Individual Portfolio

An Analysis of the Feasibility and Design of an

Online Freelancing Website

Jeremy Holt
u5009699

Systems Engineering Analysis

Lecturer: Chris Browne
Tutor: Rachel Hogan

25 October 2013

The Australian National University

Executive Summary

This report provides an analysis of the design and feasibility of an online freelancing website. To help define the nature and scope of our analysis, the website is first considered through a System Lens. A Multi-Factorial Design perspective is applied, in which we use the Pareto Principle to determine which modes of failure are most important to address. We next consider the system as a series of queues and apply Queue Theory Analysis to best optimise the website. While considering Human Factors, we examine the effect population dispersion has on our system. Finally the feasibility of a small business hiring from a freelancing website compared to traditional employment is explored using an Economic Analysis.

Key Findings:

- Queue times and the dispute resolution process are the most important issues to ensure customer satisfaction
- Nine query handlers are required to resolve disputes for a user base the size of Elance.com
- Population dispersion is a beneficial trait in the system
- The system has the feasibility to provide a competitive edge for small business employers

Recommendations:

- Ensure there is a strong review system and encourage clients to take on new freelancers
- Give searching precedence for jobs which have been posted for a long time
- Set a deadline for the bidding process
- Require the freelancer to provide ongoing progress reports during their work
- A streamlined paying system is required
- Have clear rules, agreements and mechanisms to ensure work is done well
- Have a well structured dispute resolution protocol
- Give freelancers a rating on different qualities, rather than just an overall rating
- Market online freelancing at an older, more experienced generation of workers
- Encourage long-term working relationships between freelancers and clients

Table of Contents

1. Introduction: Online Freelancing through a System Lens

Online freelancing steps away from the traditional, 9-5 employment paradigm and allows employers to post one time jobs online for workers to complete. The logistics work similarly to a government tender: the employer places a job description online on which freelancers can place bids, indicating the required hourly rate for them to complete the task. The employer then chooses one of the bidders, who completes the task and receives their payment. The idea is that, with a large enough base of employers and workers, everyone will benefit from flexible work schedules, specialised workers and cheaper work. In this report, we shall consider the important design considerations when developing an online freelancing website and analyse the long term feasibility of the large scale growth of such a system.

1.1 Putting Online Freelancing in Context

The first online freelancing website, Elance.com, was founded in 1999 and currently has 2.8 million users[1], behind oDesk.com with 3.1 million[2] and Australian founded Freelancer.com with 9 million[3] registered users. These are the three largest websites of this nature, each with a global internet traffic rank of about 400[4]. The fourth largest site, Guru.com has 1 million users[5] and is ranked 3200[4]. Using this data, we could estimate that there are less than 20 million registered online freelances globally, many of which are presumably not active.

1.2 Looking through a System Lens

To help define the scope and nature of our system, we shall look at it through a system lens and consider the elements, interconnections and functions of an online freelancing website.

1.2.1 Elements

- Clients – *Employers who post work to be completed*
- Freelancers – *Employees who bid on jobs then complete them*
- Mediators – *Middle man between clients and freelancers to ensure smooth transactions*
- Web administrators – *People in charge of the logistics and running of the website*
- CEO – *Person in charge of the overall direction of the site*
- Shareholders – *Investors in the website*
- Jobs – *The tasks which are posted and completed*
- Reviews – *The feedback on the tasks, clients and freelancers*
- Profiles of workers and clients – *Pages listing skills, past work, reviews etc*

1.2.2 Interconnections

- Reputation – *Long term collection of praise and criticism for clients, workers and the site*
- Expectation of clients – *The expected quality of work by the employers*
- Money flows – *Payments between clients and freelancers and cuts taken by website*
- Mandate of website – *The publicly available description of the goals of the website*
- Rules of website – *The operating procedures*
    - Terms and conditions – *The conditions users of the website agree to*
    - Dispute resolution protocol – *Policy for when a transaction does not go smoothly*
    - Anti-discrimination rules – *Policy to prevent discrimination on race, gender etc*
    - Bidding system – *The way in which workers can bid on potential jobs*

1.2.3 Functions

- To make money
- To grow as a company
- To provide world-wide equality and access to employment
- To connect potential workers to potential employers
- To allow workers to work from home

1.2.4 Discussion

We can analyse the importance of each of the listed points by considering what overall effect an alteration would have on the system. For example, almost all of the elements listed in 1.2.1 are constantly changing and the system is not affected. Clients move in and out of the system, posting new jobs every day for new freelancers to complete, but this does not impact how the website itself behaves. Change one of the interactions though, such as how and when money is transferred or how disputes are resolved and you have an entirely new system. What's more, if the purpose of the website is changed, the system is even more different. If the function of the website is exclusively to grow and make money, the website will look and operate very differently to if it was trying to provide access to employment in disadvantaged countries.

Of course, there are some exceptions to the cases of elements not changing the system and interconnections always doing so. For example, if the CEO of the website changed, there could be major repercussions in all aspects of the system. While if the reputation or expectation of a client changed, although this would have a major impact on the individual client or the single client-freelancer transaction, it may not impact the whole system. In this report we shall mainly focus on how the interconnections can be optimised to best serve the purpose, which we will as:

To be profitable and grow as a company

1.3 Outline of the Report

To analyse how the design of an online freelancing system might be optimised we will first consider the most likely causes of failure using a Pareto Analysis. The system is then considered as a set of interacting queues, and Queue Theory is applied to determine how wait times for customers can be minimised. We consider why Population Dispersion is a beneficial trait for our system, and discuss methods which can be used to encompass as much diversity in our customer base as possible. Lastly, the feasibility of of an online freelancing website as an alternative to traditional employment is considered from an Economic Analysis perspective. A summary of key findings can be found in the Executive Summary at the beginning of this report.

