott, 1988, p.10). Critical success factors were:

1) In the design and conception phase, the project's mission and consultation with the client are the most important factors.
2) During the planning phase, the critical factors are the mission, top management support, and client acceptance.
3) During the execution phase, important factors are mission, troubleshooting, the schedule and plan, technical tasks, and client consultation.
4) The key success factors during the termination phase are technical tasks, mission, client consultation.

[8] A factor is "an element which enters into the composition of anything; a circumstance, fact, or influence which tends to produce a result" (Oxford English Dictionary, 2004).

The selection of the right teams members for software project increases productivity, which in turn increases the odds of project success (Howard, 2001). A project champion, a small number of people and a short duration were also found to increase the likelihood of project success (J. Johnson, 1998). Risk of failure can be minimized by minimizing scope, standardizing infrastructures, and improving communication (J. Johnson, 1998).

The Standish Group (J. Johnson, 1998; J. H. Johnson, 2001)[9] examined success factors of software projects, and found the following 10 most important factors, which it calls "CHAOS 10":

Executive support, user involvement, experienced project manager, clear business objectives, minimized scope, standard software infrastructure, firm basic requirements, formal methodology, reliable estimates, amongst others.

It is important to note that these success factors apply to large companies executing large IT projects (average $1.2 million (J. Johnson, 1998)), and may not always apply to projects completed on freelance marketplaces. Typically, projects on freelance marketplaces have a lower number of team members (often only 2: the buyer and provider; or only 3 if you consider the freelance marketplace as a supervisor), a lower average project size (i.e. $4264 according to oDesk (*oDesk oConomy, december 2011*.)). The would mean that according to The Standish Group's 3 key metrics for software project success, projects on freelance marketplaces have a higher predisposition for success than typical big IT projects found in fortune 500 companies.

Khan (2009, p.213) did a systematic literature review of 122 articles and compiled a list of success factors of software development outsourcing. This list constitutes factors that providers need to address to have a positive impact on software development services buyers. The 10 most frequent success factors were cost-saving, skilled human resource, appropriate infrastructure, quality of products and services, efficient outsourcing relationships management, organisation's track record of successful projects, efficient project management, efficient contract management, SPI certification, and knowledge of the client's language and culture.

Rajkumar and Mani (2001) identified key success factors from the point of view of the development of outsourced software development. Key success factors are divided into four categories: management, project, customer, and staff factors.

[9] Although new updated versions of this report exist, it was not available for this report due to their high cost.

a) *Management factors*: Strategy and commitment.
b) *Project factors*: reasonable initial project size, project definition, offshore-onshore mix, proper estimation, test requirements, no research and development projects, and single point of customer contact.
c) *Customer factors*: Customer visit, adaptive software life cycle, communication structures, constant presence at customer site, project management skills, adding value to the customer, and educating the customer.
d) *Staff factors*: Rotation, communication, recognizes attrition, visas, and cultural and work ethics.

Rajkumar and Mani (2001) present a series of stages providers can follow to build relationships with clients. The first step is the initiation stage, where the provider will complete a small pilot project for the buyer to build a relationship. The next stage is the confidence building stage, where slightly larger projects are completed to demonstrate the abilities of the provider. In the first stage, much larger projects are completed. The last stage is the virtual software arm stage, where the provider becomes such a trusted partner that it is almost considered part of the buyer's organization.

Delmonte and McCarthy (2003) identified four critical success factors that increase the odds of success in an offshore software development venture:

a) *Maturity of the management team:* The experience and expertise of management in managing projects and working in a multicultural environment. The level of strategy and commitment of senior management.
b) *Maturity of the organization's processes:* The degree of efficiency of the buyer's own internal processes.
c) *Clarity of the objectives:* The goals and reasons for hiring a remote service provider should be clear and communicated upfront.
d) *Level of preparation:* The degree of preparation to the project by the client and vendor. The project must be appropriate and of realistic size. All parties to the project should have been trained, and the buyer's processes must be ready to connect with those of the provider.

Success factors found during the literature review were numerous and diverse. There is no consensus on an exhaustive list of success factors of software development. We can notice that factors concerning the client or buyer of services appear more often than factors that relate to the staff or provider of

services. From this observation, we can hypothesize that the buyers of services have a greater influence on the success of software development projects than the providers doing the work.

4.2 E-marketplace Success Factors

In this section we explore success factors of e-marketplaces, freelance marketplaces being a subset of an e-marketplace. The rationale is that the success of software development projects on freelance marketplaces could be in part dependent of the success of the e-marketplace. The same factor that lead to the success of the e-marketplace could lead to the success of software development projects completed on e-marketplaces.

Note that we are including e-marketplace success factors, but not website design factors. While website design factors could have an impact, we consider all freelance marketplaces to be professionally build, and that such website design factors have only a minor influence. These are therefore not scrutinized in this study.

According to Brunn et al. (2002), e-marketplaces must create a strong position, build liquidity, and capture value to become successful. Building a high transaction volume is necessary for the success of the e-marketplace.

Neil and Sharon's literature review (2004, p.40-42) highlights that success factors of e-marketplaces are critical mass, liquidity, independence/neutrality, security/credibility/trust, ease of use and service reliability, value added services, and relationships.

A successful e-marketplace requires:

a) A large number of buyers and sellers
b) The generation of sufficient funds to continue its operation. It must generate sufficient cash flow from fees, services, and other revenue streams to cover its operating costs, and avoid bankruptcy. A critical user mass will contribute to the e-marketplace's liquidity, and thus its ability to meet its financial obligations.
c) An independent and neutral stance. The e-marketplace must not be controlled by a major player, and must be fair and unbiased.
d) A secure environment favourable to trust. The e-marketplace must ensure that transactions occur with minimum risk and uncertainty.

e) They must be easy to use and reliable. Ideally, buyers and sellers should be able to use a standard web browser.
f) Value-added services on top of the basic e-marketplace services.
g) Strong relationships between the e-marketplace, the buyers, and the sellers.

Since there exist similar success factors within those previously presented, it is appropriate to do a synthesis.

4.3 Candidate Software Development Projects Success Factors

Success factors from the specialized literature were grouped by similarity to arrive at the 10 candidate success factors relevant to the context of freelance marketplaces.

Table 4 Grouping of freelance marketplace success factors

Retained candidate success factors of software development projects on freelance marketplaces	**Success factors identified in the specialized literature on software projects and e-marketplaces**	**Key authors**
Clear objectives and requirements	Project's mission, clear business objectives, strategy and commitment, clarity of the objectives	Pinto & Prescott (1988), J. Johnson (1998), Rajkumar and Mani (2001), Delmonte and McCarthy (2003)
	Consultation with the client, firm basic requirements, formal methodology, project definition, test requirements	Pinto & Prescott (1988), J. Johnson (1998), Rajkumar and Mani (2001)
	No research and development projects	Rajkumar and Mani (2001)
Technical proficiency of the provider	Troubleshooting	Pinto & Prescott (1988)
	Technical task, adaptive software life cycle	Pinto & Prescott (1988)
	Selecting the right team members, skilled human resources	Howard (2001), Khan (2009)
	Schedule and cost, reliable estimates, cost savings, proper estimations	Khan (2009)
	Standardizing infrastructures, appropriate infrastructures	Khan (2009)

Technical proficiency and experience of the buyer	Project champion, experienced project manager	J. Johnson (1998)
	Maturity of the organization's processes	Delmonte and McCarthy (2003)
The buyer being the end user	Top management support, executive support	Pinto & Prescott (1988)
	Small number of people, single point of customer contact	J. Johnson (1998), Rajkumar and Mani (2001)
Size of the project	Short duration	J. Johnson (1998)
	Minimized scope, reasonable initial project size, appropriate and realistic size	J. Johnson (1998), Delmonte and McCarthy (2003)
Communication	Improving communication, communication structures	J. Johnson (1998)
Project management skills of the buyer	Project management, contract management, project management skills, maturity of the management team	Khan (2009), Delmonte and McCarthy (2003)
Strength of the relationship	Doing multiple projects to build up a relationship	Rajkumar and Mani (2001)
	Track record of successful projects	Khan (2009)
	Efficient outsourcing relationships management, offshore-onshore mix	Khan (2009)
Culture	Knowledge of the culture	Khan (2009), Delmonte and McCarthy (2003)
Freelance marketplace volume	High volume on the freelance marketplace	Neil and Sharon (2004)

As presented in Table 4, duplicate and similar success factors from the literature were grouped together. These combined factors are the retained candidate success factors, which will be tested.

In the next following section, we define each of the retained candidate success factors. We also explain how each factor is relevant to the context of software development projects on freelance marketplaces.

- *Requirements:* Firm basic requirements, a formal methodology, clear objectives, and the project's mission are critical success factors. Proper requirements are important success factors (Boegh, 2008, p.57). The quality of the requirements could have a link with the success of the project.

- *Technical proficiency of the provider:* The technical tasks are an important success factor in the execution phase. The programming's skill level has a link with success, since a proficient programmer can create higher quality software.
- *Technical proficiency of the buyer*: Project manager's experience is another key success factor in IT projects. This could lead to better judgment of quality, better requirements, and ability to evaluate internal quality and to predict quality in use. It is also possible that buyers with more experience hiring providers on freelance marketplace have more successful products, due to their experience writing requirements, supervising the work, and communicating with providers.
- *The buyer being the end user*: End user involvement is important for success. When the person commissioning the project is the end user of the resulting software product, it is possible the odds of success are increased due to the high level of end-user involvement. The buyer, being the end user, could know his needs better than when the buyer acts as an agent for the end users.
- *Size of the project*: Minimized scope has been identified as an important success factor for software projects. Projects of manageable sizes have been identified as being more likely to succeed (Delmonte & McCarthy, 2003; Rajkumar & Mani, 2001).
- *Communication:* Consultation with the client is important throughout the process. Clear and frequent communication are likely important. The quality of the communication between the buyer and the provider, which allows feedback to be exchanged and to collaborate on the project, could have an important link with success.
- *Project management skills of the buyer:* Experience in dealing with remote workers and contractors will ensure the buyer is well prepared for the project. The higher the project management skills of the buyer, the more likely the project will achieve project management success by staying on time, budget, and scope. Furthermore, an experience project manager could increase the odds of product success through better selection of the provider, clearer writing of initial requirements, better terms, and more effective communication with the provider.
- *Strength of the relationship:* According to Rajkumar and Mani (2001), building a relationship through small pilot projects is desirable to increase success. The strength of the relationship is the extent to which the buyer and providers have worked together in the past. It is possible that projects succeed more often when the buyer and provider have worked together on many projects previously.

- *Culture:* According to Khan (2009, p.213), knowledge of the buyer's language and culture by the provider is a frequently mentioned success factor.
- *Marketplace volume*: Large volume on the freelance marketplace appears to be desirable for the success of the freelance marketplace. It is possible a large volume on the marketplace is desirable for buyers of programming services, since a higher number of potential providers could result in increased choice and more competitive bids.

This concludes our analysis of software development project success factors in the literature. In Chapter 5, we complement these findings with an analysis of success factors sourced from users' assessments expressed in blogs. While success factors from the literature relate to a wide range of software development projects, success factors sourced from blogs are specific to software development projects on freelance marketplace.

Chapter 5 - Success Factors From Users' Assessments

To complement our findings from the specialized literature on software development project success factors, we have ventured into an abundant source of information: blogs and opinionated articles.

Given that freelance marketplaces are relatively new occurrences, information on the subject is scarce. Specifically, success factors of freelance marketplaces do not seem to be documented in the specialized literature. There is, to our knowledge, no literature exploring the link between factors and project success on freelance marketplaces. Therefore, finding potential project success factors specific to freelance marketplaces can be challenging.

We have elaborated a methodology of blogs analysis to deduce candidate success factors of software development projects on freelance marketplaces. Following an analysis of preferences regarding freelance marketplaces and comparison criteria used in the evaluation of freelance marketplaces, we produced candidate success factors.

5.1 Blogs Perspectives Variety

A search of the Internet revealed that there are blogs and other self-published online articles that discuss freelance marketplaces. A frequent topic is the comparison of various freelance marketplaces. Authors often argue the differences between them, with the goal of helping the reader make a better decision while selecting one[10]. These blogs are either written from the point of view of the buyer[11], the provider[12], or are written by a commentator whose advice is aimed towards both buyers and providers[13].

In some cases, the articles are written with the goal to help a freelancer (a provider of software development services) find an adequate marketplace on which to find work. Recommendations and advice given based on experience is targeted to work providers. Other times, the author aims to help software development services buyers, such as helping entrepreneurs to find a marketplace on which to

[10] E.g. http://www.timedoctor.com/blog/2011/02/22/the-top-6-outsourcing-sites-and-how-to-use-them
[11] E.g. http://blog.assembla.com/assemblablog/tabid/12618/bid/33608/Working-with-Talent-markets-oDesk-Elance-Freelancer-Guru-vWorker.aspx
[12] E.g. http://earn-money-using-freelance.blogspot.com/2009/10/rentacoder-elance-getafreelancer-odesk.html
[13] E.g. http://whichlance.com/reviews

source work. As a last possibility, the author provides arguments aimed at both parties, or takes a general neutral stance.

From an analysis of those articles, hints of the selection process used to choose a freelance marketplace can be inferred, as well as preferences towards different aspects of freelance marketplaces.

5.2 Identification of Potential Success Factors

The goal is to find freelance marketplace assessments in blogs to extract potential factors that have a link to success. The hypothesis is that decision factors and user preferences regarding freelance marketplaces constitute factors that have an impact on the success of projects completed on freelance marketplaces. It is assumed that a buyer's goal is to achieve successful completion of their project; and thus when selecting a freelance marketplace they will try to maximize their gain by choosing a freelance marketplace with greater odds of project success. Whichever aspect buyers use to select freelance marketplaces are aspects that are susceptible to be important to the buyer for successful completion of their projects. The exploration of these factors' importance for achieving success is part of the goal of this study.

For example, if dispute resolution processes are often used as a comparison criterion to assess the merit of freelance marketplaces, dispute resolution processes is likely considered by the users to have an impact on project successes. Likewise, if blog authors frequently express a preference of individual providers, as opposed to companies, it is possible individual providers have a higher success rate than companies. The extent of the relationship between the preferences and comparison criteria found in blogs with project success will be tested.

Negative success factors, which decrease the level of success, are also considered. These were expressed by bloggers as problems with freelance marketplaces. We hypothesized that an expressed problem with freelance marketplaces consists of a factor that affects the success of projects.

This interpretative qualitative analysis of success factors from blogs constitutes the baseline for candidate success factors.

5.3 Methodology for Blog Analysis

The methodology to collect data from blogs comprises three steps:

- Search for blogs
- Selection of blogs
- Opinion analysis.

The goal is to extract factors that could possibly have a link with project success, while ensuring an acceptable degree of credibility[14]. Retained blogs must be both relevant and credible.

