VILNIUS UNIVERSITY
MATHEMATICS AND INFORMATICS FACULTY
SOFTWARE ENGINEERING

Locals to Locals

First Laboratory Work

Software Engineering II

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Summary

As a semester long academic exercise, we as a team of second year students were given a task to take over development of an application. The main part of the exercise is to learn software engineering principles and apply them in development of an actual application. For this laboratory work, we have been given the following tasks:

1. Identify, document, and analyze user needs.
2. Identify business and system boundaries.
3. Perform the domain and the process modelling.

   Use BPMN for process modelling, and UML for the rest.
4. Identify, elaborate, and validate the requirements.

The expected output is a requirements document including the identified user needs, and the domain model as well as the requirements.

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1. Context

1.1 Principles of Management

We believe that for a company to be successful, it should not only be concerned with what they are doing, but also know why they do what they do. The following are our guiding principles of management.

1.1.1 Mission

Our mission statement - Help local communities prosper.

1.1.2 Vision

Our vision - Connect local business with a larger clientele base.

1.1.3 Values

The values that we strive for:

1. *Sustainability*
2. *Community*
3. *Healthy lifestyle*

1.2 External Analysis

From Locals to Locals is a service (in development) that connects local vendors with buyers. The service is currently in the prototype stage, currently being provided through a website, the completed product would most likely include a mobile app as well. The idea of this service was born out of a real world need and as an academic assignment.

1.2.1 Business model

As most aggregate ecommerce services, our business model would in effect be *B2B2C (Business to business to customer)*.

1.2.2 Customers

Because of our business model we would have two separate main customer bases - vendors and buyers. Each customer base would require a different approach to be maintained and monetized, as without either one of these the business does not function.

1.2.2.1 Vendors

The main revenue for the business would come from the vendors, to whom the product provided would be two-fold - both the platform on which to increase their market visibility and the user base that comes associated with said platform. Of course, this depends on the business being able to create both a viable platform and attract the user base, the latter of which would be difficult without a sizable vendor base. This would be one the key obstacles to overcome for the business to be viable.

1.2.2.2 Buyers

The buyers would not be monetized directly in any way and would be buying goods directly from the vendors without any part of the sale being taken by us. However, they would be essential to attract, as in effect they would be both our customers and our products to the other half of the customer base. We hope to attract buyers by making our app completely free to use to the buyers as well as making it as intuitive and easy to use as possible.

1.2.3 Partners

The main partners of the business would be the vendors, without whom the business would not be able to function. Other partners include advertisement companies and possibly customer service companies if it would be decided that it is more efficient to outsource this part of the service.

1.2.4 Business Boundaries

The business boundaries are as such - the business itself is strictly in the service sector. From Locals to Locals is responsible only for the platform and the data displayed on it. The business cannot guarantee the quality of the products being sold from vendors, however a review system would help mitigate this issue, as well as active moderation of the data displayed on the

site. This would require a customer service team to be in place, to deal with both vendor and buyer issues.

1.2.5 Revenue Streams

While currently the application has no monetization options, we have found quite a few possible ways of monetizing our service. Note that not all the following would be applied at the same time.

1.2.5.1 Direct

The buyers would be difficult to monetize directly effectively and as an app that relies on a large user base to work, it would drive away too many potential users. Therefore, the most logical target of direct monetization are the vendors. We have thought of the possible ways of monetization:

1. Monthly subscription fee
2. A purchase fee
3. Premium subscription fee
4. Extra visibility fee

1.2.5.2 Indirect

While the buyers would not be monetized directly, indirectly there would be a few ways of earning income from this part of the user base:

1. Running advertisements
2. Analyzing buyer data and selling it to vendors who would like to know more about their clientele.

1.2.6 Expenses

The main expense at first would be the cost of the development of the online platform. However, as we are the developers, this would only cost our own time. After the app is sufficiently developed and is ready for early access launch, other expenses would arise with time, the main ones being:

1. Infrastructure costs (hosting)

2. Maintenance costs
3. Marketing costs
4. Customer service costs

1.3 SWOT Analysis

We have performed SWOT analysis of our product and organization to assess our current position.

1.3.1 Strengths

1. Large potential, as the service (with appropriate language support) could work across the globe.
2. The business does not require any physical presence.
3. Professional engineers' team.
4. Intuitive user interface and mobile responsive design.
5. Authentication is optional to browse listings.

1.3.2 Weaknesses

1. Since the service by nature is only effective with a large user base, this forces the platform to be extremely well made to be easy to use, increasing costs.
2. Currently no implemented way of monetization.
3. No personalization.
4. Weak moderation of illegitimate listings.
5. Unstable website.
6. Users cannot compare similar products between different vendors.

1.3.3 Opportunities

1. The trend of buying local, healthy, sustainable products is on the rise.
2. No direct competitors in the market.
3. Development of customer service bots.
4. A near universal mobile device ownership.
5. A significant portion of local businesses do not have a budget for advertisement and online commerce.

6. Lots of free time and a loss of jobs caused individuals to search for profitable activities.

1.3.4 Threats

1. Laws, because of the pandemic, limiting vendors.
2. Some supermarkets are starting to sell local goods.
3. Buying online is becoming more and more popular.
4. Quite a lot of small business owners are lacking computer literacy.
5. Some small businesses are in remote locations.
6. Increased number of database leaks.
7. Appearance of marketplaces in social networks.

1.3.5 SWOT Results

Our service has noticeable strengths. However, the threats and weaknesses must be acknowledged and minimized, while opportunities must be taken advantage of to improve our business. For example, a weakness of the service being effective only with a large user base could be eliminated by attracting individuals who lost their jobs and are in search of profitable activities, as well as inviting businesses to set up their listings free of charge instead of investing in advertisement. One strength - authentication being optional could be used to eliminate the threat of social network marketplaces that require registration. Another threat, that of business owners being possibly technically illiterate could be alleviated by our app's intuitive user interface. A way to improve would be implementing a personalized feed, because a lot of people own personal mobile devices.