2. Multi-Factorial Design

To improve a design, we must first identify the problems which are currently experienced. In this section we will carry out a Pareto Analysis on existing online freelancing websites to determine which factors are the most important to optimise.

2.1 Pareto Analysis

Pareto Analysis focuses on the non-linear behaviour of a system, and in our case, the causes of failure in a system. We expect the failures of the system to approximately follow a Pareto distribution, i.e. that a small percentage of root causes will generate most of the failures[6]. Before we can consider what the causes of failure on our website would be, we have to formulate an idea of what exactly encompasses a 'failure'. The first option would be to look at a literal failure of the website, where it is not accessible by the customers when they want to use it. This could be caused from a variety of sources, such as a memory leak, coding error or server failure. However, in this case we are assuming a specific failure ('can't access site') then looking at the causes of it, when in reality it may happen very infrequently. An alternative is to consider a failure to be when we don't achieve the purpose of the website, i.e. it does not grow or is not profitable enough. The problem with this approach is that failure is very subjective and it would be difficult to find useful data. The approach I used instead was to consider failure to be a complaint by a customer. The goal therefore is to maximise customer satisfaction, measured by a minimum number of complaints.

To collect data on the frequency of complaints I looked at various complaint sites such as sitejabber.com[7] and complaintsboard.com[8], then assumed a frequency percentage based on how often I saw the complaint. A root cause was determined for each complaint, seen in Table 1, and the data was presented in a Pareto Chart in Figure 1.

Table 1: Frequency and Root Cause of Common Complaints

Complaint	Root Cause	Frequency of Complaint (%)
Wait for job is too long	Queue Times	20
Wait for freelancer is too long	Queue Times	5
Didn't get paid	Dispute Resolution	20
Had to pay for poor quality work	Dispute Resolution	1
Got paid late	Queue Times	5
Didn't get paid enough	Hourly Rates	5
Have to pay too much	Hourly Rates	1
Fees are too high	Business Model	3
Customer service was slow	Queue Times	8
Can't access site	Technical Issues	2
404 File not found	Technical Issues	5
My profile was lost	Technical Issues	1
Website is a scam	Dispute Resolution	10
Fake bids	Queue Times	2
Site is slow	Queue Times	2
Site is poorly designed	Web Page Design	3
My details were stolen	Security Violation	1
Site is unfair	Business Model	3
My details were input wrongly	Human Error	3

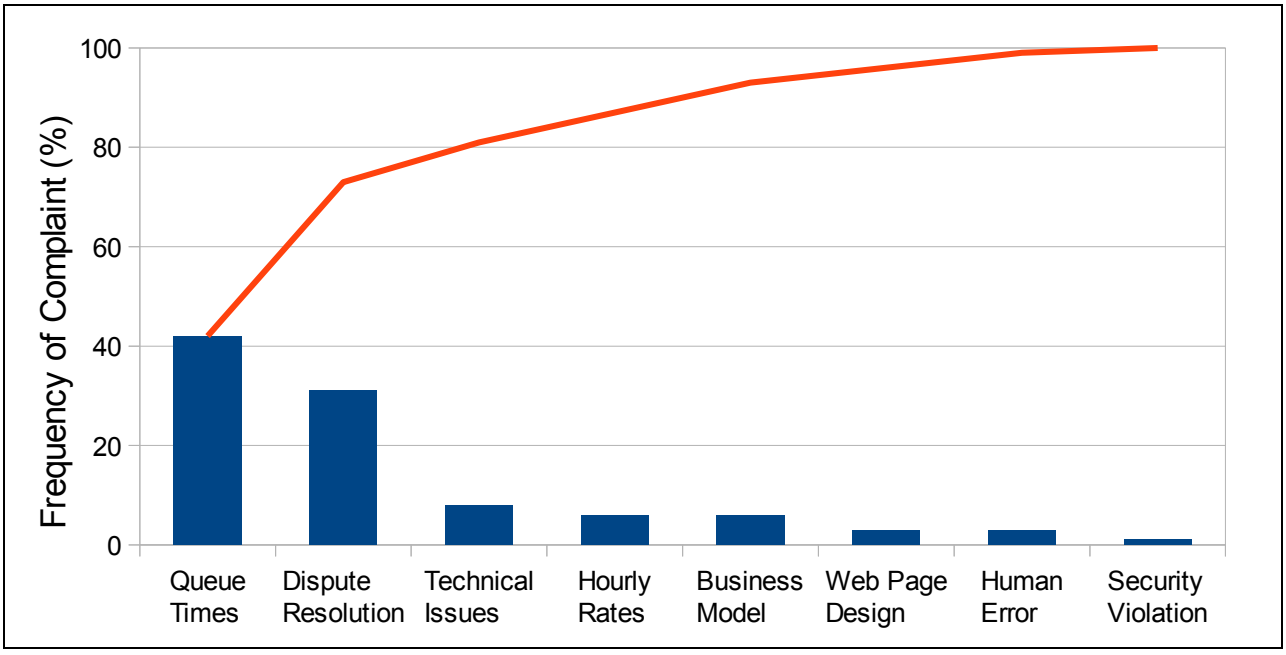

Figure 1: Pareto Chart of Complaints Received by Online Freelancing Sites

2.2 Discussion of Analysis

From the Pareto chart, we can clearly see that the first two issues, the Queue Times and Dispute Resolution Process, which make up 25% of the problems, account for nearly 75% of the complaints. This fits in with the often quoted 80-20 rule, which states that 20% of root causes account for 80% of failures. In our system then, our design can be best optimised by considering how queue times can be reduced and the dispute resolution process can be optimised.