The sources were selected based on their contents and their relevance to the topic. The blogs and articles were found by searching "freelance marketplace" and synonyms on Google (see Table 1 in section 2.5 for synonyms). Additionally, different combinations of names of individual marketplaces were searched to find articles that talk about more than one individual marketplace. It is common for articles that compare two or more freelance marketplaces to titles such as "oDesk vs vWorker". Furthermore, Google searches were done using the "related:" prefix with each article's URL to find similar blog entries on other sites.

The retained blogs must be considered credible to some extent. There doesn't seem to be a generally accepted definition of credibility, it changes depending on the field study. For example the definition of credibility in communication would not be the same as information science. In information science credibility can be defined as a criterion of relevance judgment used when making the decision to accept or reject retrieved information (Rieh & Danielson, 2007). The information must be credible, in the sense that it must be believable (Hovland, Janis, & Kelley, 1953), which means that the blog author must show expertise and trustworthiness. As previously mentioned, since the information will not contribute directly to the final findings but rather help create a pool of candidate success factors, an acceptable degree of credibility is sufficient.

There are five criteria that are generally accepted in the literature to assess the credibility of Internet-based information: accuracy, authority, objectivity, currency, and coverage or scope (Metzger, 2007). Requirements for blog article selection were made for the purpose of this study in each of these categories, as described by Metzger (2007).

- *Objectivity:* As constraints, the article must present some kind of an opinion, judgment, or appreciation of freelance marketplaces. It has to be unbiased, and thus not written or

[14] Credibility is "the quality of being trusted and believed in" (oxforddictionaries.com)

sponsored by a freelance marketplace. For the purpose of this study, a subjective opinion is desired, but not one that is biased.

- *Coverage:* It must not present only a single marketplace, we retained articles that talked about two or more freelance marketplaces, or that talked about freelance marketplaces without naming any. News articles about a single freelance marketplace merely presenting facts or making an announcement were excluded, as these did not present enough of an opinion. Though already covered in the objectivity requirements, the blog must include opinions from the author, since extracting users' opinions is the goal of the blog analysis.
- *Authority:* The reputation of the author must somewhat be reliable, even though blogs are generally not considered trustworthy sources of information for academic purposes. The author must have demonstrated a good understanding of freelance marketplaces, and lead us to believe have actually used or tried them out.
- *Accuracy:* Similarly to authority, in order for the author to portray an accurate opinion, they must have tried freelance marketplaces. If an author has never experience a freelance marketplace first hand, his opinion will not be considered valid.
- *Currency:* Anything less than 10 years old will be considered recent. Since freelance marketplaces themselves are such a new occurrence, all articles found fell within that time frame. The timestamp on the blog is the easiest indication of creation date. When absent, the registration date of the domain shows the earliest the article could have been posted. The Wayback Machine at archive.org can also be used to check for previous versions of the page, and thus infer an approximation of the age of the page.

The methodology for compiling the data consisted of filling out an excel table with each article's mention of a preference or comparison criteria. The total count of each item was then compiled, and similar items were grouped together. For example, mention of both "size" and "growth" as a selection factor where grouped together as "market size".

5.4 Blog Opinion Analysis Results

The following section presents the results of the blog opinion analysis. The findings led to candidate success factors that confirm or supplement those found in the specialized literature in the previous chapter.

5.4.1 Retained Blogs

A total of 42 sources were retained. Of those, 12 are written from the point of view of buyers, 23 from the point of view of providers, and 7 are neutral and not targeted to either party. See Annex 1 for a full listing.

5.4.2 User Preferences, Evaluation Criteria, and Problems

Table 5 illustrates the frequency of appearance of each category of preference statement. Explicit expressions of preference where far less frequent than comparison criteria. The frequencies are low and therefore result in inconclusive findings. For example, nearly as many people preferred hourly wages as opposed to fixed prices.

Table 5 Categories of preferences towards using freelance marketplaces

Categories of preferences towards using freelance marketplaces	Frequency	Narrative
Pricing structure - Prefers hourly	4	"Hourly payments are less risky"
Type of providers - Prefers individuals	2	"We get better results with individuals"
Pricing structure - Prefers fixed price	3	"Fixed price jobs are a good way to do something small"
Video time tracker - Does not like	3	"…software for monitoring his project activity. It's not cool for me."
Video time tracker - Likes	2	"Elance doesn't have this screen-capture feature that oDesk has. So I usually like to do any hourly type jobs on oDesk."
Market size - Prefers small average number of bids	2	"if a site has on an average 20 people bidding on a project while another has 5, the second site will offer you a better chance of landing more jobs"
Geographical location - Does not like providers from developing countries	2	"In general most of our experiences with workers from India, Bangladesh and Pakistan have been negative"
Paying up front to escrow- Does not like	2	"With oDesk, you don't have to pay up front, and you only pay when the job is done"
Market size - Size of market not indicator of desirability	1	"market volume is not the be all and end all of assessing a project marketplace"

Table 6 compiles the frequency of mentions of comparison and evaluation criteria. It was much more frequent for blogs to mention these as opposed to expressing preferences.

The frequency of mention of individual features were low (ranging for 1 to 4 mentions) by themselves, but once combined represented the most mentioned criterion. Fees are the most often mentioned single criterion.

Table 6 Categories of evaluation criteria

Categories of evaluation and comparison criteria of freelance marketplaces	**Frequency**	**Narrative**
Features (Search options, tools, IP protection mechanisms, communication tools, features, bidding tools, feedback system, work tracking system)	23	"The best freelance websites will allow freelancers to search for work based on their skillset"
Fees	22	"Their cut or % is much higher than Guru's"
Escrow	16	"Escrow is pretty straightforward and it's safe for both the buyer and the provider"
Market size (Size, growth)	15	"The size of the job market is perhaps the single most important factor that you need to consider"
Rules (Rules/terms, bid limits)	11	"Rules: This is one of the most important things for me"
Pre-qualification mechanism	10	"It's very important for buyers to know a worker's ratings and feedback reflect that worker's true working habits"
Aesthetic and usability	10	"I'm not saying its ugly, but it seriously needs an uplift, for aesthetics and usability in general."
Arbitration	9	"They've got an arbitration system that works quite well from what I've seen"
Payment methods	9	"Payment Methods and Mechanisms"
Providers using the OLM (Geographical location, activity sectors, turnaround time, type)	9	"caters more to US based freelancers"
Job size	8	"Average project value"
Pricing structure	5	"You can hire by the hour or by the project"
Customer support	5	"Customer service is an important aspect of any freelance site"

Community	5	"One downside is that there's very little interaction between RentACoder and the rest of the community -- no forums"
Transparency	5	"oDesk offers greater transparency"
Selection process (Worker selection process, buyer selection process)	5	"I never did really like interviews"
Possibility to bid for free	4	"posting is free"
Start-up ease	4	“It also has a fairly high barrier to entry for the employers, which usually means better paying jobs."
Project types	3	"Hourly and fixed-rate projects available"
Minimum bid	3	"The minimum pay for a Guru job is $25, while it is $50 for Elance"
Depth of user profile	2	"Profile [is a comparison criteria]"
1099 forms	1	"Send 1099 forms to contractors"
Number of bids on posted projects	1	"I got 17 bids on Elance, 11 on oDesk, and 2 on Guru"
Alexa rank	1	

Table 7 reveals that some bloggers express problems and concerns with freelance marketplaces. These problems could represent negative success factors for the success of projects. Only 3 categories were significant, while the level of consensus was low: 11 problems expressed were not expressed by other authors.

Table 7 Problems of freelance marketplaces

Problems of freelance marketplaces	Frequency	Narrative
Lack of buyer knowledge, skills, and experience	4	"If the person posting the job does not at least have some grounding in software development/engineering, then this can lead to problems. "
Asymmetry - Biased towards buyers	3	"many sites are not entirely symmetric when it comes to their feedback mechanism. While all sites include a good system for clients to use in evaluating freelancers, many skimp on the system when it comes to freelancers evaluating clients"
Quality - Difficult to find quality projects to work on	3	"Determining [the buyer's] quality is very difficult."
All others (maximum frequency of 1)	11	

Table 8 presents the popularity of freelance marketplaces as express by their frequency of mention in blogs. The freelance marketplaces mentioned the most often are eLance, oDesk, vWorker, Guru, and Freelancer. We notice that the order is similar to the top marketplaces by self-declared volume, Alexa Rank, and Google Pagerank identified in Chapter 2. The validity of results obtained regarding the popularity of freelance marketplaces is therefore high.

Table 8 Freelance marketplaces mentioned

OLMs Mentioned	Frequency
Elance	33
oDesk	30
vWorker (rentacoder)	24
Guru	24
Freelancer (GetAFreelancer)	13
ScriptLance	10
Others	6
Lime Exchange	4
iFreelance	4
GetACoder	3
SoloGig	3
Bid-Job	1
PeoplePerHour	1
ContractedWork	1
None named	1
Go Freelance	1
Fiverr	1
Project4Hire	1

5.5 Candidate Success Factors

Using the selection and comparison criteria mentioned in blogs, we created a list of candidate success factors. The success factors were retained based on the frequency of occurrence in the articles. Their relationship with project success are tested.

Analysis of preferences led to the following success factors being extrapolated:

- The project's payment type (hourly or fixed)
- The provider's capacity (individual or company)
- The presence of a time tracker
- The provider's geographical location
- The freelance marketplace's market size

Analysis of comparison criteria led to the following success factors:

- The freelance marketplace's features
- The freelance marketplace's market size (present in both preferences and comparison criteria)
- The freelance marketplace's fees
- The freelance marketplace's rules
- The freelance marketplace's pre-qualification mechanisms
- The freelance marketplace's aesthetics and usability
- The freelance marketplace's arbitration mechanisms
- The project's size

We compare in Figure 7 the candidate success factors from the literature with those from the blog analysis to illustrate corresponding results.

Candidate success factors	
Specialized literature	**Blogs**
Clear objectives and requirements	
Technical proficiency and experience of the provider	
Technical proficiency and experience of the buyer	Buyer knowledge, skills, and experience
The buyer being the end user	
Size of the project	Value of the project
	Length of the project
Communication	
Project management skills of the buyer	
Strength of the relationship	
Culture and language	Provider's geographic location
Freelance marketplace volume	Freelance marketplace volume
	Project's payment type (hourly or fixed)
	Provider's capacity (individual or company)
	Presence of a time tracker
	Freelance marketplace's features
	Freelance marketplace's fees
	Freelance marketplace's rules
	Freelance marketplace's pre-qualification mechanisms
	Freelance marketplace's aesthetics and usability
	Freelance marketplace's arbitration mechanisms

Figure 7 Correspondence between success factors from the specialized literature and blogs

Three candidate success factors sourced from users relate closely to success factors encountered in the specialized literature. Both mention the size of the project and the size of the marketplace as success factors. The provider's geographical location is closely linked with the culture and language.

Chapter 6 – Survey Methodology

This study uses a cross-sectional survey design with a questionnaire as the main data collection instrument. The purpose of this quantitative study is to examine the importance and relationship between software development project success factors, freelance marketplace characteristics, and software development project success metrics. Responses to open-ended questions are analyzed qualitatively. This section explains the rationale for choosing the type of research design, the population and sampling method used, the data collection method and data analysis of the main survey data.

6.1 Research Model

This section presents the basic research model, as well as the fundamental assumptions on which the model is built (presented in Figure 8).

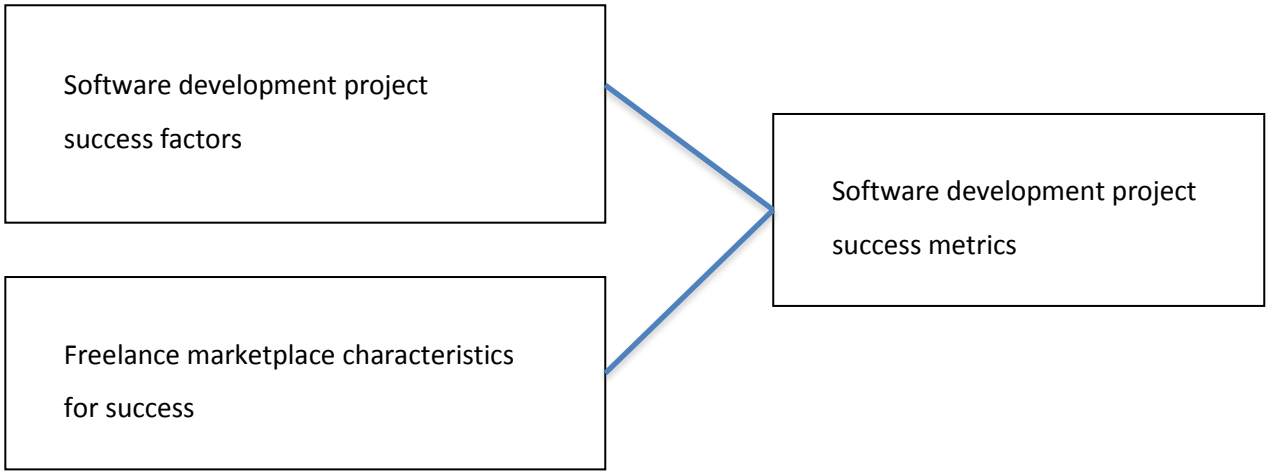

Figure 8 Research Model

The model is based on the assumption of two reciprocal relationships: the first one being between software development project success factors and software development project success metrics, and the second one being between freelance marketplace characteristics and software development project success metrics.

First assumption: The assessment of the importance of success factors by a software development services buyer using a freelance marketplace will influence the importance of the project success

metrics used in the evaluation of success. Similarly, the choice of importance success metrics by a buyer of software development services will influence the choice of important project success metrics. We can formulate the assumption that the most important software development project success factors are linked with the most important project success metrics.

For example, a buyer of software development services may think that the "project's payment type" success factor is very important to achieve success, and thus may attribute a high importance to the "budget" project success metric. A buyer of software development services who attributes a higher importance to the product success than the project management success may as a result attribute a higher importance to success factors like "Clear objectives and requirements" and "Technical proficiency of the provider".

Second assumption: It concerns the relationship between freelance marketplace characteristics and software development project success metrics. The assessment of the importance of characteristics influences the success metrics deemed important in the opinion of the buyer of software development services on freelance marketplaces.

For example, a buyer of services attributing a high importance to the freelance marketplace fees may as a result attribute a high importance to the "budget" project success metric. Similarly, a buyer attributing a high importance to the product success metrics may attribute a high importance to the "pre-qualification mechanisms" freelance marketplace characteristic.

6.2 Research Problem

The research problem is posed in the context of software development services buyers, for whom it is important to identify what affects the success of software development projects completed on freelance marketplaces, and what metrics are used to measure their success.

6.2.1 Research Question

The main research question reads as follows: "What success factors of software development projects on freelance marketplaces and freelance marketplace characteristics are the most important for the success of projects on freelance marketplaces?" As a follow up question: "What success metrics are the most important to measure the success of software development projects on freelance marketplaces?"