1.4 Porter's Five Forces

To better understand our company's position and competitiveness in the market, we have performed Porter's five forces analysis, as seen in Fig. 1.

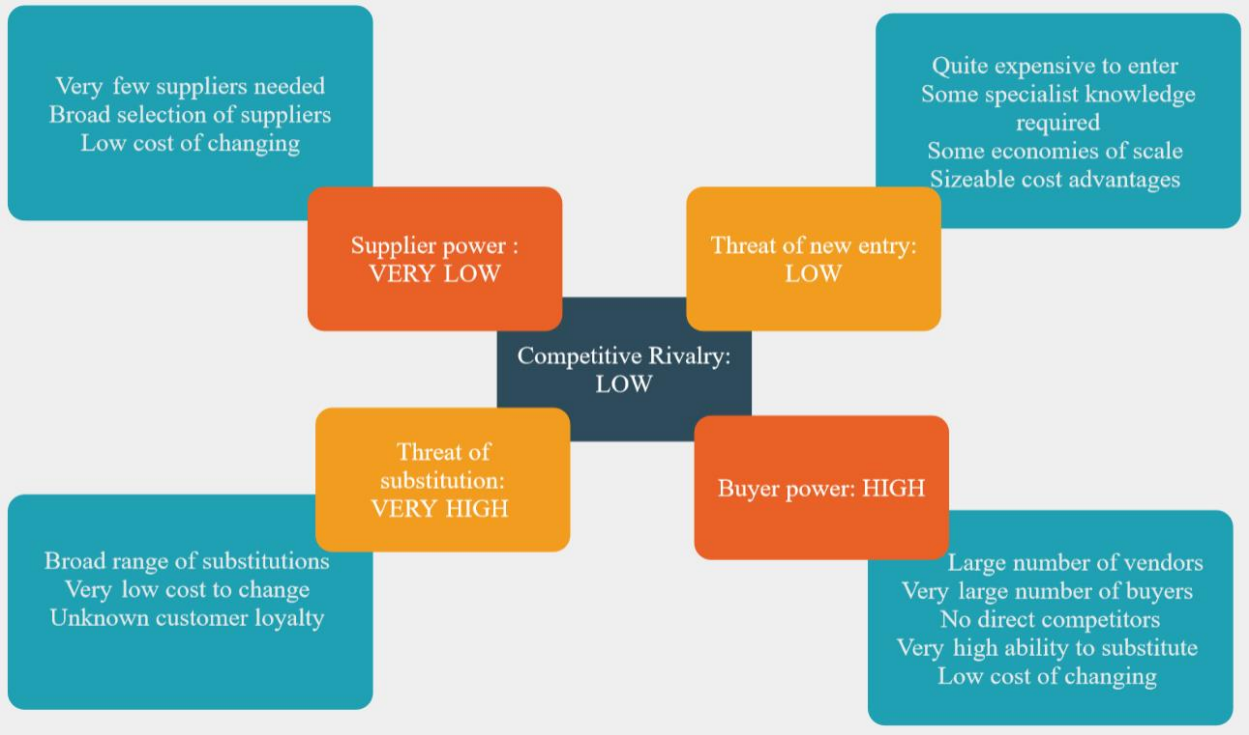

Figure 1. Porter's Five Forces

1.4.1 Threat of New Entry

We believe that it is both relatively expensive and time consuming for a new competitor to enter the market, because it is necessary to build a large customer base to be competitive, which is very difficult to do if there are established players in the market. While there is not any need for very specific specialist skills to enter the market, only IT and general business skills, established businesses do have economies of scale and cost benefits (upfront platform development costs are high) advantage. All in all, new entries would find it quite difficult to enter the market.

1.4.2 Threat of Substitution

There is a broad range of substitutes available to our service. All of them are traditional and well established - finding local vendors through walking around town, word of mouth or going to local marketplaces. Another substitution would be buying from more general online trading platforms, such as Facebook marketplace. Switching from our service would be easy and cheap. Also, we are unsure of the customer loyalty to expect. As such the threat of substitution is very high.

1.4.3 Buyer Power

The potential customer base is very large, both vendor and buyer wise. There are numerous small businesses, and no single client is too important or critical for our business. There are also currently no direct competitors in the market. However, as mentioned previously, the threat of substitution is very high, which in turn makes the overall buyer power high.

1.4.4 Supplier Power

Our service requires minimal supplies. The only requirement for our service to run in IT infrastructure, namely a hosting service. There is an abundant choice of hosting providers and the cost to change is minimal. Therefore, the supplier power is very low.

1.4.5 Competitive Rivalry

Currently, to our best understanding, there are no direct competitors in the Lithuanian market. While we have managed to find several very similar services operating in other western markets (e.g., '*Shop Where I Live', 'Live Buy Local', 'Locally UK,'Locally.com'*), none of them offer services in Lithuania, provide Lithuanian language support, or actually have any vendors signed up from Lithuania. While locally we would have no direct competition, it would be difficult to compete abroad, because it is difficult to differentiate our product from competitors. Overall, the competitive rivalry is low.

2. Stakeholders

One of our main targets is to satisfy the needs of as many stakeholders groups as possible. To do this it is necessary to analyze what are the main interests of each group. We compiled the list of needs that are crucial for each group (at least from our point of view).