2.3 Other Considerations and Limitations of the Model

We have assumed in our model that a single complaint equals a proportional failure of the system. This may not necessarily be correct, for example a customer may complain about a long queue time when in reality they are just a very impatient person and the queue time is within reasonable limits. Some categories might also be over represented because of the likelihood of complaint, for example almost everyone who has their credit card details stolen from a security breach would be likely to complain because it is a very severe issue. As such, the already small proportion of security violations in the Pareto chart probably needs to be even smaller to accurately reflect the real frequency of such an event. Some categories might also be under-represented, for example the website might experience a failure by losing a potential customer due to a poorly designed front page, however this customer is unlikely to actually lodge a complaint since they have no investment in the site yet. I have also allocated each complaint to only one root cause, which is inaccurate in cases where there are multiple causes. For example, a complaint about not getting paid could be due to either technical difficulties, a failure in the dispute resolution process or a combination of both. Another interesting point to note is that, according to the Pareto principle, 80% of complaints will come from 20% of users [9], so our data will not necessarily be representative of the population.

2.4 Summary of Multi-factorial Design

We have seen that the queue times and dispute resolution protocol are the most important factors to consider when designing our system to ensure maximum customer satisfaction.

3. Queue Theory

In section 2, the queue times came out as the biggest cause of failure in an online freelancing website. In this section, we will view our system as a queue and apply Queue Theory to consider how we might optimise the design of the website to fulfill its purpose. Queue Theory is a mathematical analysis tool which uses assumptions of queue behaviour and probability distributions to give appropriate estimations of various key characteristics of a queue, such as the average wait time or average length of the queue.

3.1 Online Freelancing Website as a Queuing Process

Figure 1 below schematically describes the various processes and queues related to a client and freelancer using our website.

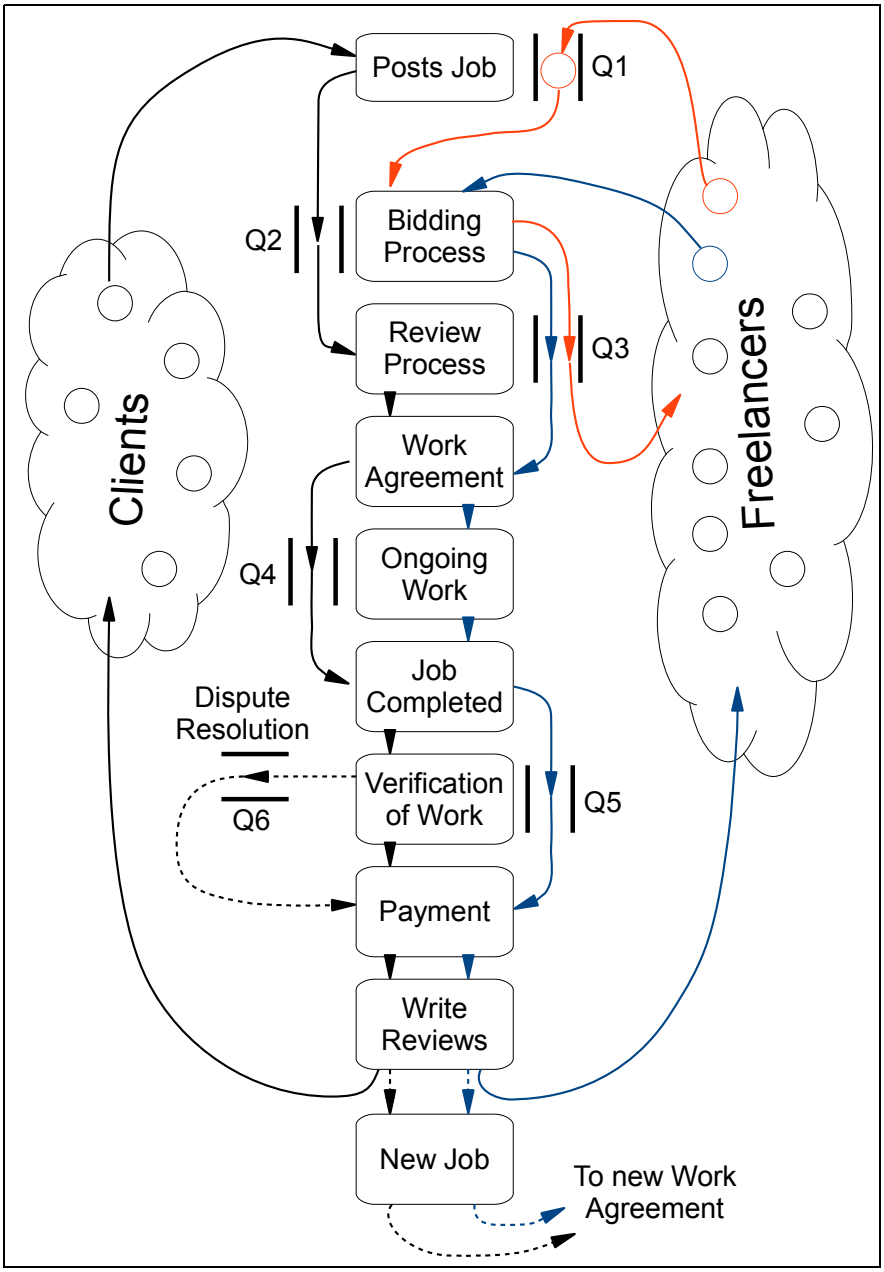

Figure 2: Schematic Representation of Online Freelancing Website. *Queues are signified by two parallel black lines. The arrowed lines show the progression of individuals through the system*

3.1.1 The Queue as a Client

From a client's point of view, they decide that they need some work completed and so post a job online with a description of the required task. They then wait in Q2 for freelancers to bid on their project. After some period of time in this queue, they review the bids, choose a freelancer to work with and sign a work agreement with them. The client waits in Q4 for the job to be completed, and once its is they must verify that the work is of a satisfactory standard. If the work does not meet the agreed upon level of quality, the client must wait in a dispute resolution queue, Q6, for a mediator to consider the case and decide whether the client is required to pay. The client then pays the worker, writes them a review and rejoins the population of idle clients. Alternatively, if they were very happy with the freelancer's performance, they might immediately offer another job to them.