6.2.2 Research Hypothesis and Research Goal

The research hypothesis is formulated as such: Software development project success factors, freelance marketplace characteristics, and software development project success metrics influence to a certain degree the evaluation of the success of software development projects, as perceived by the software development services buyer.

The goal of this research is to determine with the use of a survey of software development services buyers the mix of software development project success factors, freelance marketplace characteristics, and software development project success metrics that contribute the most to the perceived success of software development projects.

6.3 Research Framework

The research framework lists the candidate success factors of software development projects on freelance marketplaces, freelance marketplace characteristics that influence success, success metrics of software development projects on freelance marketplaces, and the relationship between them.

Chapters 4 and 5 have identified elements that are likely to play an important role in answering the research question, “What success factors of software development projects on freelance marketplaces and freelance marketplace characteristics are the most important for the success of projects on freelance marketplaces?”, as well as the follow up question, “What success metrics are the most important to measure the success of software development projects on freelance marketplaces?”

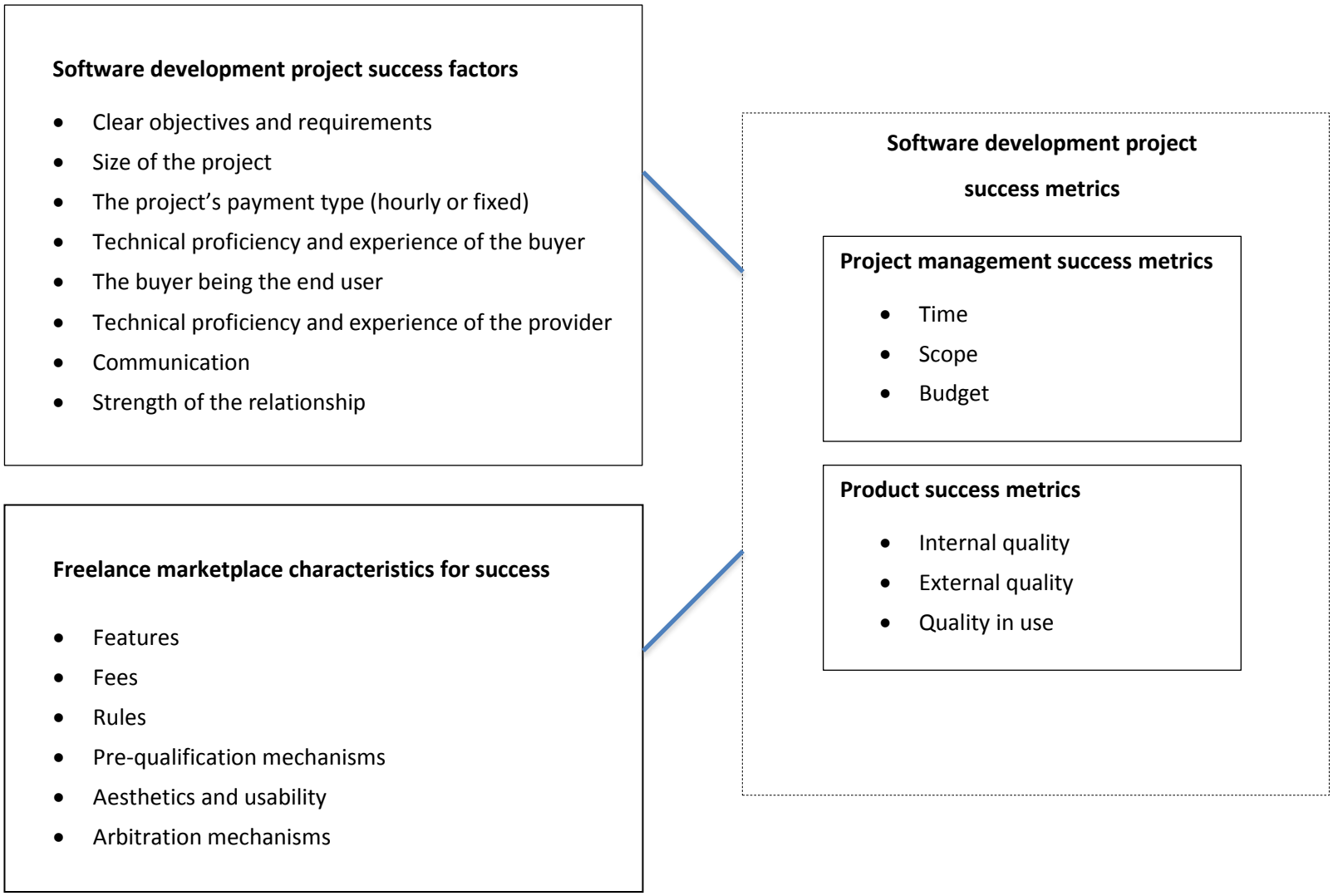

Figure 9 Research Framework

The left side of the research framework presents elements that are susceptible of having an influence on the success of software development projects on freelance marketplaces. These elements are composed of project success factors and freelance marketplace characteristics. Each of the project success factor and freelance marketplace characteristics is tested with the use of a question in the questionnaire.

The right side of the research framework identifies metrics used to measure the success of software development projects on freelance marketplaces. Project success is measured by a combination of two components: project management success and product success. Each of these two success components is divided into three success metrics. These six success metrics are tested with the use of a question in the questionnaire.

6.4 Empirical Research Model

The empirical research model contains the variables identified in the Research Framework, complemented with control variables. The control variables are used to test whether the importance of variables or the relationship between variables depends on the values of the demographic, organizational, and buyer satisfaction. The control variables also serve as a context for the research findings, as they describe the characteristics of the software development services buyers from which the data was collected.

Figure 10 Empirical Research Model

The empirical model contains three sets of contextual control variables.

The first set of control variables is demographic information. It includes gender, age, sex, location, education, and experience in IT projects.

The second set of control variables is organization control variables. It includes sector of activity, number of employees, and experience with freelance marketplaces.

The last control variable is the level of satisfaction by the buyer of software development services. Different levels of buyer satisfaction can lead to different interpretations of success factors, of the appreciation of freelance marketplace characteristics, or of success metrics.

6.5 Research Design

A quantitative approach provides an effective way to investigate the relationship between success factors and the success of projects. Statistical analysis will be used to determine the importance of each project success factor and success metrics. Respondents will be grouped based on the similarity of their evaluations.

In this research, the studied variables can be expressed numerically, thus are suitable for a quantitative design. Numeric Likert scales to illustrate the degree of importance of each element are used; as a result numeric values are assigned to answers. In one of the question, the respondents are asked to order metrics based on importance, which also allows numeric values to be assigned.

The purpose of the study is to identify the importance and relationship between different variables. A qualitative design would have been appropriate if the research variables were unknown. As potential success factors were identified through the literature review and from users' assessments mined from blogs, a quantitative design can be used to test the relationship between these variables and success.

However, to complement the interpretation of some questions, we added two open-ended questions to the survey. The responses to these questions will be qualitatively analyzed.

The quantitative design is suited to test the research hypotheses.

6.6 Population and Sampling

The studied population is composed of buyers that have commissioned software development work on freelance marketplaces. This includes entrepreneurs, business owners, or employees of companies that have hired remote contractors to complete software development projects through freelance marketplaces. We will refer to the respondents as software development services buyers.

A major challenge was to identify respondents that fit the selection criteria. To obtain a representative sample of the population, a purposive sampling was used since a restriction was imposed on

respondents: only respondents that have completed projects on freelance marketplaces were retained. Given the purpose of the study and the survey questions, the retained selection criteria were experience with freelance marketplaces given that it is necessary to assure the validity of answers.

Respondents were found and contacted by various methods. Potential respondents include: authors of articles and blog posts on the subject, people that have posted on freelance marketplaces, and business acquaintances. The contact information of freelance marketplaces users are never displayed on the freelance marketplace to avoid disintermediation; however in some cases it is possible to infer it by looking up the company name or other clues from the project description. By using these means of contact, 36 successfully filled out questionnaires were obtained.

6.7 Data Collection

The instrument used to collect data is an online survey. This was desirable due to the geographic dispersion of respondents, to its unobtrusive nature, and to the ease of data compilation it allows. An online survey service, qualtrics.com, was used to host the questionnaire.

It was more convenient to have a sample of respondents fill out an online survey than proceeding with in-deep interviews with a smaller sample. Given the worldwide nature of freelance marketplaces, the population is geographically dispersed. An online questionnaire was more suitable to administer than any other method.

The construction of the questionnaire is based on the empirical research model. The questionnaire will include questions about the respondent's experience with freelance marketplaces, two main sections, as well as demographic questions. The full questionnaire can be found in Annex 3.

First, the questionnaire enquires about the software development services buyer's experience with freelance marketplaces. Specifically, it asks which freelance marketplaces the respondent has used, the number of projects attempted or completed, and the total lifetime spending on freelance marketplaces. The overall level of satisfaction is asked, with possible answers following a 7-point Likert scale.

Second, the software development services buyer is asked answer a series of questions about their opinion of the important of each success factor to achieve successful software development projects. 10 questions are asked, which are answered following a 5-point Likert scale ranging from very important

to very unimportant. The respondent also rates the importance of 5 freelance marketplace characteristics, also on a 5-point Likert scale.

Third, in order to measure the importance given to each software development project success metric, the software development services buyer must order 6 project success metrics from most important to least important.

Fourth, two open-ended questions are asked about success factors in the context of the software development services buyer's most and least successful project.

Fifth, the survey asks general demographic questions, which include age, education level, experience in IT, activity sector, and size of company. These questions are asked at the end of the questionnaire to minimize loss of interest at the beginning.

Table 9 presents the items on the questionnaire with their corresponding elements from the empirical research model.

Table 9 Software development project success factors measurement scale items

Candidate success factors	**Correspondent scale items**
Clear objectives and requirements	The project's requirements are clear
Technical proficiency and experience of the provider	The provider is technically proficient
Technical proficiency of the buyer	The buyer is technically proficient
The buyer being the end user	The buyer is the end user of the finished product
Size of the project	The scope of the project is limited
	The project is completed in a short amount of time
Communication	Communication with the provider is adequate
Strength of the relationship	The buyer has previously hired the same provider for another project
Freelance marketplace volume	The marketplace on which the project was completed has large volume (Volume data from a separate source, not from the respondents' answers)
The project's payment type (hourly or fixed)	The provider is paid hourly
	The provider is paid a flat rate

Some other candidate success factors were left out because they were considered secondary to our precise analysis, namely: Project management skills of the buyer, culture, language, and geographic location, presence of a time tracker, the provider's capacity (individual or company).

The respondent was asked to rate the importance of the following 7 freelance marketplaces characteristics following the same Likert scale from very importance to unimportant: Arbitration mechanism, rules, features, pre-qualification mechanisms, aesthetics and usability, fees.

On the web version of the questionnaire, a question mark icon appears next to each of these characteristics. The respondent can click the icon to view a definition of the associate characteristics. The definitions are at the end of Annex 3.

6.8 Pre-testing of Questionnaire

Four experts were asked to check the questionnaire for clarity and understandability, and to find any potential problems with the questions. They were asked to judge if the questions were easy to answer, and free from confusion and free biases. The terminology used in the questionnaire has to be the same that is used in practice by freelance marketplace users, since the terms used in the academic literature could differ from the ones used by practitioners. The four respondents were acquaintances of the principal researcher, and have extensive experience with freelance marketplaces. Two of the experts expressed their opinion that the questionnaire was ready to be sent out, while the other two experts made only minor suggestions.

As a result of a suggestion, the phrasing of the second section was changed to make it clearer that the first part asks about success factors, and the second part about freelance marketplace characteristics. The respondent reported having to read the question twice after feeling a doubt he was answering the wrong question.

Another comment was to highlight the importance of a question about the level of satisfaction of the buyer with freelance marketplaces, the rationale being that this data would add an interesting depth to the analysis.

The questionnaire was approved by the Ethics Board of the University of Ottawa prior to being distributed (Annex 8).

6.9 Description of the Sample with the Demographic Control Variables

The questionnaire was sent out to 201 potential respondents, and was completed validly 36 times. This corresponds to an 18% response rate.

This section provides demographic information of the respondents. Demographic information collected includes age, sex, education level, geographical location, and amount spent on freelance marketplaces.

6.9.1 Age

As indicated in Figure 11, the most frequent age range of respondents is between 26 and 34. 86.1% of respondents are between 26 and 54.

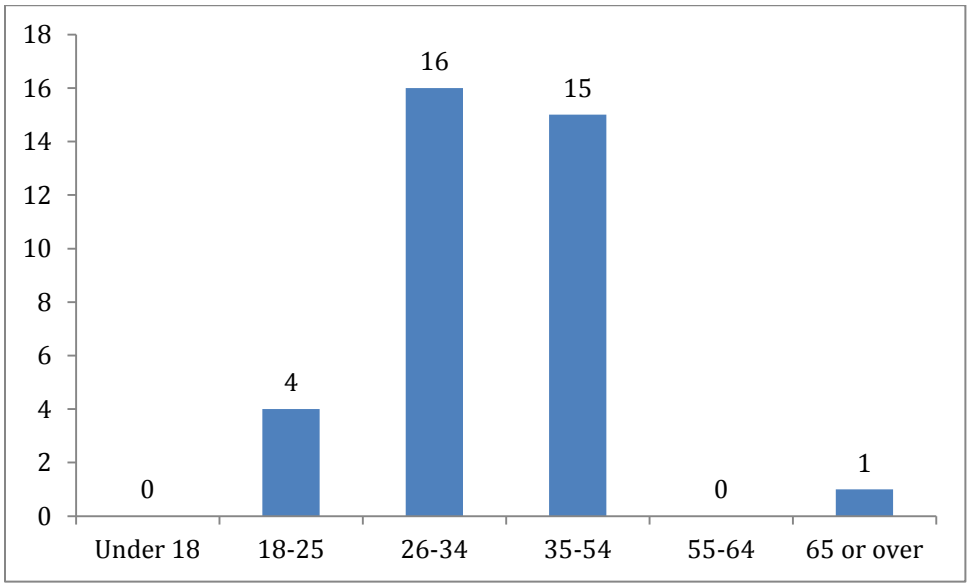

Figure 11 Distribution of respondents' ages

Table 10 presents the age ranges as percentages of total respondents.

Table 10 Respondents' ages

Answer	Responses	Percentage
Under 18	0	0.0%
18-25	4	11.1%
26-34	16	44.4%
35-54	15	41.7%
55-64	0	0.0%
65 or over	1	2.8%
Total	36	100%

6.9.2 Sex

There was only one woman that answered the questionnaire; the sample is 97.2% male (Table 11).