2.1 Product Owners

1. Steady flow of income
2. Satisfaction of customers
3. Easy moderation of system
4. Implementation of changes that earns more money than costs
5. Staying competitive in the market
6. Attracting new users

2.2 Local businesses owners

1. Ability to advertise their business
2. Attract customers by creating a description that stands out
3. Build reputation by customer feedback (this system is good place to collect and store reviews)
4. Inform customers about discounts and other important events

2.3 Users

1. Ability to find nearest vendors
2. Ability to select best option by comparing prices and reviews of other users
3. Get detailed information about work hours, prices etc.
4. Express opinion about used services
5. Safe environment (no false information, data safety etc.)

2.4 Software engineers developing the service

1. Understandability of requirements
2. Adequate payment for implementation of requested improvements

3. Logical deadlines
4. Constructive feedback

2.5 Conclusion

To provide stakeholders with the best solution we must satisfy as many needs as possible and not on the price of others. It is required to design and implement features that do not require complicated systems since budget and time are limited. Another important task is to keep the non-functional requirements (such as performance, security, and stability). While at the same time increasing the satisfaction of the user base with the implementation of ordered features. It is important to add that understandability of requirements and constructive feedback allows us to achieve these goals.

3. Requirements

Usually, requirements are classified as *functional* and *non-functional*, however in accordance with recent research we have chosen the name *quality* requirements instead of *non-functional* as to not understate the importance of these types of requirements.

Initially, our team communicated with our client to elicitate the requirements and we agreed upon an informal list of requirements for the service, which we then refined and formalized to be concrete and enumerable.

3.1 Initial

1. Every service should be able to add product listings.
2. Create admin and user roles:
    2.1. Admin can delete services, reviews, and any other inappropriate content.
    2.2. Registered users can report services, reviews, and any other inappropriate content.
    2.3. Admins to have their own separate menu on the site, where they can handle user reports.

3.2 Functional

1. Vendor should be able to:
    1.1. Create product listings for each of their own services
    1.2. Edit product listings
    1.3. Delete product listings
    1.4. Arrange the order of product listings
2. Product listings must be composed of:
    2.1. Name
    2.2. Price
    2.3. Picture
    2.4. Description
3. Registered users should be able to:
    3.1. Report inappropriate content:

3.1.1. Report services

3.1.2. Report product listings

3.1.3. Report reviews

3.1.4. Report replies to reviews

3.1.5. Report profiles

4. Create administrator role
5. Administrators should be able to:
   5.1. See content that was reported as they browse
   5.2. See a list of user reports
   5.3. Delete user reports
   5.4. Delete inappropriate content:
      5.4.1. Delete services
      5.4.2. Delete product listings
      5.4.3. Delete reviews
      5.4.4. Delete replies to reviews
      5.4.5. Delete profiles

3.3 Quality

1. Usability requirements
   1.1. All updates must be in English and Lithuanian
   1.2. Administrators should have a separate menu where admin functions are located.
2. Security requirements
   2.1. Admin accounts must be secure (resistance to basic types of attacks)
3. Capacity requirements
   3.1. New features should not impact the general performance of the website (average load times to remain in the same 10% timeframe)
4. Availability requirements
   4.1. New features must work just as well as the whole service
5. Interoperability requirements
   5.1. Usage of PostgreSQL

6. Reliability requirements
    6.1. New features should be relatively bug free (no unhandled crashes)
7. Regulatory requirements
    7.1. Comply with GDPR requirements

3.4 Traceability Matrix

To check how our formalized requirements cover the informal requirements initially given to us, we have created a requirements traceability matrix shown in Fig. 2.

Client requirements \ FR	1.1.	1.2.	1.3.	1.4.	2.1.	2.2.	2.3.	2.4.	3.1.1.	3.1.2.	3.1.3.	3.1.4.	3.1.5.	4.	5.1.	5.2.	5.3.	5.4.1.	5.4.2.	5.4.3.	5.4.4.	5.4.5.
Every service should be able to add product listings	X	X	X	X	X	X	X	X														
Create admin and user roles														X								
Admin can delete services, reviews and any other inappropriate content																		X	X	X	X	X
Registered users can report services, reviews and any other inappropriate content.									X	X	X	X	X									
Admins have their own separate menu on the site, where they can handle user reports.															X	X	X					

Figure 2. Traceability Matrix

4. Process Overview

4.1 Core Processes Landscape Model

We have created a core processes landscape model to provide the most abstract view of our process architecture, shown in Fig. 3. Because of the focus of our exercise, we chose to forgo the modeling of management and support processes as they are irrelevant for our purposes.

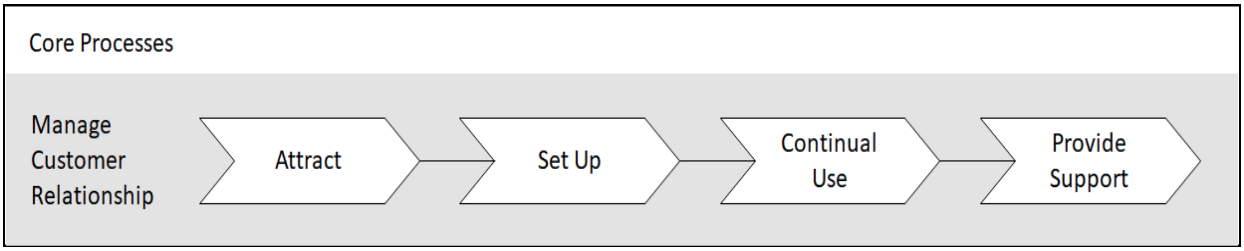

Figure 3. Process Landscape Model

4.2 Core Process Decomposition

Further on, we have created a decomposition diagram of core processes to display the scope of each process clearly and structurally, shown in Fig. 4.