3.1.2 The Queue as a Freelancer

We can also consider the process from the freelancer's perspective, which is linked very closely to the client's process. The orange freelancer decides he wants to do some work, and so looks online for available jobs. There are none which he can do, so he must wait in Q1 for an appropriate job to become available, and he bids on it when it does. The blue freelancer also decides to do some work and she immediately finds and bids on an appropriate job, thus bypassing Q1. The two freelancers must then wait in Q3 for the client to review their bids. The client chooses the blue freelancer for the work, meaning the orange freelancer must rejoin the population and either re-enter Q1 or immediately bid on another job. After signing a work agreement, the blue freelancer completes and submits the job. She then has to wait in Q5 for her work to be verified before she is paid. She receives her payment, writes a review of the client and rejoins the workforce, or immediately gets offered another job, bypassing Q1 and Q3.

3.1.3 Defining the Type of Queues

Of course, this process is happening simultaneously for many users at a time. In the frame of reference of a client, the clients are the queuers and the freelancers are the service providers, and vice-versa in the freelancer's point of view. Since there are many service providers bidding while the client is in Q2, i.e. the client has the option to go to many different service providers, we call this type of queue a multi-channel queue. Similarly Q1 is a multi-channel queue for the freelancers, since there are many service providers (clients) which could open up a job for them. Q3, Q4 and Q5 are single-channel queues, and the queuers must wait for a specific service provider to complete a task before the process can move forward. Q6 could be either multi-channel or single-channel, and will be discussed further in section 3.3.

3.2 Conceptual Optimising of the Process

Ideally the amount of time spent in all the queues would be minimal, however our schematic and our definition of the queues allows us to conceptually decide where it is most important to ensure short queue times. We want to optimise the queues to ensure profit and growth, so the key here is to ensure minimal wasted time and more importantly, that no clients or freelancers leave due to anger over long queue times. We shall assign queues priorities which indicate their importance in achieving this aim. Q1 is a necessary queue, which will automatically get reduced as clients posts more jobs. It is medium priority, but is only an issue if a freelancer must go through Q1 many times before they actually get a job, meaning they might give up and leave out of frustration. To reduce the likelihood of this the website could **ensure there is a strong review system and encourage clients to take on new freelancers** so that the only people waiting in Q1 are the bad workers which are inevitable on the site. Q2 is a low priority queue since the client has not yet invested much into the project, unless a client's project never gets bid on, in which case they might be likely to leave

out of frustration. To reduce the occurrence of this, the website could **give searching precedence for jobs which have been posted for a long time.** Once a freelancer has bid in Q3, they have nothing invested in the project, can bid on other projects and continue with other work, so this queue is not a high priority. Perhaps one way to reduce frustration would be to **set a deadline for the bidding**, so the process does not go on indefinitely and the freelancers know when they'll find out if a bid is successful. Q4 will usually be the longest queue time, however the client can easily understand why they are waiting, because the work takes time to complete, and so it is another low priority queue. To reduce frustration and the likelihood of the client leaving, it is important to have ensure **the freelancer provides ongoing progress reports during the work.** Q5 and Q6 are closely linked, in that those waiting in Q5 also have to wait until people have passed through Q6. Q5 relates to the freelancer receiving money for work they've already completed. A lot has been invested and there is money on the line, meaning a long queue time could quickly cause frustration and anger. Usually Q5 would not be long unless the client passes through Q6, which relates to clients having to pay for work they are not happy with, so again money is on the line and frustration is likely if wait times are long. As such Q5 and Q6 are high priority queues. To reduce waiting time in Q5, **a streamlined paying system is required and Q6 must be short.**

3.3 Optimising the Dispute Resolution Queue

Q6, or the dispute resolution queue, is the highest priority queue to ensure a minimal wait time, as discussed in section 3.2. We shall do an analysis here to determine whether a single-channel or multi-channel queue is more beneficial to the website's goal. To start, we shall collect some data and make some estimations to inform our analysis.

Looking at Elance.com as a basis[1], clients post 80 000 jobs/month, and if we assume 80% of these jobs are completed by freelancers we have 64 000 jobs/month or 2000 jobs/day. If 5% of these jobs need to go through the dispute resolution queue, we have 100 queries/day. If the query handlers work 9-5 with a 1 hour lunch break, that's 7 hours a day, so in total they'd receive 15 queries/hour. If it takes 20 minutes to resolve a dispute, a single query handler can service 3 queries/hour. So $\lambda = 15/hour$ and $\mu = 3/hour$. We can see immediately that $\lambda > \mu$, and therefore a single-channel system will not suffice with these numbers. We could attempt to reduce the number of queries by having **clear rules, agreements and mechanisms to ensure work is done well.** Alternatively, we could serve more customers by spending less time on each one, which could be achieved by having a **well structured dispute resolution protocol**. Even with both of these in play we are unlikely to make $\lambda < \mu$, and so we conclude that Q6 must be a multi-channel queue.

If we apply queue theory with the original arrival and service rates, we create Table 2.