Table 11 Sex of respondents

Answer	Responses	Percentage
Male	35	97.2%
Female	1	2.8%
Total	36	100%

6.9.3 Education Level

The respondents are well educated, with 69.4% having a 4-year degree or better. The most frequently encountered education level was 4-year College, with 41.7% of responses.

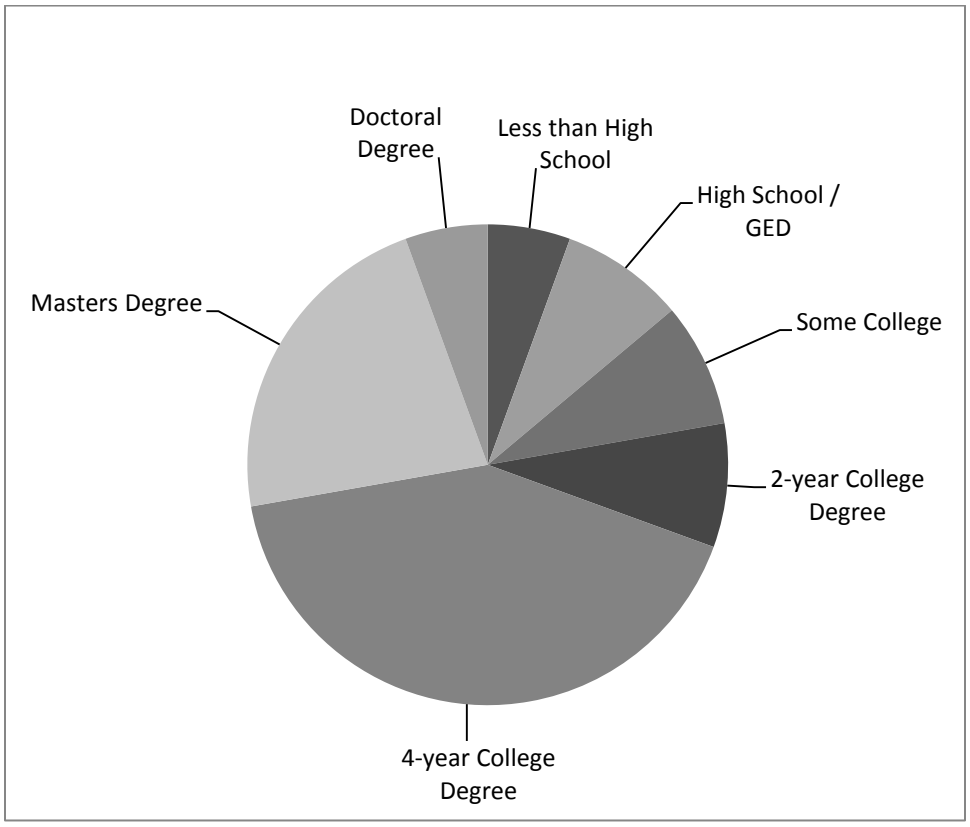

Figure 12 Education level of respondents

Table 12 Education level of respondents

Answer	Responses	%
Less than High School	2	5.6%
High School / GED	3	8.3%
Some College	3	8.3%
2-year College Degree	3	8.3%
4-year College Degree	15	41.7%
Masters Degree	8	22.2%
Doctoral Degree	2	5.6%
Professional Degree (JD, MD)	0	0.0%
Total	36	100%

6.9.4 Geographical Location

The locations of the respondents were determined with a lookup of the IP address that completed the questionnaire with the MaxMind GeoIP database[15]. Half of the respondents were located in the United States.

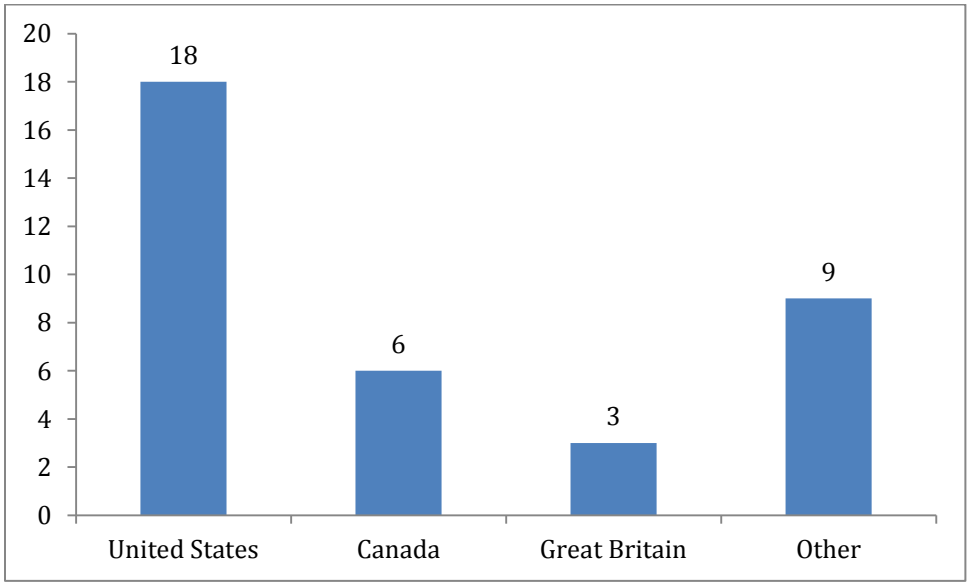

Figure 13 Geographic location of respondents

As shown by Table 13, the non-us respondents are very geographically dispersed. A quarter of the respondents are from a country with a frequency of one.

[15] http://www.maxmind.com/en/geoip_demo

Table 13 Geographic location of respondents

Country	Responses	Percentage
United States	18	50.0%
Canada	6	16.7%
Great Britain	3	8.3%
Germany	1	2.8%
Jamaica	1	2.8%
Lebanon	1	2.8%
Mauritius	1	2.8%
Netherlands	1	2.8%
New Zealand	1	2.8%
Philippines	1	2.8%
Saint Vincent And The Grenadines	1	2.8%
Australia	1	2.8%
Total	36	100%

6.9.5 Lifetime Freelance Marketplace Spending

Half the respondents have spent over $10,000 on freelance marketplaces. In hindsight the range should have been higher to more accurately capture the spent amount. The precision of the data could have been higher by adding spending ranges above $10,000.

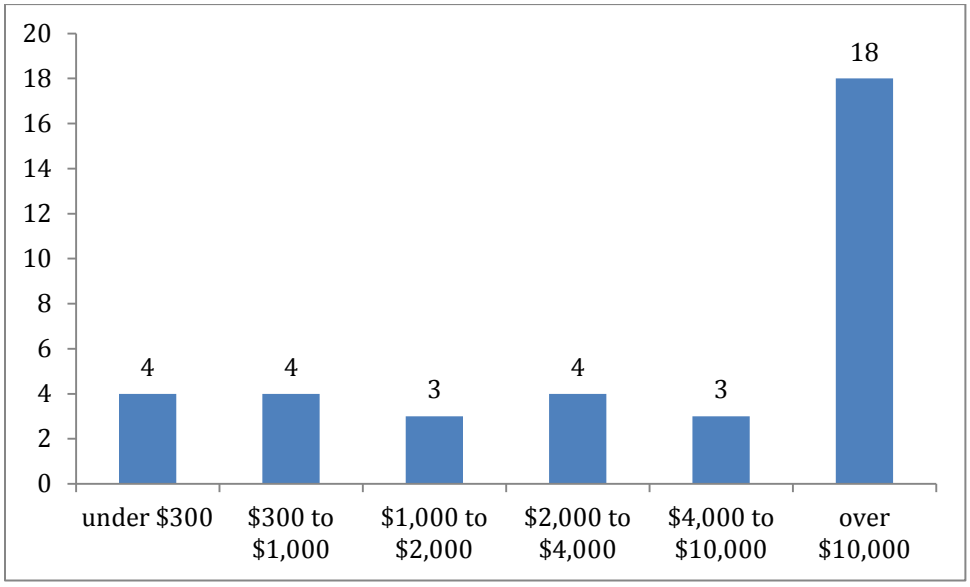

Figure 14 Lifetime spending on freelance marketplaces

The sending level of half of the responses is varied across the first five possible answers, while the other half have spent a substantial amount on freelance marketplaces.

6.10 Experience with IT Projects

The majority of respondents have between 11 and 20 years of experience with IT projects. 88.9% of respondents have at least 6 years of experience with IT projects.

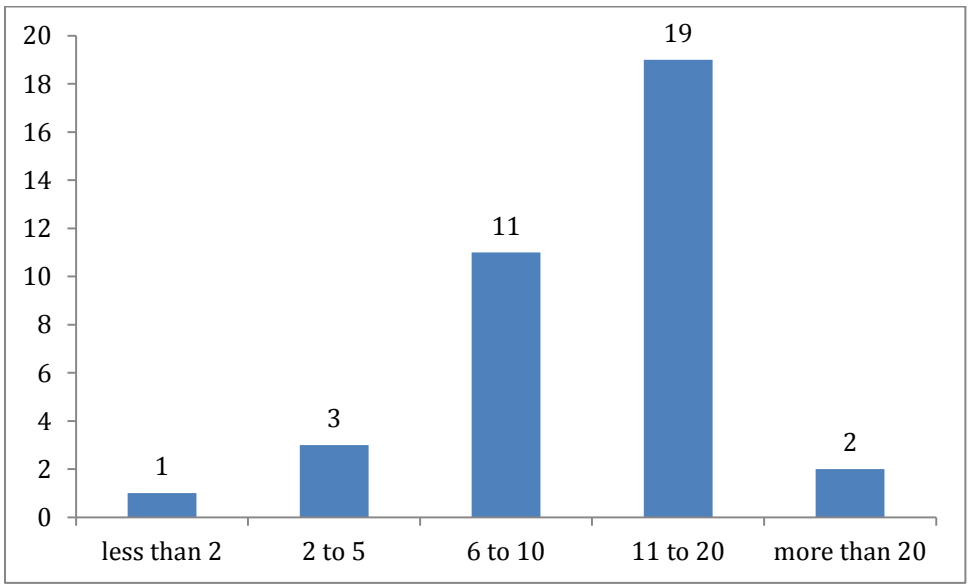

Figure 15 Experience with IT projects

The high number of years of experience of respondents suggests that they are knowledgeable, and that they will be able to provide reliable input for the purpose of this research.

Table 14 Experience with IT Projects

Answer	Responses	Percentage
less than 2	1	2.8%
2 to 5	3	8.3%
6 to 10	11	30.6%
11 to 20	19	52.8%
more than 20	2	5.6%
Total	36	100%

6.11 Number of Employees

The respondents were asked how many employees are in their company. The majority of respondents are self-employed or the sole proprietor of their business. 83.3% of respondents work in a company of 10 or less people. Respondents work in relatively small businesses by number of employees.

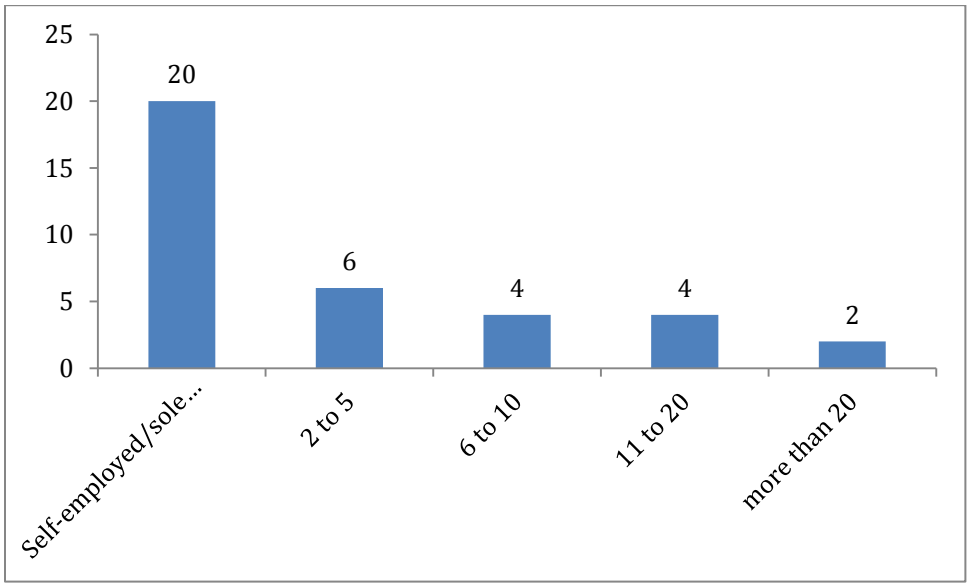

Figure 16 Number of employees

The respondents are divided almost equality in two categories: the sole entrepreneur, and being part of a business with more than one person.

Table 15 Number of employees

Answer	Responses	Percentage
Self-employed/sole proprietor	20	55.6%
2 to 5	6	16.7%
6 to 10	4	11.1%
11 to 20	4	11.1%
more than 20	2	5.6%
Total	36	100%

6.12 Sector of Activity

The respondents were asked to input their sector of activity in an input box. No choice of answers were given, but the answers were later group by category. Answering this question was not mandatory.

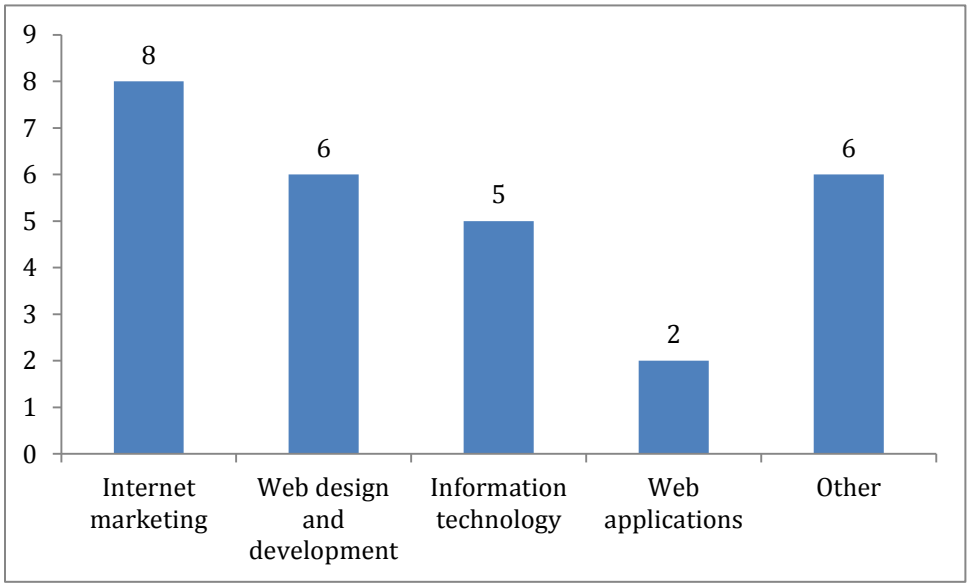

Figure 17 Sector of activity

81.5% of respondents entered a sector of activity related to information technologies. The most frequent declared sectors were Internet marketing and Web design and development.