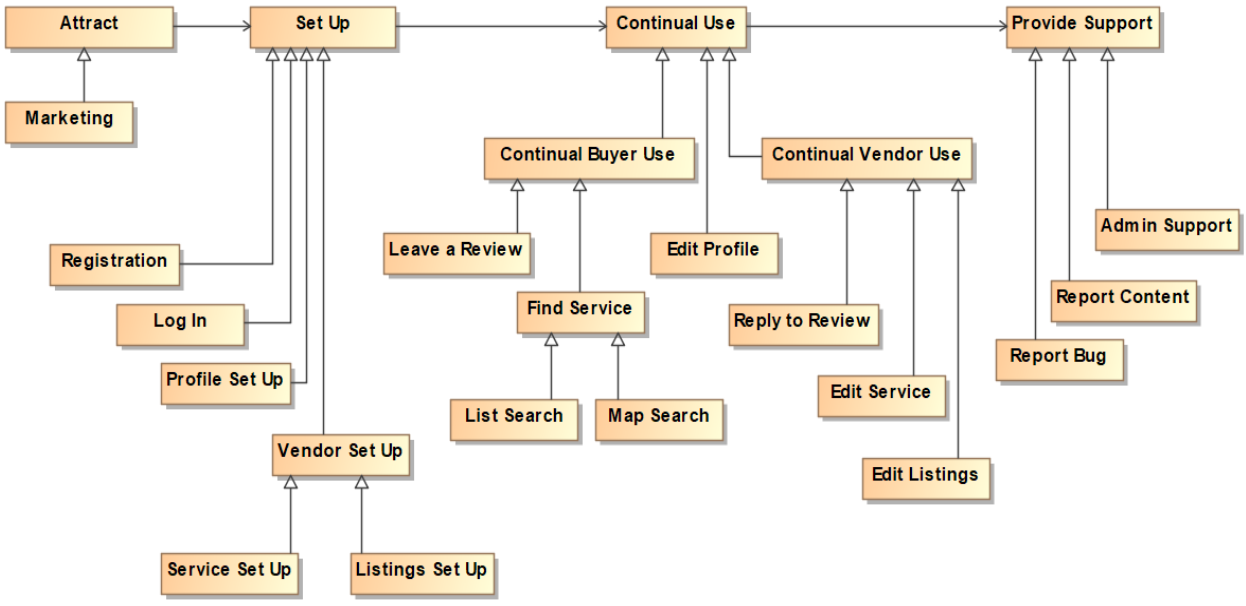

Figure 4. Decomposition of Core Processes

4.3 Business processes analysis

We analyzed the business processes and created several BPMN diagrams that represent the overall business process and some smaller, important processes in more detail. In Fig. 5 we analyzed present core interactions of Users and Administrators. As each registered User gains Vendor's functionality, Fig. 6 displays what it consists of.