Table 2: Characteristic of Dispute Resolution Queue

Number of Channels	Mean waiting time (minutes)	Probability of any wait (%)	Total Cost for C_W = 10 C_S (% of 6 channel case)
15	0.00	0.02	42.41
14	0.00	0.07	39.59
13	0.01	0.21	36.79
12	0.02	0.59	34.04
11	0.05	1.51	31.45
10	0.14	3.61	29.29
9	0.40	8.05	28.29
8	1.12	16.73	30.50
7	3.24	32.41	42.70
6	11.75	58.75	100.00

Let us assume that due to losing frustrated customers, the cost of a customer waiting in a line for an hour (C_W) is 10 times more expensive than a query handler working for an hour (C_S). We can then generate the cost graph in Figure 3. The second line assumes that C_W is only 3 times C_S and despite the large difference between 3 and 10, the optimum number of query handlers only changes by 1, showing the sensitivity of our assumption is low and therefore we can be fairly confident of our results, which are that the optimum number of query handlers working at one time is 9, with a average wait time of 24 seconds and a probability of waiting of 8%.

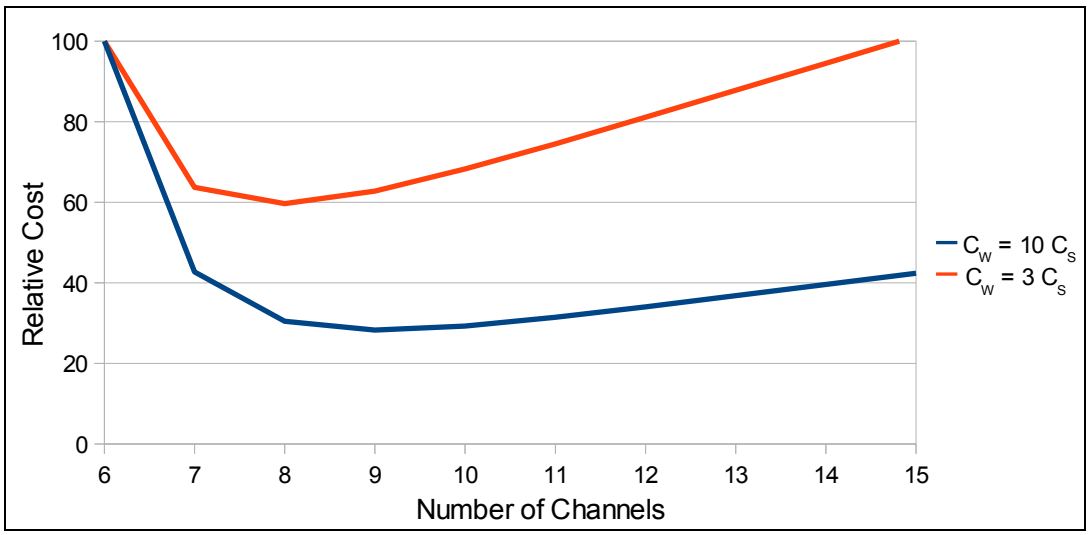

Figure 3: Cost of Multi-channel Queue

3.4 Other Considerations and Limitations of the Model

We have assumed in our model that the arrival rate follows the same Poisson distribution for every hour that the query handlers are working, but this is clearly not true. Firstly, arrivals could happen during the query handlers' lunch hour and, since this is a global business, overnight or on the weekend. If we kept the model of query handlers working 9-5 on weekdays then there would be a huge influx of queries in the first hour of the day and the hour after lunch, which is not included in our model. Secondly, the arrival rate will not have a constant mean value since the world wide

activity fluctuates during the day as big countries, such as the USA or India, do work during their peak times. As such, it would be necessary to track the amount of activity during the day and match the number of query handlers to this by having offices around the world in different time-zones.

3.5 Summary Queue Theory

We have characterised the online freelancing process as a series of queues, and suggested various methods to reduce queue times such as having a strong feedback system and giving precedence to queuers who have been waiting for the longest. We consider which queues were most important to optimise. The highest priority queue, the dispute resolution process, was considered in more detail and it was determined that the optimum number of query handlers working at one time would be 9.

4. Human Factors – Dispersion in Population Data

In Section 3, we considered clients and freelancers to be objects moving through a process. In reality these objects are people, and the way in which they interact with the system is a vital component of ensuring a well optimised design. In this section we will discuss the dispersion of the customer population and why it is beneficial to encourage increased dispersion.

4.1 Minimising Dispersion in Traditional Systems

Traditionally in many engineering systems, dispersion in the population of users is an undesirable trait which must be carefully managed to ensure a maximum number of users can interact with minimum cost. When designing a cheap chair, for example, it must be a certain height above the ground. The usual solution is to make the chair a median height above the ground so that it 'fits' as many people as possible, say 90% of the population; a one-size-fits-all approach where you design for the majority and ignore the minority. From the designer's point of view, this is a much more attractive option than designing an adjustable chair which is complicated, expensive and difficult to manufacture. So a smaller spread in the population is better, since a greater percentage of people are satisfied. Sometimes the dispersion is artificially narrowed by targeting the design at a specific market, such as building a chair for year 6 students. Such a chair might be likely to fit 99% of year 6 students since the spread is smaller.

4.2 Argument for Increasing Dispersion

In our online freelancing system however, I hypothesise that dispersion in user population is a beneficial trait. In Section 2 we discussed a Pareto distribution, which would state that 80% of profits would come from 20% of customers. If this were the case then we would tailor our website to the most valuable 20%, attract more similar individuals and discourage population dispersion.

This is the case with many traditional sales environments, for example a watch shop. 80% of the company's profits come from selling the most expensive watches to the top 20% of the customers. As such a company, e.g. Rolex, might be inclined to stop stocking cheap watches and focus all of their attention on marketing and producing for this top 20%, thus reducing their population dispersion. However the key is that our website does not follow the 80-20 rule, but rather a long-tail distribution. A long-tail distribution means that the 'tail' of the distribution, i.e. the 80% in the Pareto case, accounts for more than 50% of the overall profits[10]. oDesk showed that their profits followed this long tail behaviour[11]. This long tail behaviour is beneficial for an online freelancing website because it means clients can get access to exactly the skills they need, and freelancers can work on exactly what they're best at. The reason why our online freelancing site is able exhibit this long tail nature is because of the specificity allowed by search engines and a large user base looking for specific skills. To promote this we need a population base with a large variety of skills and therefore should encourage population dispersion.