The respondents belong to three general categories of activity sectors: internet marketing, information technology, and other. Information technology includes respondents identifying their activity sector as web development, web design, mobile development, and web applications.

Table 16 Sector of activity

Activity sector	Frequency	Percentage
Internet marketing	8	29.6%
Web design and development	6	22.2%
Information technology	5	18.5%
Web applications	2	7.4%
Mobile applications and scientific software	1	3.7%
Media	1	3.7%
Telecommunications & others	1	3.7%
Music	1	3.7%
Real estate	1	3.7%
Total	27	100%

Observations of the results and characteristics of the sampling allow us to group the respondents into three categories of sectors of activity: internet marketing, information technology, and others. Typically, internet marketers are more involved in the communication and selling side of business, while the work of information technology specialists revolves around software. Respondents from both professions have used freelance marketplaces to source software development projects, but they contrast in the sense that software development is usually the IT professional's area of expertise, while it is not the Internet marketer's bread and butter.

Chapter 7 – Analysis of Software Development Project Success on Freelance Marketplaces

This chapter presents a detailed analysis of the data collected with the questionnaire. The principal data consists of software development project success factors, freelance marketplace characteristics, and software development projects success metrics. The level of buyer satisfaction with freelance marketplaces in relation to control variables was analyzed, and the profiles of a typical satisfied and unsatisfied respondent were drawn.

Reports and outputs from qualtrics.com, Excel, SPSS, and NVIVO were used for data analysis.

We first examine the organizational aspects control variables, then the buyer satisfaction control variable, followed by the analysis of the 3 components of the empirical research model.

7.1 Analysis of the Organizational Control Variables

The section presents statistics about the experience of the respondents relevant to the evaluation of success factors of software development projects on freelance marketplaces.

The experience with freelance marketplaces of software development services buyers is demonstrated by identifying which freelance marketplaces they have used to source software development projects, and their total lifetime spending on freelance marketplaces.

Three broader questions were asked about the respondent's business activities. They include the sector of activity, the number of employees in the software development services buyer's company, and the number of years of experience in IT projects (not exclusively to freelance marketplaces).

7.1.1 Freelance Marketplaces Used

The respondents of the survey have used a wide range of freelance marketplaces. No respondent answered "none", which would have disqualifies their results.

The three most used marketplaces are oDesk, elance, and freelancer.com. Since this research was started, vWorker (formely rentacoder) was acquired by freelancer.com.

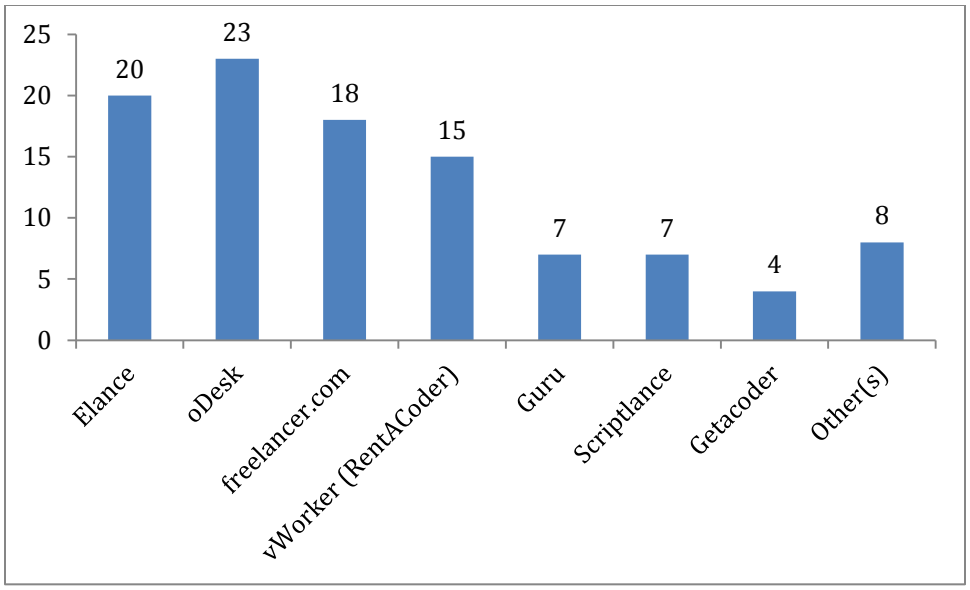

Figure 18 Freelance marketplaces used

On average, respondents have reported having used 3 different freelance marketplaces. Nobody reported having used peopleperhour and ifreelance. The large variety of freelance marketplaces used, and the fact that nearly all respondents have used more than one freelance marketplace suggests various hypotheses. Possible reasons are that users have jumped from one marketplace to another due to dissatisfaction with results, that different freelance marketplaces are better for different types of projects, or that users are migrating to superior freelance marketplaces as the marketplaces evolve and surpass their peers.

Table 17 Freelance marketplaces used

Answer	Responses	Percentage
Elance	20	55.6%
oDesk	23	63.9%
freelancer.com	18	50.0%
vWorker (RentACoder)	15	41.7%
Guru	7	19.4%
Scriptlance	7	19.4%
Peopleperhour	0	0.0%
Ifreelance	0	0.0%
Getacoder	4	11.1%
None	0	0.0%
Other(s)	8	22.2%
Total	102	100%

The results entered for “Other(s)” by respondents include the following:

- Fiverr.com (twice)
- OnlineJobs.ph
- Mindfire Solutions
- Craiglist
- Drupal.org user-to-user
- Virtual Staff Funder
- Codeur.com
- Guru (already an option, missed by the respondent)
- Staff.com

Of these sites listed in the “Other(s)” field, it appears only onlinejobs.ph, codeur.com and staff.com would fit into our definition of freelance marketplaces – the other sites being either a micro-task marketplace (fiverr) or a job posting board where the provider is paid outside of the website.

In conclusion, the representativeness of the sampling seems adequate, and the experience of the respondents with IT projects and freelance marketplaces assures the validity of the responses. The variety of sectors of activity and geographical locations prevents biased results of over-representing a group.

7.2 Analysis of the Buyer Satisfaction

This section aims to determine what variables have a link with the level of satisfaction of buyers of software development services on freelance marketplaces. The level of buyer satisfaction across all projects is considered a control variable.

7.2.1 Buyer Satisfaction

The most frequent response to the buyer satisfaction with freelance marketplaces question was “somewhat satisfied”. Less than a third of respondents were at satisfied or very satisfied, which could signal freelance marketplaces have a lot of room to improve the satisfaction of their service buyers.

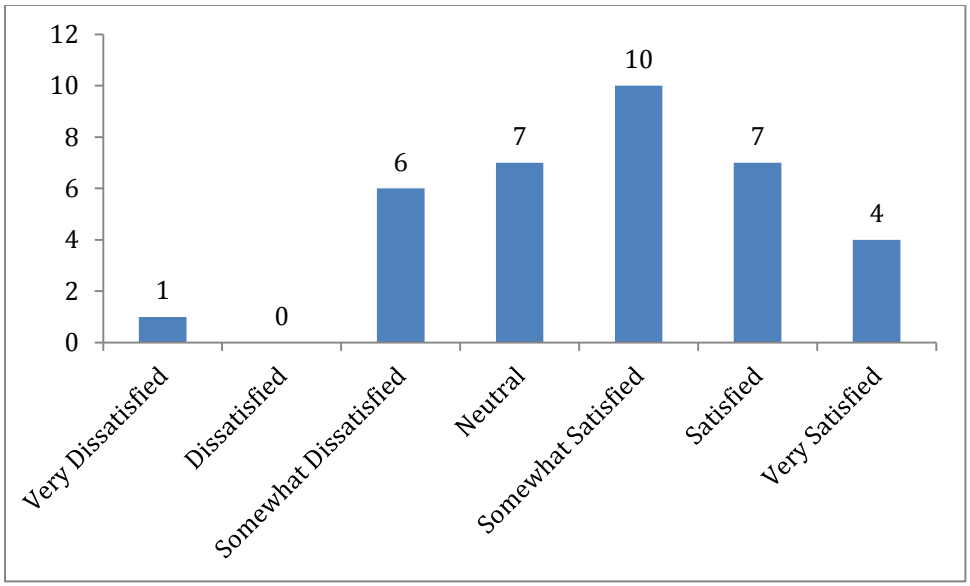

Figure 19 Buyer satisfaction

Table 18 Buyer satisfaction

Answer	Responses	Percentage
Very Dissatisfied	1	2.9%
Dissatisfied	0	0.0%
Somewhat Dissatisfied	6	17.1%
Neutral	7	20.0%
Somewhat Satisfied	10	28.6%
Satisfied	7	20.0%
Very Satisfied	4	11.4%
Total	35	100%

The room for improvement in the level of satisfaction regarding freelance marketplaces validates the research question. It signals problems or lack of knowledge regarding achieving consistently successful projects. Freelance marketplaces have room to improve in the level of satisfaction of software development services buyers.

An analysis was done to define the profiles of software development services buyers at different levels of satisfaction. The next sections examine whether there are other elements that can explain the level of buyer satisfaction with freelance marketplaces.

7.2.2 Relation of Organizational and Demographic Variables with Buyer Satisfaction

With the use of pivot tables and descriptive statistics, the relation of the level of satisfaction and the value of other variables was examined. To improve the clarity by demonstrating the trends, the 7-point Likert scale from very dissatisfied to very satisfied was converted to a 3-point Likert from dissatisfied to satisfied, with the middle response option staying neutral. Noteworthy discoveries are presented.

7.2.2.1 Buyer Satisfaction by Sector of Activity

We compared the level of satisfaction in relation to the sector of activity of respondents. The three categories of sector of activity are Internet marketing, information technology, and other.

The average satisfaction value is 4.78, which represents a level between neutral and somewhat satisfied. The respondents that have identified their sector of activity as being an IT-related field have a slightly higher satisfaction level at 5.13, compared to 4.52 for the other respondents.

Table 19 lists the level of satisfaction by sector of activity

Table 19 Satisfaction by sector of activity

Sector of activity	Buyer satisfaction					
	Dissatisfied		Neutral		Satisfied	
	Count	Row N %	Count	Row N %	Count	Row N %
Internet Marketing	2	22.2%	2	22.2%	**5**	**55.6%**
IT	3	18.8%	3	18.8%	10	62.5%
Other	2	18.2%	2	18.2%	7	63.6%

Software development services buyers identified as working in the Internet marketing field have a slightly lower percentage of satisfied responses compared to the other two groups.

Accordingly, the number of respondents having answered “satisfied” or “very satisfied” is the lowest of Internet marketing, while respondents in the Information Technology field have the highest level of satisfaction. The level of satisfaction towards freelance marketplaces is somewhat related to the activity sector.

7.2.2.2 Buyer Satisfaction by Employee Count

Table 20 presents the level of buyer satisfaction with freelance marketplace by number of employees

Table 20 Satisfaction by employee count

Employee Count	Buyer satisfaction					
	Dissatisfied		Neutral		Satisfied	
	Count	Row N %	Count	Row N %	Count	Row N %
1 to 5	4	15.4%	5	19.2%	**17**	**65.4%**
6 to 10	1	25.0%	2	50.0%	**1**	**25.0%**
11 +	2	33.3%			**4**	**66.7%**

The percentage of satisfied respondents is very high for companies with 1 to 5 and more than 11 employees, but is low for respondents with 6 to 10 employees. By drilling down into the level of satisfaction of company sizes of 1 to 5 employees, it becomes apparent that companies with only one person have the highest percentages of satisfied respondents at 75%.

Table 21 Satisfaction by category of number of employees

Employee Count	Buyer satisfaction					
	Dissatisfied		Neutral		Satisfied	
	Count	Row N %	Count	Row N %	Count	Row N %
1	1	5.0%	4	20.0%	**15**	**75.0%**
2 to 5	3	50.0%	1	16.7%	2	33.3%
6 to 10	1	25.0%	2	50.0%	1	25.0%
11 to 20	2	50.0%			2	50.0%
> 20					2	100.0%

Respondents belonging to companies with 11 or more employees have an average satisfaction score of 4.77 compared to 4.83 for the rest of the respondents. The difference is negligible, even though percentage of respondents having answered at least “somewhat satisfied” is higher than the 6 to 10 employees group of respondents.

Self-employed and sole proprietor respondents have an average satisfaction level of 5.25 (between “somewhat satisfied” and “satisfied”) while the rest of respondents have an average satisfaction level of 4.19 (between “neutral” and “somewhat satisfied”).

The self-employed and sole proprietor group appears to be the most satisfied of freelance marketplaces.

7.2.2.3 Buyer Satisfaction by Years of Experience with IT Projects

Table 22 presents the level of buyer satisfaction with freelance marketplace by number of years of experience with IT projects.

Table 22 Satisfaction by years of experience

Years of experience with IT projects	Buyer satisfaction					
	Dissatisfied		Neutral		Satisfied	
	Count	Row N %	Count	Row N %	Count	Row N %
less than 2			1	100.0%		
2 to 5			1	33.3%	2	66.7%
6 to 10	2	18.2%	1	9.1%	8	72.7%
11 to 20	5	26.3%	3	15.8%	11	57.9%
more than 20			1	50.0%	1	50.0%

There were a higher percentage of satisfied respondents with 6 to 10 years' experience with IT projects than respondents with 11 to 20 years' experience.

A possible explanation for this difference is that as buyers are more experience, their needs and projects become more complex, and it becomes harder to achieve satisfaction.

7.2.2.4 Buyer Satisfaction by Age

Table 23 presents the level of buyer satisfaction with freelance marketplace by number of years of experience with IT projects.

Table 23 Satisfaction by age

Age	Buyer satisfaction					
	Dissatisfied		Neutral		Satisfied	
	Count	Row N %	Count	Row N %	Count	Row N %
< 18						
18 - 25	1	25.0%	3	75.0%		
26 - 34	1	6.2%	2	12.5%	13	81.2%
35 - 54	5	33.3%	2	13.3%	8	53.3%
55 - 64						
> 65					1	100.0%

There were a higher percentage of satisfied respondents aged between 26 and 34 compared to respondents aged 35 to 54.

7.2.3 Profile of a Satisfied and Unsatisfied Buyer

By observing the cases/situations where the level of satisfaction of respondents was the highest, we created the profile of a satisfied buyer of software development services on freelance marketplaces.

A satisfied buyer operates in an Information Technology related field, is an entrepreneur without employees, has 6 to 10 years' experience with IT projects, and is between 26 and 34 years of age.

In contrast, and unsatisfied buyer works in Internet Marketing, works in a company with 6 to 10 employees, has 11 to 20 years of experience with IT projects, and is 35 to 54 years old.

The demographic and organizational control variables appear to have an effect on the level of satisfaction, which could in turn influence the software development services buyers' opinion of the importance of project success factors, freelance marketplace characteristics, and software development project success metrics.