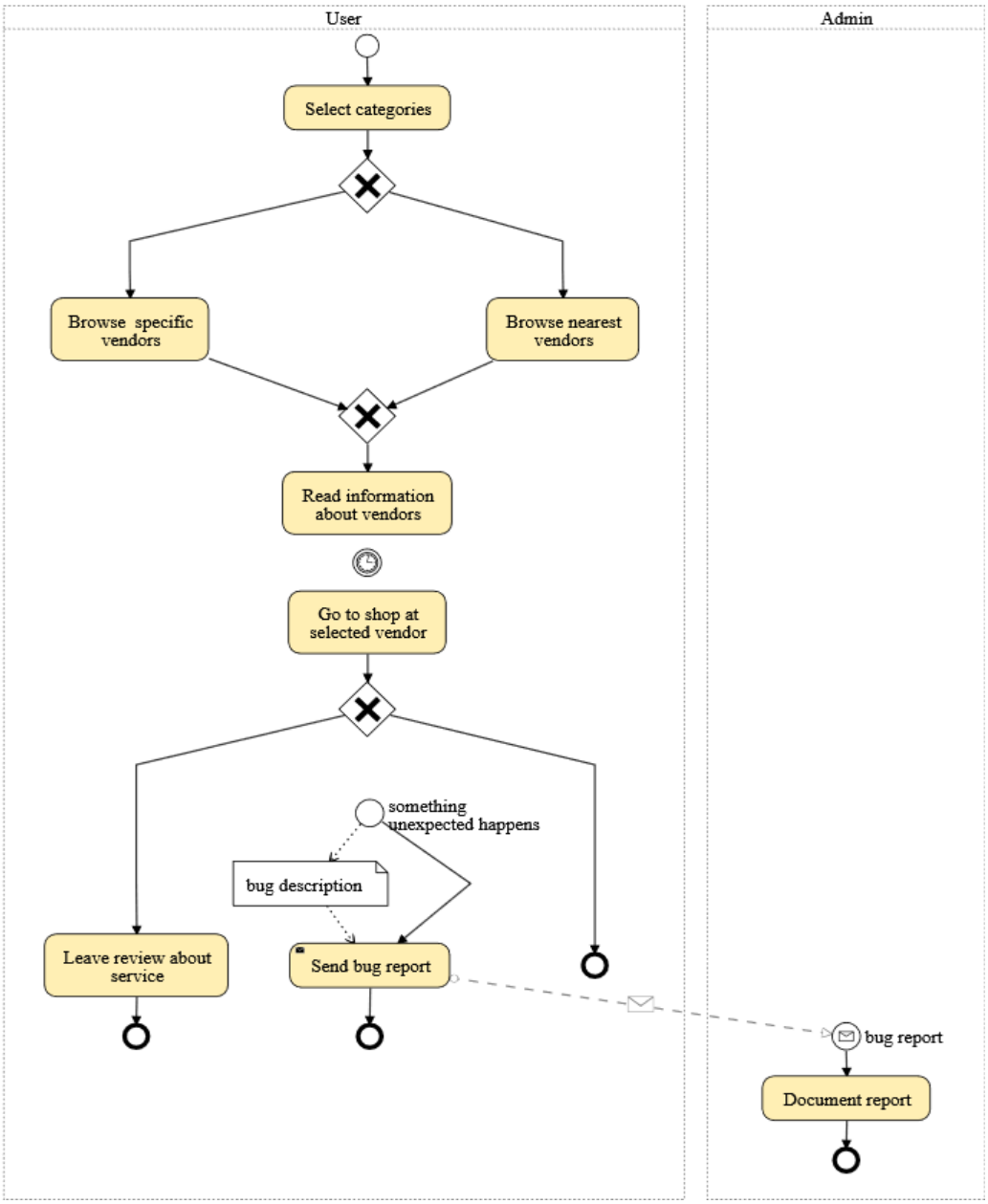

Figure 5. Present User and Admin Processes

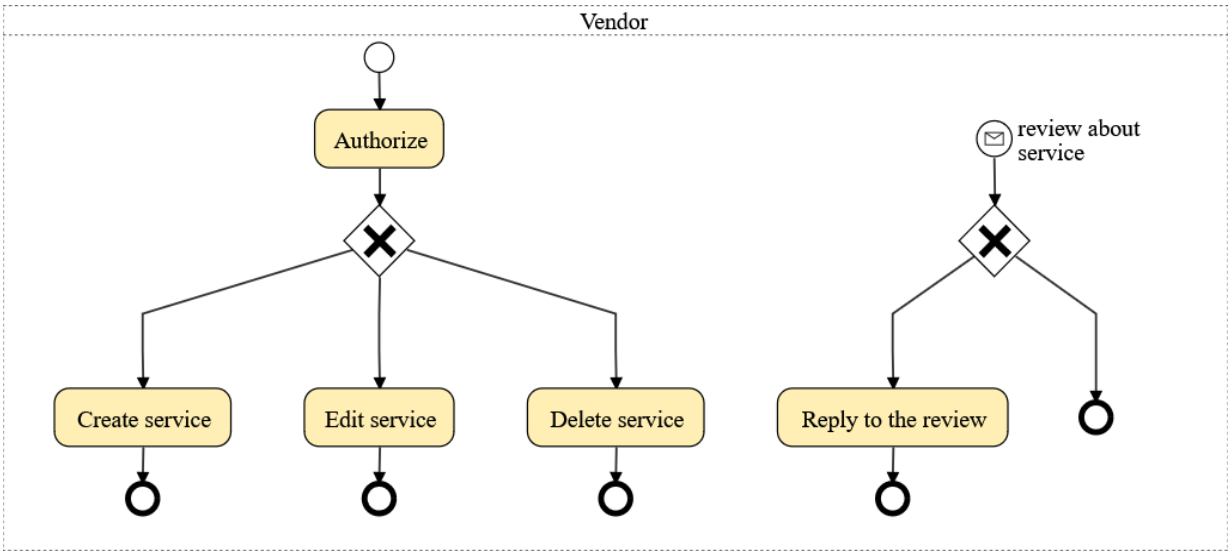

Figure 6. Present Vendor Processes

We tried to model how those processes will look like after implementation of requested changes in Fig. 7 and Fig. 8.