4.3 Understanding the Relevant Dispersion

I have claimed that we want dispersion, so now we must consider where this dispersion should be. Ideally we want a user base with a large range of skills (what they can do) and proficiencies (how good they are at it). This variability which is directly desired we'll call primary dispersion; examples include creativity, initiative, work ethic, what hourly rate is satisfactory, willingness to work in a team, usual work hours etc. Remember that these are the qualities we want to vary, not for the users to have the 'best' quality. We want a user base with varying degrees of creativity, for example, because some clients would want their workers to approach a task creatively while others would not. We could encourage these primary dispersions directly, for example by **allowing clients to give freelancers a rating on various different qualities, rather than just an overall rating**.

Alternatively the site could utilise the vast variability which already exists in humans such as gender, language or culture, which we'll term secondary dispersion. Our assumption here is that these secondary dispersions will result in primary dispersions. We want to have dispersion in work hours so that clients around the world have access to freelancers when they need them, so an obvious secondary dispersion to take advantage of is the location and time-zone of a freelancer. Other examples of secondary dispersion are age, full/part time and work experience.

The key is to ensure that the website promotes and caters for as wide a range of these secondary dispersion characteristics as possible. Methods for doing this might be to examine how a certain quality is currently dispersed and encourage more users of the minority class. For example, Figure 4 shows the dispersion in age for Elance.com. We can see that there are fewer older people

freelancing, who would add a very different skill set to the younger people, and so one strategy might be to **market online freelancing at an older, more experienced generation of workers.**

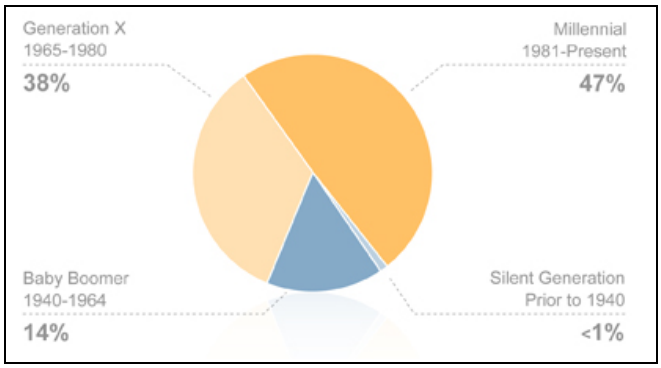

Figure 4: Birth Years Showing Age Dispersion[12]

4.4 Other Considerations and Limitations of the Model

The danger of having a very disperse user base is that it is very costly and complicated to cater to everyone. For example, although location and culture are both beneficial secondary dispersion characteristics, the accompanying characteristic is language which is very difficult to account for. As such it is important to draw a line to ensure resources are not extended too far, such as providing support for only a limited number of languages.

4.5 Summary of Human Factors

We have discussed the importance of promoting population dispersion in our customer base using methods such as characteristic specific ratings and marketing to the minority, while being careful not to extend resources too far to encompass too much.

5. Economic Analysis

In this section we will consider the economic feasibility of a online freelancing system compared to a traditional employment system.

5.1 Life-Cycle Costs

We shall consider a case study of a small business looking to hire a Web-Designer. There are a number of life-cycle costs which would need to be considered. Firstly there is the acquisition cost, i.e. finding and choosing an appropriate employee to hire. In a traditional system, the small business would be required to advertise the position in a newspaper, magazine, online or hire a company to find an appropriate worker. Running an ad to ensure enough coverage could cost $2000[13], while most online freelancing websites have no sign up fee and so it is free to post and advertise your job. After receiving application, a lot of time is required to sort through the resumes and choose which

applicants to follow up and interview. I have allowed 100 hours[13] for the whole reviewing and selecting process, which would often need to be done by someone high up in the small business, so I've valued their time at $80 an hour. Due to the streamlined nature of the online freelancing site, employers have easy access to well ordered information about applicants to their jobs, such as reviews, previous work completed and general profiles. What's more, I will assume that each freelancer will be hired for only 1 month, and therefore the selection process does not need to be as careful. As such I assume that the process will only take 10% of the time of traditional methods[14]. An average salary for a web-designer in Australia is $54000/yr[15], while on Elance.com, the average hourly rate for a web-designer is $22/hr[16]. However employees get benefits, such as superannuation and worker's compensation insurance, and time off. These come out as costing approximately 15% of the salary each[17]. Unlike a freelancing website, employees must be managed by human resources staff and given advice on career paths, performance appraisals and counselling. These soft-costs can end up costing up another 15% of the employees salary[18]. Freelancers also need to be managed, but they require much less management, which we'll quantify as 5% of total salary. Other costs include the extra building space a non-virtual employee requires, training costs and the cost of rehiring employees who leave. An average employee works with the same business for approximately 4 years[19]. The numbers discussed are summarised in Table 3 below.