7.3 Quantitative Analysis of Success Factors and Metrics

This section presents the findings from the questionnaire's main questions. The data discussed consists of freelance marketplaces project success factors, freelance marketplace characteristics that influence success, and success metrics.

7.3.1 Software Development Project Success Factors

Respondents were asked to evaluate the importance of factors that influence the success of software development projects on freelance marketplaces based on a 7-point Likert scale.

7.3.1.1 Descriptive statistics of software development project success factors

The most important project success factors according to the software development services buyers are the provider is technically proficient, the project's requirements are clear, the communication with the provider is adequate, and the buyer is technically proficient. All of these factors have a mean response of at least "important". The standard deviations are also the lowest for these four factors, signaling a higher level of consensus amongst respondents than other factors.

The three least important factors were the provider is paid a flat rate, the buyer is the end user of the finished product, and the provider is paid a flat rate.

Both the flat rate and hourly rate factors did not score high in importance and had a relatively high standard deviation, which suggests that there is no universally better way of paying the provider and that it depends on the project.

Table 24 Descriptive statistics of factors that influence success

Software development project success factor	N	Mean	Std. Deviation
The provider is technically proficient	36	1.11	0.398
The project's requirements are clear	36	1.22	0.422
Communication with the provider is adequate	36	1.28	0.513
The buyer is technically proficient	36	1.92	0.937
The scope of the project is limited	36	2.53	0.910
The buyer has previously hired the same provider for another project	36	2.56	0.877
The project is completed in a short amount of time	36	2.58	0.874
The provider is paid a flat rate	36	2.97	1.341
The buyer is the end user of the finished product	36	3.36	1.334
The provider is paid hourly	36	4.00	1.014

The value of 1 signifies “very important”, while the value of 5 signifies “unimportant”.

We observe that IT specialists have assessed “the buyer is technically proficient” as being more important than Internet marketers. The importance of this factor was 1.7 according to IT specialists compared to 2.1 for other respondents.

The importance of project success factors as measured are relatively independent from one another, as no significant correlation exist between them. The correlations between the variables were generally weak, with the strongest correlation being of 0.399. The full correlation table is in Annex 4.

7.3.1.2 Interpretative analysis of project success factors by software development services buyers

A factor analysis was conducted on the success factors to reveal the key components. These are the principal components considered as important by software development services buyers. Four components were retained (Eigenvalue above 1) and are presented in Table 25. Bold type groups the principal success factors of each component. A correlation table is presented in Annex 5.

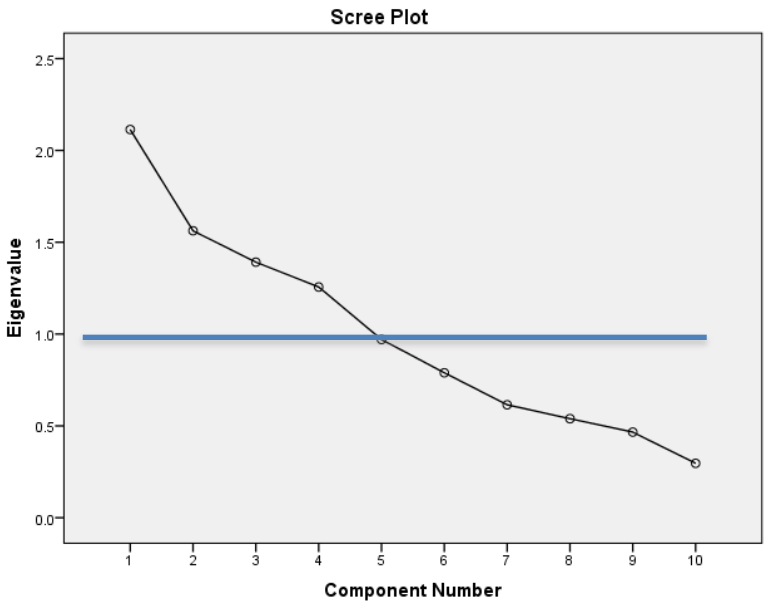

Figure 20 Scree plot of eigenvalue to component

Table 25 Rotated component matrix of success factors[16]

	Component			
	1	2	3	4
The project is completed in a short amount of time	**.761**	-.071	.173	-.279
The provider is paid a flat rate	**.721**	-.058	.085	.260
The provider is paid hourly	**.662**	.108	-.334	.008
The buyer has previously hired the same provider for another project	-.166	**.743**	.158	.112
The scope of the project is limited	-.081	**.722**	.065	-.186
Communication with the provider is adequate	.293	**.627**	-.160	.084
The buyer is the end user of the finished product	.108	-.061	**.818**	-.269
The buyer is technically proficient	-.111	.241	**.733**	.367

[16] Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 7 iterations.

The project's requirements are clear	.250	-.192	-.052	**.736**
The provider is technically proficient	.405	-.248	-.027	**-.639**

The first component includes the items: “the project is completed in a short amount of time”, “flat rate payment”, and “hourly rate payment”. The common link is time: the short duration of the project is measure of time, while the two different payment methods deal with the way the provider’s time is remunerated. Time is linked with project cost. A short project duration remunerated at an hourly rate would ensure the cost is low, while a flat rate payment for the entire project would ensure costs are contained at a certain level, regardless if the provider takes more time than anticipated. We will refer to this component as “cost control factors”.

The second component includes “having previously hired the same provider”, “the project’s scope being limited”, and “communication being adequate”. These three success factors improve the efficiency of the project. Having worked with the same provider in the past removes uncertainty and increases confidence in a success completion of the project, due to past experience with the provider. A limited scope puts on upper bound on the project complexity, scope creep, and makes planning simpler, thus reducing the chances of overruns or misunderstanding about what is expected to be created. Adequate communication ensures the needs to the buyer are well understood by the provider, and that the project stays on track. We will refer to this component as “project efficiency factors”.

The third component includes “the buyer being the end user”, and “the buyer being technically proficient”. Very clearly, the common theme is that these success factors relate to the buyer. We will refer to this component as “qualifications of the buyer”.

The fourth component consist of “clear requirements” and “the provider being technically proficient”. The common theme relates to quality. They are conditions to achieve a quality finished product. Both of these success factors are needed to achieve a quality product that fits the initial vision of the buyer. The requirements must be clear for the provider to understand what needs to be done, and the provider needs to be technically proficient to be able to develop what needs to be done. Both are needed to be able to complete the project as the buyer envisioned it. The last success factor has a negative value for component 4, suggesting the respondent think of the technical proficiency of the provider as being is a separate category. We will refer to this component as “focus on product quality”.

In conclusion, the factor analysis has shown that software development services buyers view project success factors as consisting mainly of four elements: "cost control factors", "project efficiency factors", "qualifications of the buyer" and "focus on product quality".

7.3.2 Freelance Marketplace Characteristics That Influence the Success of Software Development Projects

Respondents were asked to evaluate the importance of freelance marketplace characteristics prone to influence the success of software development projects based on a 7-point Likert scale, where 1 means "very important", and 5 means "unimportant".

7.3.2.1 Descriptive Statistics of Freelance Marketplace Characteristics

As illustrated in Table 26, the mean answers range from 2.11 to 2.53, which mean they all hover around the "important" mark. The most important characteristic was pre-qualification mechanisms, while the least important was fees.

There was not a freelance marketplace characteristic that was noticeably more important than another. This signals that software development services buyers view all freelance marketplace characteristics of similar importance.

Table 26 Descriptive statistics of freelance marketplace characteristics that influence success

	N	Mean	Std. Deviation
Pre-qualification mechanisms	36	2.11	0.854
Arbitration mechanism	36	2.19	1.167
Rules	36	2.31	1.167
Features	36	2.39	0.994
Aesthetics and usability	36	2.46	1.245
Fees	36	2.53	1.183

As shown in Table 27, fees and aesthetics and usability had a correlation factor of 0.627, while fees and rules had a correlation factor of 0.526.

Table 27 Correlation metrics of freelance marketplace characteristics

	Arbitration mechanism	Rules	Features	Pre-qualification mechanisms	Aesthetics and usability	Fees
Arbitration mechanism	1.000					
Rules	.542	1.000				
Features	.307	.370	1.000			
Pre-qualification mechanisms	.063	.193	.525	1.000		
Aesthetics and usability	.076	.099	.614	.523	1.000	
Fees	.278	.526	.522	.395	.627	1.000

There were seven pairs of success metrics with correlation coefficients of more than 0.5, with a maximum value of 0.627.

Features, aesthetics and usability, and pre-qualification mechanisms are correlated with each other at a coefficient of more than 0.5. This could suggest the respondents considered these metrics as being linked. Respondents appear to associate a similar importance to different freelance marketplace characteristics, which signals that a more detailed analysis would need to be done to find the foundations of their judgments.

7.3.2.2 Interpretative Analysis of Freelance Marketplace Characteristics

A factor analysis was done to find any similarities in the answers. Two components have an Eigenvalue above 1 and are presented in Table 21. Bold type groups the principal success factors of each component.

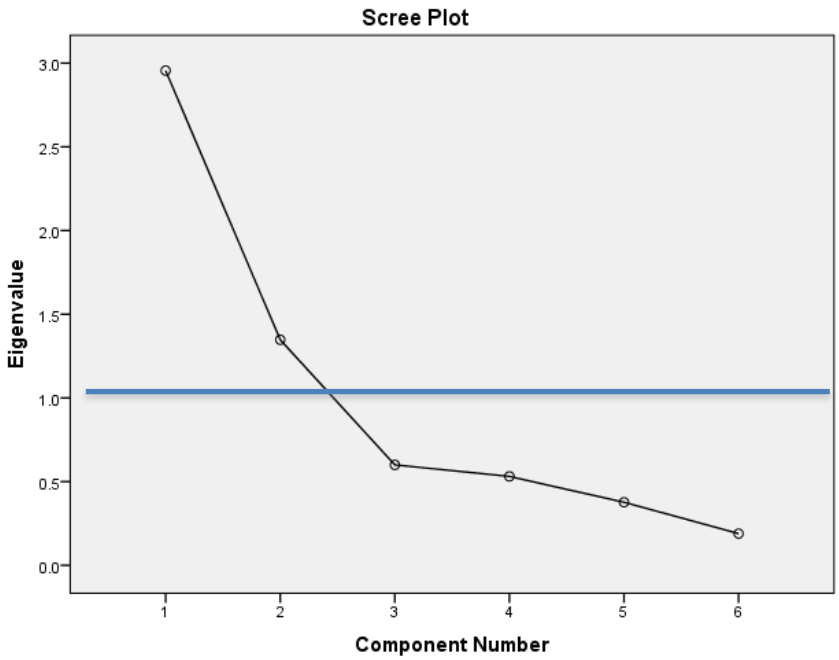

Figure 21 Scree plot of eigenvalue to component

Table 28 presents the correlations related to each component.

Table 28 Rotated component matrix of freelance marketplace characteristics [17]

	Component	
	1	2
Aesthetics and usability	**.891**	-.017
Pre-qualification mechanisms	**.782**	-.004
Features	**.770**	.321
Fees	***.695***	.446
Rules	.185	**.867**
Arbitration mechanism	.021	**.857**

The first component consists of the items: “aesthetics and usability”, “pre-qualification mechanisms”, “features”, and “fees”. The “fees” characteristics is a weak element in the first component, since it has a high value in both component, and is therefore distinguishable from the other three elements within

[17] Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 3 iterations.

component 1. The common theme between the first three elements is that they are functional elements of the website. The aesthetics and usability consists of how a website looks, and how well its interface functions. Pre-qualification mechanisms are questions and skill tests that a buyer or provider takes on the website to have their suitability evaluated. Features includes elements such as search options, tools, IP protection mechanisms, communication tools, features, bidding tools, feedback system, work tracking system. The first three freelance marketplaces characterizes in component one are tools or functional elements, with the forth being fees. We name this component "website functionalities".

The second component includes "rules and arbitration mechanisms". Rules consist of elements such as terms of use, bidding limits and restrictions. Arbitration mechanisms consist of the dispute resolution process administered by the freelance marketplace in case of disagreement between the buyer and the provider. The similarity is that they both deal with terms agreed upon by both parties with using the freelance marketplace. Parties agree to the terms, the rules, and the dispute resolution process in case of disagreement. We will refer to this component as "terms agreed upon".

The software development services buyers perceive two distinct groups of freelance marketplace characteristics that influence project success: "website functionalities" and "terms agreed upon".

7.3.3 Software Development Project Success Metrics

The respondents were asked to order success metrics from most important to least important. Success metrics are the criteria used to evaluate the success of a programming project. The values obtained are akin to a 6-point Likert scale from important to unimportant, where each value can only be assigned once. By forcing the respondents to order the success metrics, we force an answer by order of importance and prevent several items being identified as equally important.

7.3.3.1 Descriptive Statistics of Project Success Metrics

Quality in use was identified as the most important success metric, with a mean value of 1.83. This means that most respondents ranked it first or second in importance. There is a significant gap between the importance of quality in use and the next success metric, suggesting a lack of consensus about the importance of the other success metrics.

Table 29 Software development project success metrics

Answer	Mean	Standard Deviation
Quality in use: The end product works well in use. Criteria include effectiveness, efficiency, satisfaction, freedom from risk, and context coverage.	1.83	1.34
External quality: The end product's functional suitability and usability is satisfactory.	3.03	1.30
Budget: The budget was respected.	3.50	1.54
Time: The project is on time.	4.11	1.45
Internal quality: The source code is of quality. Criteria include performance efficiency, compatibility, reliability, security, maintainability, and portability.	4.19	1.82
Scope: The scope is met.	4.33	1.43
Total		

Since it was not possible for respondents to rate two metrics as equally important, there are a high number of negatively correlated items. Noteworthy is the fact that "time and internal quality", "time and quality in use", "budget and quality in use", and "time and quality in use" have correlation coefficients of less than -0.4. This makes sense considering that projects that take more time and require higher budgets usually achieve higher quality levels.

7.3.3.2 Interpretative Analysis of Project Success Metrics

A factor analysis was done conducted to identify the components by which software development services buyers refer to evaluate the success of a software development project on a freelance marketplace. Three components have an Eigenvalue above 1 and are presented in Table 30. Bold type groups the principal success metrics of each component.