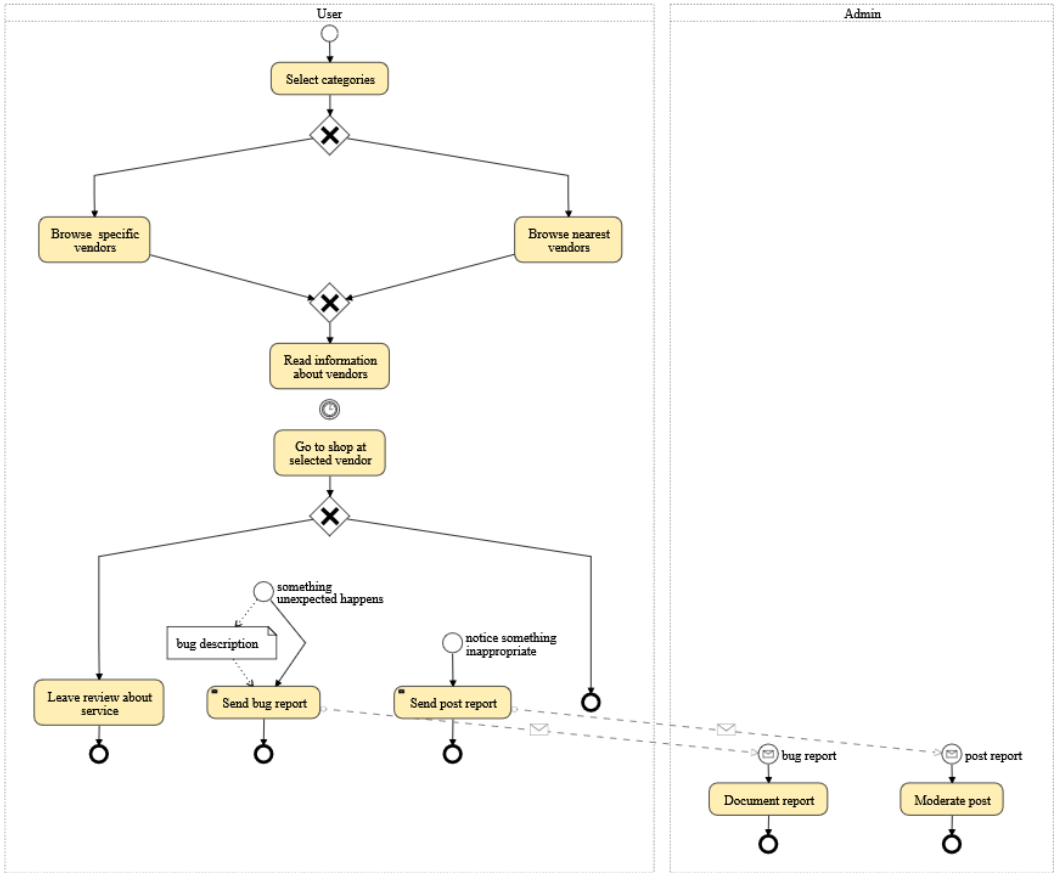

Figure 7. User and Admin Processes After Changes

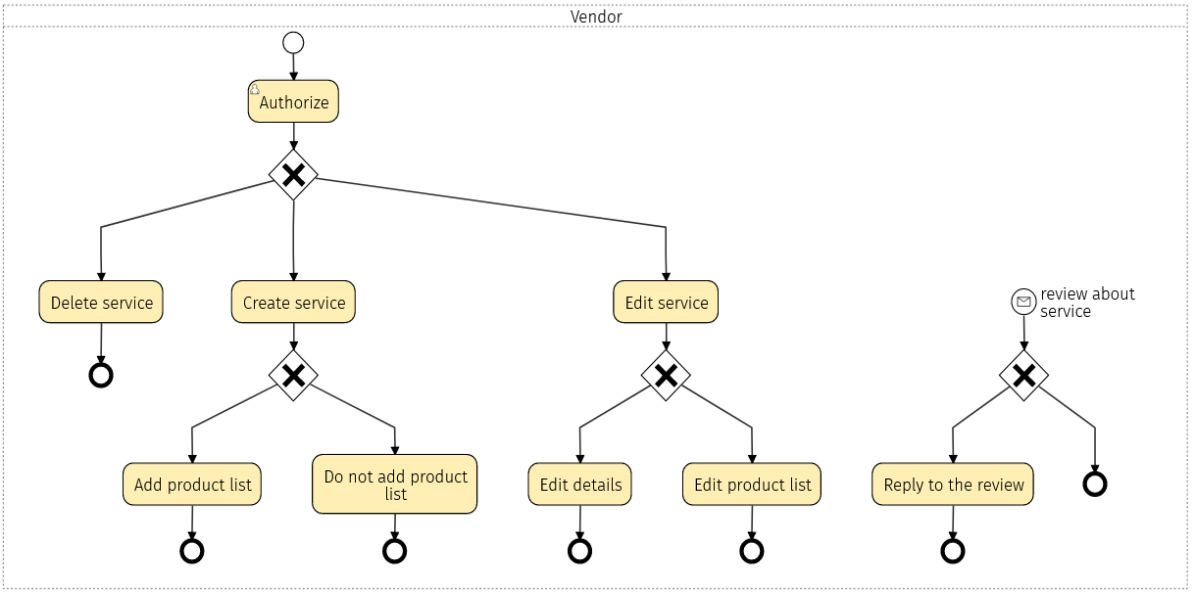

Figure 8. Vendor Processes After Changes

More detailed models of important vendor's processes are provided in Fig. 9, Fig. 10, and Fig. 11.