Table 3: Life-Cycle Costing for Hiring an Online Freelancer vs a Traditional Employee

		Online Freelancer	**Traditional Employee**
Acquisition Cost	Advertising	$0	$2000
	Reviewing Applicants	6hrs @ $80/hr = $480	60hrs @ $80/hr = $4800
	Selecting Applicants	4hrs @ $80/hr = $320	40hrs @ $80/hr = $3200
Operations Cost	Salary	1800 hrs[20] @ $22/hr = $48600/yr	$54000/yr
	Benefits	$0	15% of Salary = $8100/yr
	Holidays/Sick leave	$0	15% of Salary = $8100/yr
	Day-to-Day management/HR	5% of Salary = $2400	15% of Salary = $8100/yr
	Website Cut	14% of Salary[21] = $6800/yr	$0
Maintenance Costs	Extra Building Space/ Facilities	$0	$600/$m^2$/yr[22]*19 m^2 /worker[23] = $11400
Training Costs	Training	$100/job * 12 jobs/yr = $1200/yr	$5000[24]/Employee
Disposal Costs	Rehiring	$900 / job * 12 jobs/yr = $10800/yr	$15000 / 4 yrs = $3750/yr

5.2 Discussion of Analysis

The capital cost for an online freelancer is $900 and $15000 for a traditional employee, including the acquisition and training costs. The yearly cost for a online freelancer is $68600 and $93450 for employees. We can immediately see that with a higher capital cost and higher yearly cost, traditional hiring for small businesses is not the economically preferred option. Looking at the table,

the highest cost for a freelancing website is the rehire cost. Therefore it would be economically beneficial for the freelancing website **to encourage long-term relationship between freelancers and clients to make their service more affordable**. In Figure 5, we can see the economic benefit represented graphically. The 'steps' seen in the blue line indicate the upfront costs of hiring a new employee when the old one leaves. These don't exist for online freelancing because the rehiring process happens after every job.

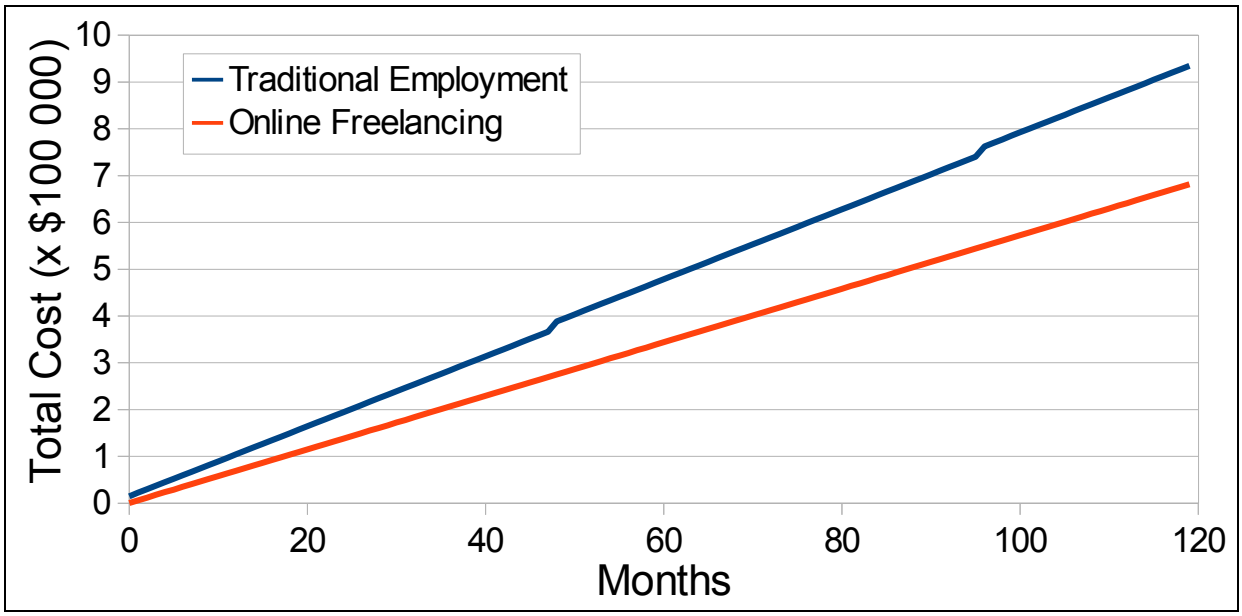

Figure 5: Life Cycle Cost Comparison

5.3 Other Considerations and Limitations of the Model

Various sources quote that for a traditional employee, total costs can be 'between 1.5x and 3x'[24], 1.4x[17] or 2x[18] salary. Our calculations showed costs at 1.7x the salary, which help verify our numbers. Elance.com states that there is a 53% cost saving by using an online freelancing service over traditional employment[25]. My calculations show about a 30% saving in yearly costs, which is not unreasonably different from the Elance.com statistics if we consider the bias and fact that the number quoted was estimated by their clients.

One aspect our analysis does not take into account is the inconvenience and difficulty in finding a new worker after every job. Although on average it might not take long to find a new worker, there would be occasions where a worker was needed but couldn't be found, resulting in lost money. We have also assumed that a freelancer only works for a company for a single month, when sometimes they may end up maintaining a working relationship and coming back for future job. This analysis also only considered a small business hiring a single worker for full time work. The analysis could work out differently if we considered a different business model, such as a large business hiring many workers which must work closely together. What's more, this is an economic analysis which didn't consider factors such as the convenience of having your employee on site to talk to.

We did not consider how the different productivity of the workers would affect the company. An established traditional employee would have a stronger connection with the boss and other workers and could arguably be more productive than a new freelancer. However, when a traditional employee first starts there is a period of time when they are settling in and are therefore less efficient, while freelancers are used to jumping into new environments so may be better at the start. What's more, freelancers only get paid for the work they do, so a 1800 hour year by a freelancer may be significantly more productive than the same number of hours worked by a traditional employee who works on Friday afternoons.

5.4 Summary of Economic Analysis

In this section we showed that it could be more economically feasible for a small business to hire an employee from an online freelancing website compared to a traditional employee. This implies that there is a large potential market for online freelancing websites to utilise.