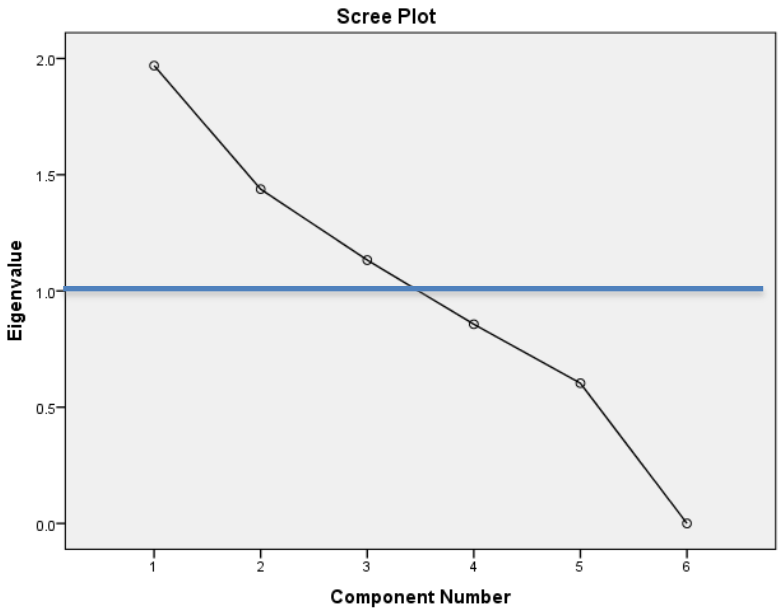

Figure 22 Scree plot of eigenvalue to component

Table 30 Rotated component matrix of success metrics

	Component		
	1	2	3
Budget	**-.758**	.187	-.303
Quality in use	**.717**	-.086	-.017
Scope	**.657**	.362	-.416
Internal quality	-.056	**-.949**	-.040
Time	-.505	**.678**	-.073
External quality	.074	.039	**.973**

The first component consists of "budget", "quality in use", and "scope". Scope is however divided into the other components as well, meaning that its role in component 1 is weak. The common link is initial objects. Scope and budget are parameters for the project that are set at the start of the project, while achieving quality in use (satisfying to the end users in a real-world setting) is also one of the initially defined objectives. We will refer to this component as "initially defined objectives".

The second component includes internal quality and time. The common link is quality of the execution. Internal quality refers to the inner structure of the software, while time is a typical measure of project efficiency. We will refer to this component as "quality of the execution".

The third component relates to external quality. The value is very high, signaling the respondents think external quality's importance as a success metric is different than the other metrics. We will refer to this component as "functional quality".

The factor analysis permitted the success metrics to be reduced to three components: "initially defined objectives", "quality of the execution", and "functional quality".

7.3.4 Freelance Marketplace Software Development Project Success Model

Figure 23 presents the software development services buyer reference model regarding project success factors, freelance marketplace characteristics, and project success metrics.

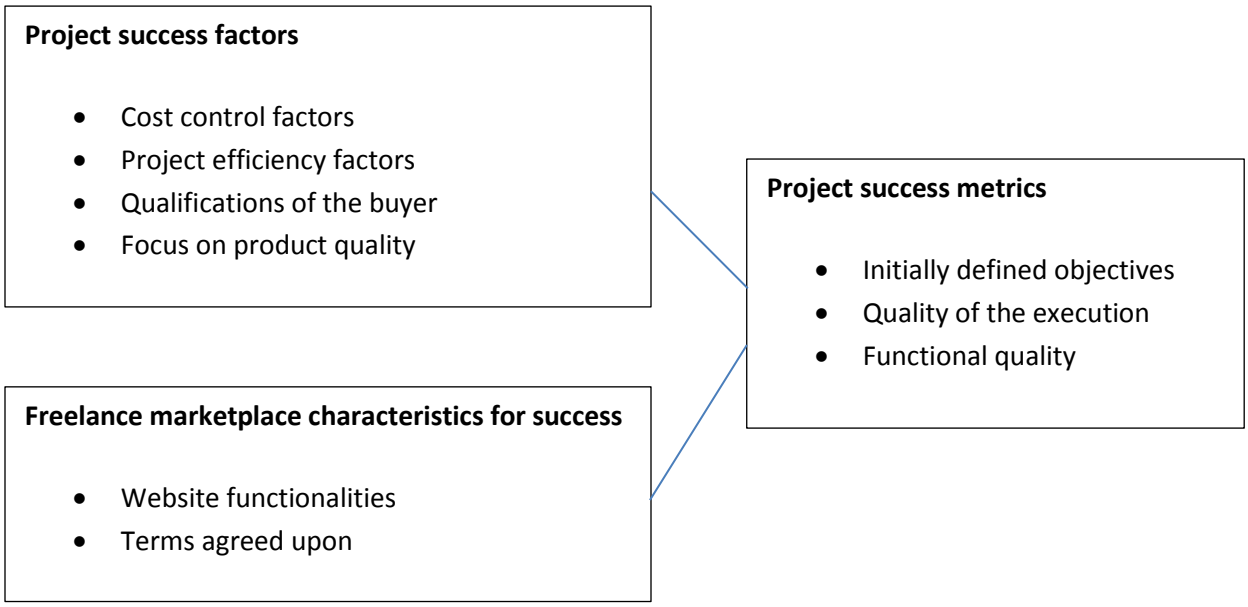

Figure 23 Freelance marketplace software development project success model

7.4 Qualitative Analysis of Success Factors

The following section presents a qualitative analysis of the responses to the questions regarding elements that enabled or prevented success of software development projects on freelance marketplaces. It allows the success model to be confirmed or improved.

7.4.1 Elements That Led to Success or Prevented Success

The respondents were asked with an open-ended question what elements led to the success of their most successful project, followed by a question about what elements prevent the success of their least successful project.

The text answers were coded into nodes with NVIVO to identify the most frequently recurring ideas.

The most frequently mentioned elements that led to or prevented success are: the skills and experience of the provider, the requirements, and communication.

Annex 6 provides a list of all sources identified by the software development services buyers as having enabled or prevented project success.

The top three elements were broken down into more precise children nodes, when the respondent provided more information. Note the total of references of children nodes doesn't match its parent's reference count, because some respondents did not describe the element in more detail. For example, when a respondent only wrote "communication", we did not have a more specific description of the sources such as "good communication" or "fluent communication".

Annex 7 provides a breakdown of child nodes that compose the top elements that enabled of prevented project success.

The qualitative analysis concluded that the top four elements that enabled or prevented the success of software development projects on freelance marketplaces are "skills of the provider", "communication", "price/cost", and "clear requirements".

The quantitative analysis concluded that the most important project success factors according to the software development services buyers are focus on product quality, project efficiency factors, cost control factors, and qualifications of the buyer.

The results of the qualitative analysis of the open-ended questions coincide with the results of the quantitative analysis of the success factors questions as evidenced in Table 31. The combination of these two analyses helps in confirming the validity of the software development project success factors on freelance marketplaces.

The success factor of "focus on product quality" matches two important factors from the qualitative analysis: "skills of the provider" and "clear requirements". "Project efficiency factors" matches "communication", while "cost control factors" is a close match for "price/cost". The success factor of "qualifications of the buyer" did not have a match with open-ended responses. This could be because respondents did not self-evaluate the importance of their own competencies in project management or software development.

Table 31 Comparison of quantitative and qualitative results

Most important freelance marketplace software development success factors	
Quantitative analysis	**Qualitative analysis**
Focus on product quality	Skills of the provider Clear requirements
Project efficiency factors	Communication
Cost control factors	Price/cost
Qualifications of the buyer	[No match]

7.4.2 Additional Comments by Respondents

Respondents were freely invited on the last question to leave any comments on their experience with freelance marketplaces. An outline of the comments left is discussed below.

Freelance marketplaces are better suited for small projects, and do not work well for long term projects. More complex projects lead to misunderstanding of the requirements. One respondent alleged that they are not worth using at all, except for very small projects.

Monitoring the work is important. Freelance marketplaces should provide tools to monitor the progress of the developer. The freelance marketplace themselves could monitor the work. Monitoring the progress on a daily basis can cut the total time of the project in half, according to one respondent.

Finding the right provider is very difficult. Freelance marketplaces are great when the developer is competent, but a waste of time when they are not. There are developers on freelance marketplaces that are scammers, or consistently do bad work.

Some buyers choose work done overseas simply because of low costs, however communication problems due to the developer's poor English make it harder to complete projects successfully.

Chapter 8 – Conclusion

This chapter presents a discussion of the results drawn from this research. The major contributions of the thesis are presented. The principal findings are summarized. The known limitations of the thesis are discussed. Finally, future research ideas are outlined.

8.1 Review of Major Contributions

The most important contribution of the thesis is an analysis of success factors of software development projects on freelance marketplaces. Through the use of a literature review, a blog analysis and a questionnaire, the importance of 10 success factors of software development projects on freelance marketplaces was assessed. Furthermore, respondents were asked what prevented or led to the success of their projects, allowing them to mention further factors not present on the list.

Success metrics for software development projects on freelance marketplaces were compiled. These criteria were divided into project success and product success. The importance of each metric to measure project success was assessed with the questionnaire. The "quality in use" metric was the most important, while the importance of other metrics was about the same.

The definition of the freelance marketplace field constitutes another contribution. A freelance marketplace is a web-based e-marketplace that supports the entire process of contracting out a software development project to a single independent remotely-located programmer for a fixed price or hourly rate, while offering related information, tools, and services.

The methodology for arriving at the definition of freelance marketplaces constitutes another research contribution. The definition was formulated after examining the leading e-marketplace websites for software development.

The thesis presents another methodological contribution: mining information from blogs and self-published articles. The method used to extract opinions from online articles to source information and method for applying credibility criteria could be inspiring to other researchers. This source of information of unproven reliability is verified with the use of the questionnaire to achieve findings of greater validity.

8.2 Key Findings

It appears that the level of satisfaction of buyers of software development projects with freelance marketplaces is variable, meaning they still have room for improvement. Only a third of respondents were "satisfied" or "very-satisfied" (the two best answers on the 7-point Likert scale). Respondents have on average used 3 freelance marketplaces, signaling they may have tried different websites in the goal to achieve better results. Of the 31 respondents who have commented in the option-ended questions, all of them had something to say about their least successful project, which indicated that no one in our sample group had only entirely successful projects.

A satisfied buyer typically operates in an Information Technology related field, is an entrepreneur without employees, has 6 to 10 years experience with IT projects, and is between 26 and 34 years of age.

Table 32 Synoptic table of the most important project success factors, freelance marketplace characteristics, and project success metrics

Majors aspects	**Key success factors and metrics**
Project success factors	• Focus on product quality • Project efficiency factors • Cost control factors • Qualifications of the buyer
Freelance marketplace characteristics	• Website functionalities • Terms agreed upon
Project success metrics	• Quality in use

The most important project success factors, freelance marketplace characteristics, and the most important project success metric are presented in Table 32. These success factors are coherent with the results found in the questionnaire's open-ended question, the literature review, and the analysis of blogs. The level of importance of all freelance marketplace characteristics were similar, therefore we cannot present any characteristics as more important than others.

While no freelance marketplace characteristics were found to be significantly more important than another, characteristics are divided into two distinct categories: website functionalities and terms agreed upon.

Freelance marketplaces play the role of an enabler of project success factors. For example, the project success factor of adequate communication may be supported by private messaging functionalities on the freelance marketplace. As another example, the freelance marketplace could help assess the proficiency of a provider by displaying feedback left about the provider by previous customers. The freelance marketplace supports the project management process by providing functionalities which are in line with achieving success.

Freelance marketplaces could also be responsible for reducing non-payment risk for the provider and reducing risk of payment for incomplete work for the buyer. The terms agreed upon by the buyer and provider of services on a freelance marketplace could help with these aspects of the project management.

The most importance success metric, as signaled by the respondents' answers, was quality in use. There was a wide margin between the quality in use metric and the other metrics. The results about the importance of the other metrics were inconclusive, suggesting there may not be a set order of importance.

A factor analysis of the responses was conducted to identify key components of success. The most distinguishable success factors were cost control factors, project efficiency factors, qualifications of the buyer and focus on product quality. The success factor of "focus on product quality" was found to be dominant, since it corresponded to two of the most important factors found in the qualitative analysis. Freelance marketplace characteristics that influence success were reduced to website functionalities and terms agreed upon. Finally, success metrics were reduced to initially defined objectives, quality of the execution, and functional quality.

8.3 Limitations of the Thesis

The small number of respondents constitutes a limitation to the thesis. With a larger number of respondents, further statistical analysis could have been done. The number of respondents was small, mainly due to difficulty in finding contact information of users of freelance marketplaces. Freelance marketplaces purposefully do not display the buyers' contact information to prevent disintermediation and thus avoiding paying their fees. Very little projects have identifying information, such as the name of the website or product the project relates to. Furthermore, nearly all of the contact with potential respondents was cold, resulting in a lower response rate.

The research was limited to an analysis from the point of view of the buyer of software development services. Different types of buyers answered the survey, which could explain the variation in obtained responses.

The convenience sample used does not allow the results to be generalized to the total population of buyers of software development services on freelance marketplaces and results in low external validity. The subjects were not selected to represent the entire population; rather any respondent that could be contacted and that successfully completed the questionnaire was retained.

8.4 Future Research

This thesis is amongst the first academic research on the topic of software development projects on freelance marketplaces. There exist many opportunities to conduct further research on these types of e-marketplaces.

There exist multiple possibilities for academic research on freelance marketplaces. A similar study could be executed, but from the providers point of view. The questionnaire in this thesis asked the buyers of services what they considered important for success, but similar questions could be asked to the providers of services regarding what they consider important to achieve successful projects.

Success factors of different types of projects on freelance marketplaces could be examined. This study focused on software development project, however there are many prominent activity sectors present on freelance marketplaces: design, writing, and virtual assistances to name a few. The process and success factors of design work for example are likely very different, as the evaluation of the quality of the work is very subjective, and the success of projects is harder to assess.

Research on success factors of freelance marketplaces could be examined from a qualitative point of view. In depth interviews with buyers having a track record of consistently achieving success projects could add greatly to the body of knowledge. This may yield techniques and best practices for the management of projects completed by a remotely-located service provider.

There are many unanswered questions from the buyer point of view regarding software development projects on freelance marketplaces: how to find and assess qualified talent, communicate effectively the project requirements, and ensure the project is on track during development.

There are many unanswered questions from the freelance marketplace point of view regarding software development projects on freelance marketplaces: how to retain buyers, weed out under qualified providers, and ensure the buyers have the know-how to succeed. Specifically, they should educate buyers on topics such as to how to increase their odds of success, assess success, follow up frequently with the provider, write clear requirements while understanding the technical aspects, communicate effectively, and assess the skills of the provider. Since their success depends on helping projects complete successfully to ensure buyers of services continue using the marketplace to source software development projects, they should share the best practices and processes to enable the buyers to achieve successful projects more frequently, and thus increasing their level of satisfaction towards freelance marketplaces.

Hopefully, this study will be a stepping stone to additional research on freelance marketplaces.