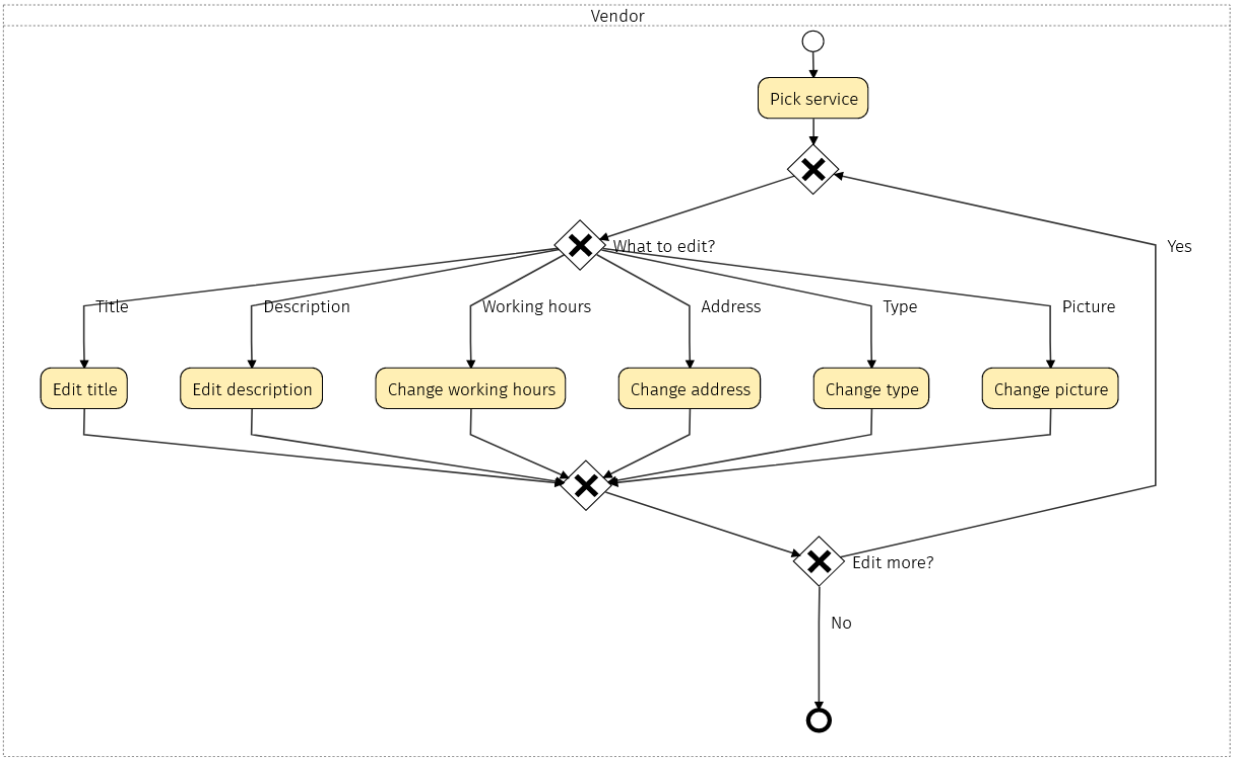

Figure 9. Service Management

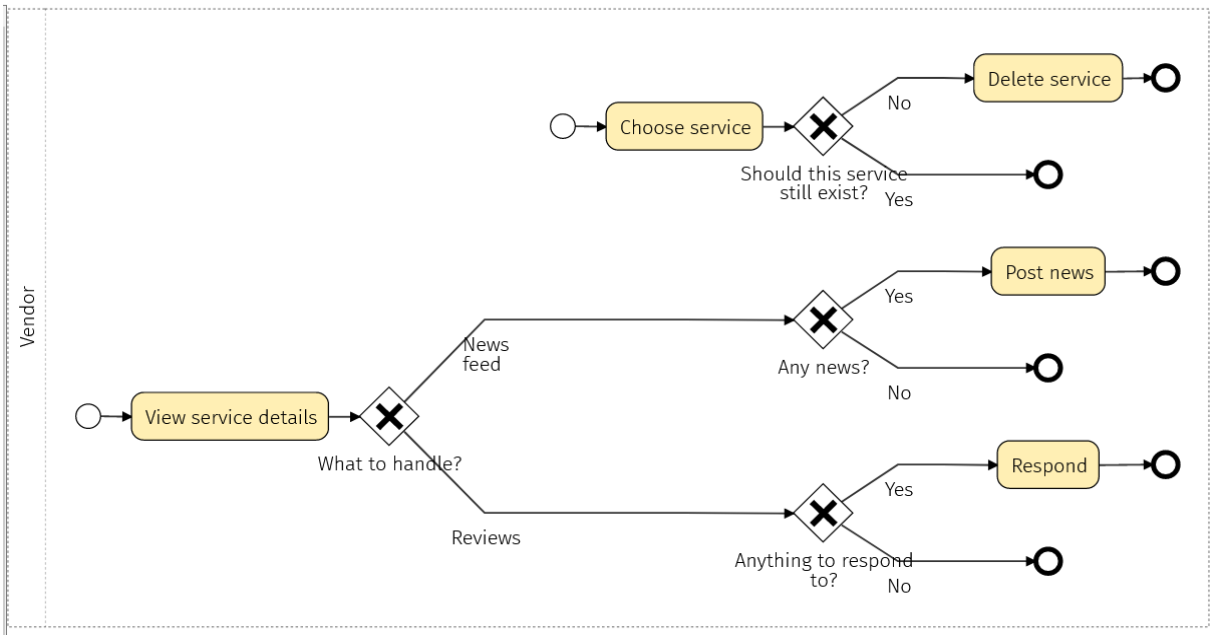

Figure 10. Service Feed Management

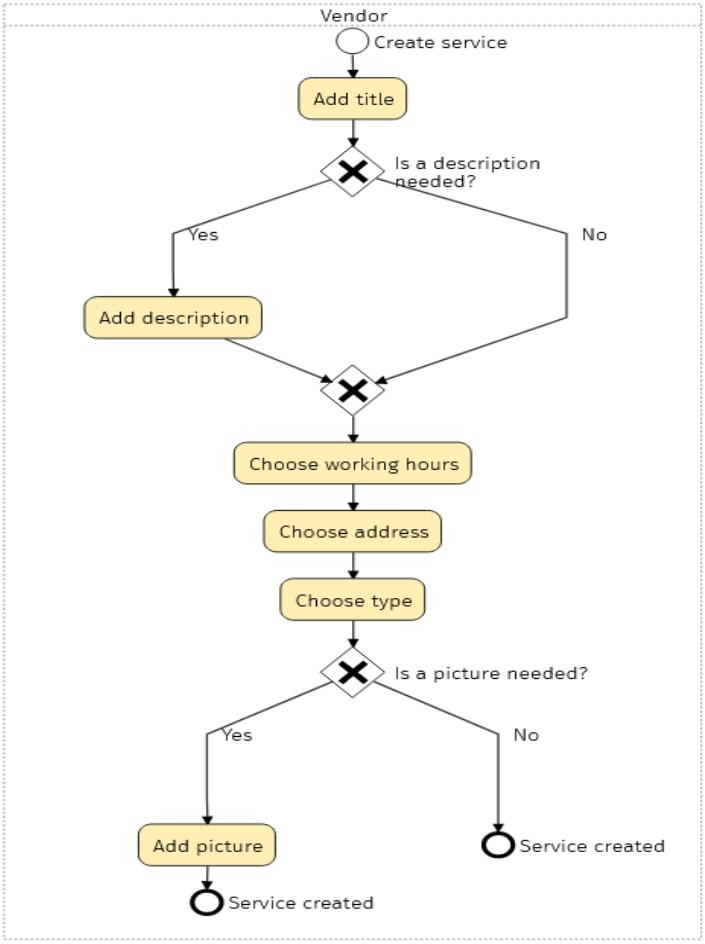

Figure 11. Service Creation

4.4 Domain Model

This domain model conceptualizes the different system parts and their relationships. It provides a visual representation of different processes to the stakeholders.

We have created both a current domain model and a domain model to-be after the requirements are fulfilled, shown in Fig. 12 and Fig. 13, respectively.

