

Electronic Payments Workflow Optimization in Fashion E-tail

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Master's Dissertation

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Mestrado Integrado em Engenharia Industrial e Gestão

2015-07-26

Ao meu avô

Abstract

Electronic payments are a crucial part of E-commerce. From the Customer perspective, being able to easily pay without incidents improves the shopping experience. Nevertheless, sometimes Customer experience payment refusal by the system and although a few cases occur due to Customer's fault, there is a larger part occurring because of the most problematic inefficiencies of the payment workflow, that runs in the background.

The payment system is very complex and involves a very diverse group of entities, frequently situated in different backgrounds, ruled by distinct legislation and with proper procedural practices. This results, in some cases, in incompatibilities that undermine the success of the transaction. The number of transactions exposed to this issue has made Farfetch, an online fashion retailer, to lose a considerable amount of revenues.

To tackle this problem, a large quantity of data was collected and analysed, allowing to identify the causes of inefficiencies and the improvement opportunities. Two markets, the United States and the United Kingdom, were studied and compared to understand the performance of each entity in both markets, relatively to the metric: percentage of authorised transactions.

With the analysis' results it was possible to build a new workflow model based on the Bank Identification Number (BIN), essential tool to recover the Customer bank information. The logic behind the new workflow consists in routing the transaction through the path which best suits the respective bank in terms of authorisation performance.

The dissertation discriminates all the steps to achieve the model as well as all the relevant analyses covering the issuing banks. The main conclusion is the importance of a creating payment workflows where the entities are aligned in what concerns procedural aspects because it is the way of improving the gains for both parts. The Customer, in the end, is benefited in his shopping experience despite being unaware of the whole process behind.

Resumo

O processo de pagamento é uma parte fundamental do comércio electrónico. Da perspectiva do cliente, ter uma experiência sem sobressaltos no pagamento de uma encomenda, melhora a experiência da compra. No entanto, por vezes, o cliente tem de lidar com a recusa de pagamento por parte do sistema. Muitas vezes deve-se a culpa directa do cliente mas uma grande parte acontece devido a um conjunto de ineficiências próprias do sistema, pela forma como foi construído.

O sistema de pagamentos é muito completo e envolve um conjunto de entidades muito diferentes, muitas vezes provenientes de diferentes contextos, leis e com práticas operacionais muito próprias. Isto resulta, em muitos casos, em incompatibilidades inultrapassáveis que tornam o resultado da transacção negativo. O número de casos em que isto sucede na Farfetch, empresa de comércio online de moda de luxo, resulta numa perda considerável de receitas.

Para resolver este problema, um grande quantidade de dados foi analisada, permitindo a identificação das principais causas das ineficiências registadas anteriormente e das oportunidades de melhoria. Os dois mercados estudados, norte americano e britânico, foram comparados de forma a perceber o rendimento de cada entidade envolvida em ambos os mercados relativamente à métrica definida: percentagem de transacções autorizadas.

Após esta análise de dados, foi possível construir um novo modelo de fluxo de pagamentos baseado em BIN's (Número de Identificação do Banco), ferramenta essencial para a identificação da informação do banco do cliente. A lógica deste modelo consiste em dirigir cada transacção pelo fluxo que sirva melhor o banco em questão em termos de performance.

A dissertação descreve todos os passos realizados para obter este modelo assim como todas as análises realizadas cobrindo principalmente os bancos dos clientes. A principal conclusão a retirar é a importância de criar um fluxo de pagamentos onde as entidades estão alinhadas no que diz respeito aos aspectos processuais porque é a melhor forma de potenciar os ganhos para ambas as partes. O cliente, por seu lado, é beneficiado na sua experiência enquanto consumidor apesar de estar completamente alheio de todo o processo.

Acknowledgements

First of all, I would like to thank my dissertation supervisor, Prof. Teresa Bianchi Aguiar, for always being available for me and for the wonderful inputs given to the project. Without them, the dissertation wouldn't be the same.