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Annex

Annex 1 - Blog and Article Sources

Sources URLs
• http://blog.assembla.com/assemblablog/tabid/12618/bid/33608/Working-with-Talent-markets-oDesk-Elance-Freelancer-Guru-vWorker.aspx • http://earn-money-using-freelance.blogspot.com/2009/10/rentacoder-elance-getafreelancer-odesk.html • http://www.fruitsack.com/2010/01/elance-vs-odesk-vs-guru-the-best-freelance-site-to-start-making-money-online/ • http://www.timedoctor.com/blog/2011/02/22/the-top-6-outsourcing-sites-and-how-to-use-them • http://whichlance.com/reviews • http://secretmarketingsuccess.com/blog/geo-arbitrage/vworker-or-odesk-which-freelance-marketplace-should-you-use/ • http://www.justoutsourcing.com/wp/2010/11/rentacoder-vworker-vs-odesk/ • http://phildhingra.com/2010/03/elance-vs-odesk-vs-gurucom.html • http://thethriftygeek.com/2008/11/14/comparing-the-online-consulting-sites/ • http://www.entrepreneur.com/startingabusiness/businessideas/article79500.html • http://www.themanager.org/Resources/Freelancer.htm • http://efreelance2u2.blogspot.com/2010/10/freelancing-on-internet-industry-review.html • http://www.freelancingguide.net/html/fg_Criteria_for_Choosing_Online_Freelancing_Marketplace_Sites.htm • http://www.thewebcitizen.com/2011/04/04/10-freelance-marketplaces-to-outsource-your-projects/ • http://www.how2freelance.com/freelancing/freelance-sites/top-6-freelance-marketspaces-reviewed/ • http://www.starreviews.com/freelance-website-reviews.aspx • http://joshkotsay.com/outsourcing/odesk-review • http://www.associatedcontent.com/article/484499/elance_vs_guru_which_online_auction.html?cat=3 • http://blog.auinteractive.com/adventures-in-outsourcing-rent-a-coder-vs-odesk • http://ezinearticles.com/?Elance-Vs-ODesk-Review---A-Freelancers-Perspective&id=4813158 • http://factoidz.com/why-i-like-odesk-better-than-elance-simpler-work-tracking-and-payment-management/ • http://allfreelancewriting.com/2010/04/09/freelancing/business-career/another-freelance-marketplace-bites-the-dust-elance-work-view/ • http://www.squidoo.com/odeskandelancereview • http://www.zubrag.com/articles/freelance-sites-list.php • http://www.notscam.com/work-online/vworker-scam-or-legit/

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Annex 2 - Definitions

External quality: the fitness of the software to its requirements as used by the end user (also known as indirect quality and functional quality).

Freelance marketplace: web-based e-marketplaces that support the entire process of contracting out a software development project to a single independent remotely-located programmer for a fixed price or hourly rate, while offering related information, tools, and services.

Information Technology (IT): "the study, design, development, application, implementation, support or management of computer-based information systems" (Proctor, 2011)

Internal quality: the quality of the software's source code (also known as direct quality and structural quality)

Project management success: the achievement of an efficient process, as measured by the meeting the time, cost and quality criteria.

Project success: the achievement of project management success and programming success

Product success: the achievement of an effective project output, by meeting the project's objectives. Measured by the attainment of a satisfactorily level of internal quality, external quality, and quality in use of the project's output.

Software: "instructions (computer programs) that when executed provide desired function and performance, data structures that enable the programs to adequately manipulate information, and documents that describe the operation and use of the programs." (Pressman, 2005)

Software development project: a web or software development project where one of the project's tasks consists of planning, creating, modifying, or reviewing code.

Software development services buyers: small business owners, entrepreneurs, employees, and individuals that have used freelance marketplaces to hire out software development projects.

Annex 3 - Research Questionnaire

Freelance marketplace success factors survey

This surveys aims to better understand success factors of software development projects completed on freelance marketplaces. Freelance marketplaces are web-based e-marketplaces that support the entire process of contracting out a software development project to a single independent remotely-located programmer for a fixed price or hourly rate, while offering related information, tools, and services. Freelancer.com, oDesk, vWorker (RentACoder), and Guru are examples of freelance marketplaces.

If you have purchased programming services on a freelance marketplace, we invite you to participate in the survey which consists of questions on your experience with freelance marketplaces. Programming services includes web and PC software development, design, maintenance, and customization.

All data is confidential, and will not be disclosed outside the research team or used for any other purposes than for this research. Neither you nor your organization will be identifiable, only aggregated data will be presented. There are no risks associated with participation.

This study is part of my master's thesis in eBusiness Technologies under the supervision of Dr. Dominique Ferrand at the University of Ottawa, Canada.

You may withdraw from the survey at any time, and you can ask of the results of the research after it is completed. Questions can be directed to Alex Walter at a******@uottawa.ca or at +1 (613) XXX-XXXX.

The survey should take approximately 10 minutes.

Which of the following freelance marketplaces have you used for software development projects? (e.g. web or desktop programming)

- ❑ Elance
- ❑ oDesk
- ❑ freelancer.com
- ❑ vWorker (RentACoder)
- ❑ Guru
- ❑ Scriptlance
- ❑ Peopleperhour
- ❑ Ifreelance
- ❑ Getacoder
- ❑ None
- ❑ Other(s)

If answer “Other(s)” is selected, this question is shown:

What other freelance marketplace(s) have you used?

In the last 5 years, how often have you used freelance marketplaces to complete software development projects?

- ❍ Never
- ❍ Less than Once a Year
- ❍ Once a Year
- ❍ 2-3 Times a Year
- ❍ Once a Month
- ❍ 2-3 Times a Months
- ❍ Weekly

What is your total lifetime spending on freelance marketplaces?

- ❍ under $300
- ❍ $300 to $1,000
- ❍ $1,000 to $2,000
- ❍ $2,000 to $4,000
- ❍ $4,000 to $10,000
- ❍ over $10,000

Project Success Factors

Based on your experience, what are the most important elements that influence the success of software development projects on freelance marketplaces?

a) **Factors** that influence the success of software development projects on freelance marketplaces

The buyer is technically proficient	❍	❍	❍	❍	❍
Communication with the provider is adequate	❍	❍	❍	❍	❍
The provider is paid hourly	❍	❍	❍	❍	❍
The provider is paid a flat rate	❍	❍	❍	❍	❍
The provider is technically proficient	❍	❍	❍	❍	❍
The buyer has previously hired the same provider for another project	❍	❍	❍	❍	❍
The scope of the project is limited	❍	❍	❍	❍	❍
The project is completed in a short amount	❍	❍	❍	❍	❍

of time The buyer is the end user of the finished product	❍	❍	❍	❍	❍
The project's requirements are clear	❍	❍	❍	❍	❍

b) **Freelance marketplace characteristics** that influence the success of software development projects on freelance marketplaces

Arbitration mechanism	❍	❍	❍	❍	❍
Rules	❍	❍	❍	❍	❍
Features	❍	❍	❍	❍	❍
Pre-qualification mechanisms	❍	❍	❍	❍	❍
Aesthetics and usability	❍	❍	❍	❍	❍
Fees	❍	❍	❍	❍	❍

Project Success Metrics

Based on your experience, how do you measure project success? Arrange these criteria from most critical to least critical. *(Note: in the web version of the questionnaire, the respondent can drag the items to change the order)*

_____ Quality in use: The end product works well in use. Criteria include effectiveness, efficiency, satisfaction, freedom from risk, and context coverage.
_____ Budget: The budget was respected.
_____ Time: The project is on time.
_____ External quality: The end product's functional suitability and usability is satisfactory.
_____ Scope: The scope is met.
_____ Internal quality: The source code is of quality. Criteria include performance efficiency, compatibility, reliability, security, maintainability, and portability.

In the case of your most successful project, what elements were the most important for success? What went right?

_____

_____

What prevented your least successful projects from succeeding? What went wrong?

_____

_____

Overall, how satisfied are you with freelance marketplaces?

- ❍ Very Dissatisfied
- ❍ Dissatisfied
- ❍ Somewhat Dissatisfied
- ❍ Neutral
- ❍ Somewhat Satisfied
- ❍ Satisfied
- ❍ Very Satisfied

How old are you?

- ❍ Under 18
- ❍ 18-25
- ❍ 26-34
- ❍ 35-54
- ❍ 55-64
- ❍ 65 or over

What is the highest level of education you have completed?

- ❍ Less than High School
- ❍ High School / GED
- ❍ Some College
- ❍ 2-year College Degree
- ❍ 4-year College Degree
- ❍ Masters Degree
- ❍ Doctoral Degree
- ❍ Professional Degree (JD, MD)

How many years of experience do you have with IT projects?

- ❍ less than 2
- ❍ 2 to 5
- ❍ 6 to 10
- ❍ 11 to 20
- ❍ more than 20

How many employees in your company?

- ❍ Self-employed/sole proprietor
- ❍ 2 to 5
- ❍ 6 to 10
- ❍ 11 to 20
- ❍ more than 20

What is your sex?

- ❍ Male
- ❍ Female

What is your sector of activity or industry?

_____

Thank you for your time! If you would like to receive the survey results, please send an email to a********@uottawa.ca

If you have any other comments about freelance marketplaces or the survey, please enter them below.

Definitions *(Note: on the web version, the definition appears when the respondent clicks the*  *icon next to the term in the questionnaire. They are listed below for the paper version.)*

Freelance marketplace: web-based e-marketplaces that support the entire process of contracting out a software development project to a single independent remotely-located programmer for a fixed price or hourly rate, while offering related information, tools, and services.

Features: includes elements such as search options, tools, IP protection mechanisms, communication tools, features, bidding tools, feedback system, work tracking system.

Fees: the freelance marketplace's remuneration, such as commission fees and subscriptions.

Rules: includes elements such as terms of use, bidding limits and restrictions.

Pre-qualification mechanisms: tests or processes to assess the buyer's or the provider's credibility, seriousness, and aptitudes.

Aesthetics and usability: the visual attractiveness and the ease of use of the website.

Arbitration mechanism: the dispute resolution process administered by the freelance marketplace in case of disagreement between the buyer and the provider.

The web version of the survey can be accessed at http://tinyurl.com/aoeznbv

Annex 4 - Correlation Matrix of Success Factors

	The buyer is technically proficient	Communication with the provider is adequate	The provider is paid hourly	The provider is paid a flat rate	The provider is technically proficient	The buyer has previously hired the same provider for another project	The scope of the project is limited	The project is completed in a short amount of time	The buyer is the end user of the finished product	The project's requirements are clear
The buyer is technically proficient	1.000									
Communication with the provider is adequate	.049	1.000								
The provider is paid hourly	-.210	.110	1.000							
The provider is paid a flat rate	.021	-.030	.399	1.000						
The provider is technically proficient	-.281	-.016	.141	.113	1.000					
The buyer has previously hired the same provider for another project	.267	.282	-.129	.014	-.182	1.000				
The scope of the project is limited	.120	.167	.062	-.128	-.166	.338	1.000			
The project is completed in a short amount of time	-.078	.202	.258	.355	.383	-.249	-.039	1.000		
The buyer is the end user of the finished product	.299	-.109	-.106	.006	.137	.019	.074	.206	1.000	
The project's requirements are clear	.048	.103	.067	.163	-.151	-.112	-.166	.026	-.096	1.000

Annex 5 - Correlation Matrix of Success Metrics

	Quality in use	Budget	Time	External quality	Scope	Internal quality
Quality in use	1.000					
Budget	-.401	1.000				
Time	-.416	.269	1.000			
External quality	-.063	-.293	-.169	1.000		
Scope	.104	-.349	-.128	-.251	1.000	
Internal quality	-.103	-.281	-.496	-.087	-.289	1.000

Annex 6 - Elements That Led to Success or Prevented Success

Element	Led to success	Prevented success	Total
skills of the provider	19	12	31
communication	10	14	24
clear requirements	8	11	19
price	4	6	10
quality	1	3	4
time	2	2	4
hiring multiple providers on a trial basis	0	2	2
lack of provider engagement in work	1	1	2
misevaluating the provider	1	1	2
providers abandon the project	2	0	2
providers acting as a middle man between the buyer and another provider	2	0	2
small projects	0	2	2
adjustment to scope creep	0	1	1
cheating on performance tests	1	0	1
copyright infringement by the provider	1	0	1
cultural barriers	1	0	1
inability to adapt to changes in requirements	1	0	1
knowledge of the provider	0	1	1
low number of qualified bidders	1	0	1
provider creates mockups at the start of the project	0	1	1
repeat work with same providers	0	1	1
satisfaction of the buyer	0	1	1
the provider was working on a subpart of a large project without knowledge of the root project	1	0	1
throughout verification of final product	0	1	1
use of proprietary technologies	1	0	1

Annex 7 - Children Nodes of Top 3 Elements That Led to Success or Prevented Success

Name	References
skills of the provider	31
• lack of skills of the provider	5
• misrepresentation of provider skills	5
• lack of experience by the provider	4
• false representation of abilities	3
• experience of the provider	3
• technical proficiency of the buyer	2
• lack of knowledge from provider	1
• difficulty in finding top talent	1
• provider provides solutions based on their experience	1
communication	25
• communication and understanding	3
• good communication	3
• failure in communication	3
• fluent communication	2
• communications around changes	2
• language barrier	1
• poor communication	1
• language skills	1
• fast and frequent interaction	1
• mismanaged communication	1
• great communication	1
• constant feedback	1
• communication problems	1
• bad communication	1
• clear communication	1
• lack of communication	1
clear requirements	20
• lack of understanding of the requirements	6
• understanding of the requirements by the provider	3
• lack of clear requirements	2
• detailed project requirements	2
• lack of clear direction	1
• understanding of requirements	1

Annex 8 - Ethics Approval

File Number: 01-13-05 **Date (mm/dd/yyyy):** 02/01/2013

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Ethics Approval Notice

Social Science and Humanities REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Dominique	Ferrand	School of Management	Supervisor
Alexandre	Walter	School of Management	Student Researcher

File Number: 01-13-05

Type of Project: Master's Thesis

Title: Success Factors in Leveraging Freelance Marketplace in Software Development Projects

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
02/01/2013	01/31/2014	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:
N/A

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http://www.recherche.uottawa.ca/deontologie/index.html

File Number: 01-13-05 **Date (mm/dd/yyyy):** 02/01/2013

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Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement and other applicable laws and regulations in Ontario, has examined and approved the application for ethical approval for the above named research project as of the Ethics Approval Date indicated for the period above and subject to the conditions listed the section above entitled "Special Conditions / Comments".

During the course of the study the protocol may not be modified without prior written approval from the REB except when necessary to remove subjects from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the study (e.g. change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, information/consent documentation, and/or recruitment documentation, should be submitted to this office for approval using the "Modification to research project" form available at: http://www.research.uottawa.ca/ethics/consent.html.

Please submit an annual status report to the Protocol Officer four weeks before the above-referenced expiry date to either close the file or request a renewal of ethics approval. This document can be found at: http://www.research.uottawa.ca/ethics/consent.html.

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5387 or by e-mail at: ethics@uOttawa.ca.

Kim Thompson

Protocol Officer for Ethics in Research
For Barbara Graves, Chair of the Social Sciences and Humanities REB

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