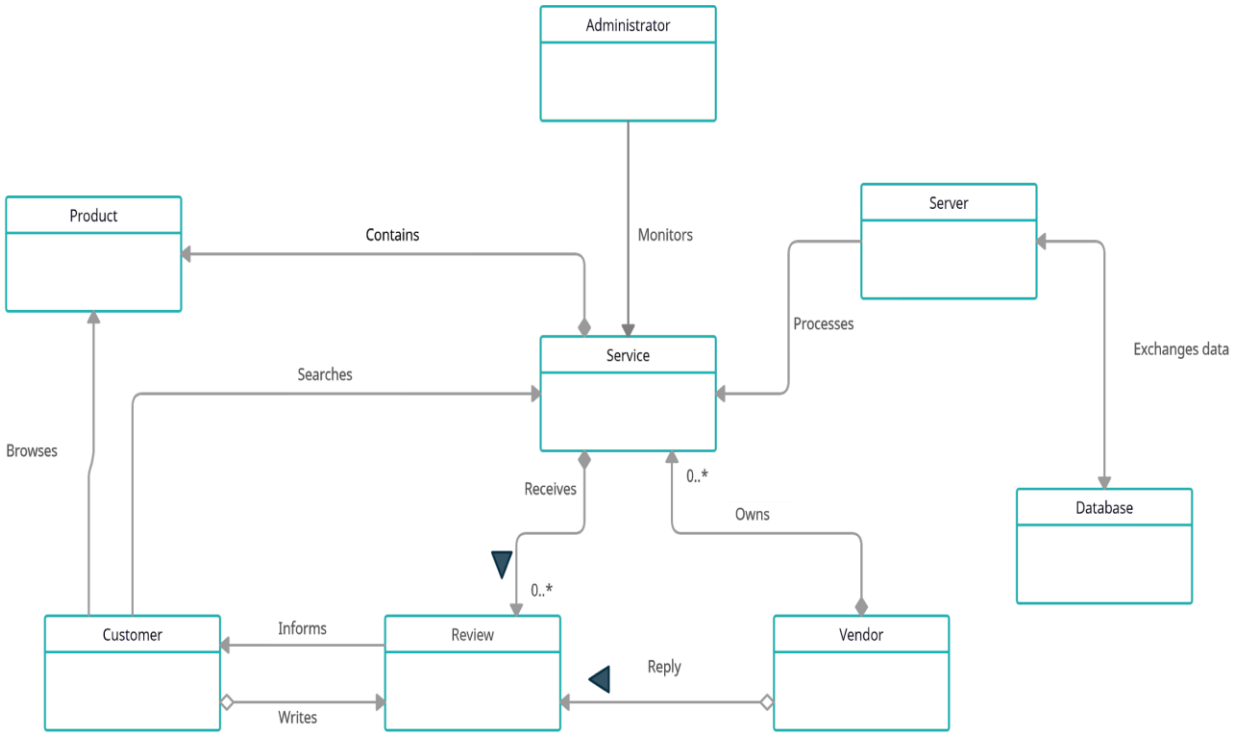

Figure 12. Present Domain Model

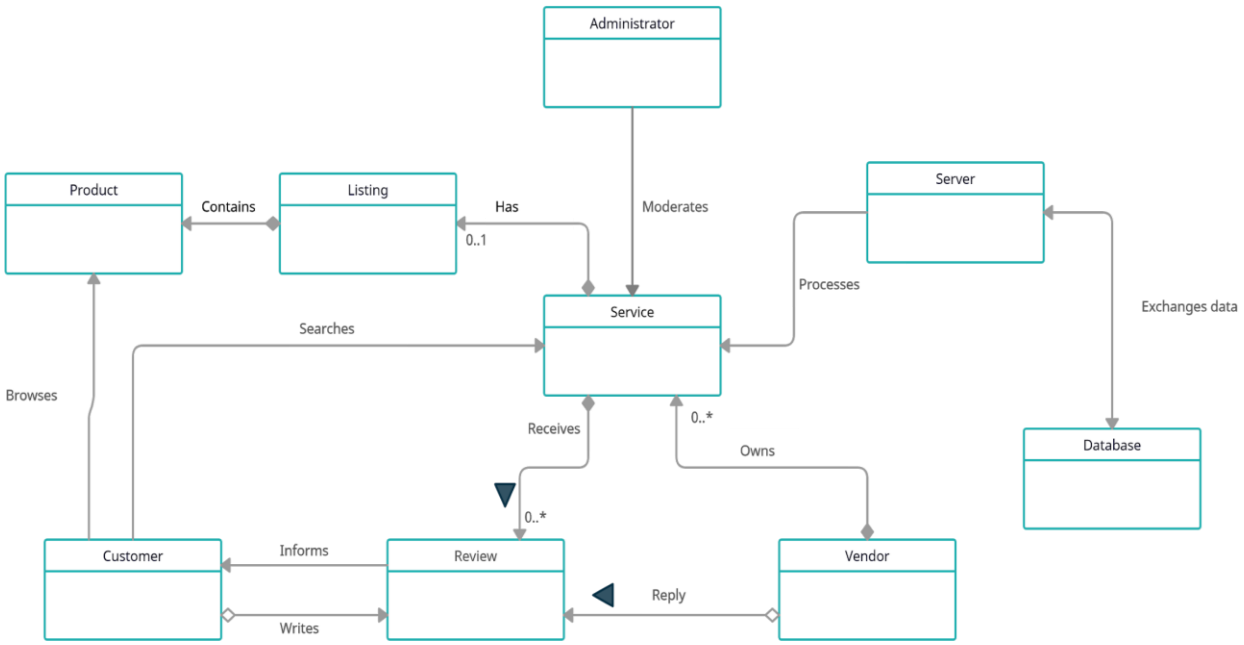

Figure 13. Domain Model After Changes