6. Conclusion

In this paper we have suggested methods to improve the design of an online freelancing website by examining the system with various analysis techniques. We used a system lens to help define the scope of our system and decided that the goal of our system was to be profitable and grow. A Pareto Chart allowed us to draw attention to the two most import aspects of our system, the queue times and dispute resolution process, while an in depth application of queue theory resulted in numerous specific approaches to reduce average queue times. I hypothesised that it would be beneficial to our system to maximise population dispersion and suggested methods which could facilitate this. Finally, we looked at the feasibility of hiring from an online freelancing website for a small business from an economic perspective.

There are more analysis tools which we could apply to our system in future work, for example we could create an Energy Flow Diagram to further explore the feasibility of this system, this time from an environmental sustainability perspective. A diffusion of innovations approach might also be interesting, which would allow us to consider and maximise the adoption rate of our system. In this report we mainly focused on the bottom line, business perspective of an online freelancing website. However, I believe that the true power of the system is the humanitarian benefits of providing global employment opportunities, especially to countries undergoing political or social turmoil where work is difficult to find. In future work, it would be interesting to analyse the impact on things such as the global economy if such a system became commonplace.

1. 7. References

[1] Elance Inc. 2013, *Elance*, Mountain View, California, viewed 19 October 2013, <www.elance.com>

[2] oDesk Corporation 2013, *oDesk*, Redwood City, California, viewed 19 October 2013, <www.odesk.com>

[3] Freelancer Technology Pty Limited 2013, *Freelancer*, Pyrmont, New South Wales, viewed 19 October 2013, <www.freelancer.com>

[4] Alexa Internet, Inc. 2013, *Alexa Traffic Ranks*, San Francisco, California, viewed 19 October 2013, <www.alexa.com/siteinfo>

[5] Guru Inc 2013, *guru*, Pittsburgh, Pennsylvania, viewed 19 October 2013, <www.guru.com>

[6] Fenton, N & Ohlsson, N 2000, 'Quantitative analysis of faults and failures in a complex software system', *IEEE Transactions on Software Engineering,* vol. 26, no. 3, p 798

[7] LegitScript 2013, *Site JABBER*, San Francisco, California, viewed 20 October 2013, <www.sitejabber.com>

[8] ComplaintsBoard.com 2013, *Complaints Board*, viewed 20 Octorber 2013, <www.complaintsboard.com>

[9] Richard Koch 2004, 'Living Life the 80/20', Nicholas Brealey Publishing , viewed 20 October 2013, <http://books.google.com.au/books/about/Living_the_80_20_Way.html?id=TIjUdX-V1FMC&redir_esc=y>

[10] Brynjolfsson, E; Hu, Y & Simester, D 2006, 'Goodbye Pareto Principle, Hello Long Tail: The Effect of Search Costs on the Concentration of Product Sales', *Social Science Research Network,* viewed 20 October 2013, <www.ssrn.com/abstract=953587>

[11] Deutschkron, S 2013, 'The Rise of Specialists Online: Growing Opportunity for a Long Tail of Skills', *oDesk Blog*, viewed 20 October 2013, <www.odesk.com/blog/2013/08/1billion-odeskskillslongtail/>

[12] Elance Inc. 2012, 'The State of the Freelance Market - September 2012', *Elance*, viewed October 21 2013, <www.elance.com/q/freelance-talent-report-2012>

[13] Bliss, W 2013, 'Cost of Employee Turnover', *Small Business Advisor*, viewed 21 October 2013, <www.isquare.com/turnover.cfm>

[14] Bayt.com 2013, 'The Benefits of Online Recruitment', *Bayt International*, viewed 21 October 2013, <www.bayt.com/en/career-article-1121/>

[15] Open Universities Australia 2013, 'Career Advice: Web Designers', *OUA*, viewed 21 October 2013, <www.open.edu.au/careers/design-architecture/web-designers>

[16] Elance Inc. 2013, 'Elance Talent Around the Globe', *Elance*, viewed 21 October 2013, <www.elance.com/trends/talent-available>

[17] Books Onsite 2013, 'The Hidden Costs of Employment', *Books Onsite,* viewed 21 October 2013, <www.booksonsite.com.au/content_common/pg-thehiddencostsofemployment.seo>

[18] Sweeney, S 2009, 'How Much Does a Full-Time Employee Really Cost?', *3 Coast Resources,* viewed 21 October 2013, <www.3coastresources.com/how-much-does-a-full-time-employee-really-cost/>

[19] Kamenetz, A 2012 'The Four Year Career', *Fast Company* , viewed 21 October 2013, <www.fastcompany.com/1802731/four-year-career>

[20] Organisation for Economic Cooperation and Development 2012, 'Average annual hours actually worked per worker', *OECD*, viewed 21 October 2013, <www.stats.oecd.org/Index.aspx?DatasetCode=ANHRS>

[21] Kozierok, C 2012, 'Cost Comparison for the Big Five Online Freelance Marketplace Sites, *Freelancing Guide*, viewed 21 October 2013, <www.freelancingguide.net/html/fg_Cost_Comparison_for_the_Big_Five_Online_Freelance_Marketplace_Sites_-_Results.htm>

[22] NSW Government 2010, 'Global Office Costs', *NSW Government Trade & Investment*, viewed 21 October 2013, <www.business.nsw.gov.au/invest-in-nsw/about-nsw/infrastructure-and-business-costs/global-office-costs>

[23] Bibb, P 2009, 'How many workers can you fit in an office?', *Sydney Morning Hearld*, viewed 21 October 2013, <www.smh.com.au/national/how-many-workers-can-you-fit-in-an-office-20091130-k176.html>

[24] Mueller, A 2011, 'The Cost Of Hiring A New Employee', *Investopedia*, viewed 21 October 2013, <www.investopedia.com/financial-edge/0711/the-cost-of-hiring-a-new-employee.aspx>

[25] Elance Inc. 2012, 'Global Business Survey 2012', *Elance*, viewed October 21 2013, <www.elance.com/q/global-business-survey>