I would like to thank Farfetch for giving me the opportunity to develop this project and specially to my company supervisor Joana Fernandes for always supporting me and transmitting the passion about the subject. A word of gratitude to Francisca Marinho for helping me in the project initial phase.

I would also like to thank to my intern colleagues in Farfetch for being with me in this path, all together. To all my friends and to the people that in the most difficult moments knew how to cheer me up and to take me forward.

To all the professors that guided me through the years and made me a better person.

Finally, to my family, brother, mother, father and Conceição for giving me the best of the educations and providing the best opportunities. And to my grandfather, an inspiration.

“It is only through labor and painful effort, by grim energy and resolute courage, that we move on to better things.”

Theodore Roosevelt

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Abbreviations

A-A	Acquirer A
A-B	Acquirer B
A-C	Acquirer C
A-FEU	Acquirer Fallback Europe and Rest of the world
A-FUS	Acquirer Fallback United States
A-FBR	Acquirer Fallback Brazil
AMEX	American Express
APAC	Asia-Pacific
AR	Authorisation Rate
ATM	Automated Teller Machine
AUD	Australian Dollar
AWB	Airway Bill
BIN	Bank Identification Number
BR	Brazil
BRL	Brazilian Real
CAD	Canadian Dollar
CHF	Swiss Franc
EUR	Euro
EU & ROW	Europe and Rest of the World
FF	Farfetch
GBP	British Pound
JPY	Japanese Yen
KRW	South Korean Won
RUB	Russian Ruble
MXN	Mexican Peso
P-A	Provider A
P-FEU	Provider Fallback Europe and Rest of the world
P-FUS	Provider Fallback United States
P-FBR	Provider Fallback Brazil
PSP	Payment Service Provider
ROW	Rest of the World
SGD	Singapore Dollar
UAE	United Arab Emirates
UK	United Kingdom
US	United States
USD	United States Dollar

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Chapter 1

Introduction

The present dissertation arises from a compelling need to optimize and increase the efficiency of the core processes within the 8-year-old online luxury fashion company - Farfetch. In this particular context, the project will approach mainly the remodeling and improvement of the current electronic payment system with credit card implemented in the company.

Online payment systems with credit card is admittedly a very complex topic taking into account the number of entities involved and the major security issues required for enabling the trust of Customers in these methods. Moreover, due to a very stringent legislation and a group of contractual issues with the several entities involved, it only allows to act on some surgical parts of the system in order to achieve better results.

Payment failures by the issuing bank are the responsible for many lost orders, resulting in a considerable loss of revenues. Part of these rejections have their root cause on the inadequate payment flow where the several actors are not linked in the most profitable and efficient way. For that reason it is necessary to spot the biggest flaws and to tackle them in order to increase the payment operational performance and consequently the Customer service and the company revenues.

1.1 Farfetch

Farfetch is an online marketplace focused on luxury fashion launched in 2008. The company has grown in a rapid pace in the last few years raising a huge interest in investors which allowed the company to become an "unicorn" start-up after raising 86 million dollars in March 2015 reaching to 1 billion dollar valuation.

The company sells a wide range of luxury fashion items from more than 400 boutiques all over the world such as Stefanie Mode, Biondini Paris or Eraldo. It allows Customers to buy from their favourite boutiques from any place in the globe that were inaccessible in the past. Its diversity and creativity cause an excellent impression on customers as well as the continuous effort on satisfying the customer strongest desires. The market where the sales volume is higher is United States and then, with a lower expression, United Kingdom, Hong Kong, China and Russia.

Introduction

Farfetch business model is the main competitive advantage that allowed the company to thrive on this market. First of, the most relevant characteristic is that Farfetch does not own stock. All the articles presented and sold to Customers are owned and kept by boutiques. The company works on a sales commission basis established with each boutique. Each item is sold and sent to the Customer via an external courier provider.

The company is the intermediary between Customers and boutiques. All operational issues like standardize and support order processing by boutiques, photographing all the items, developing the website and integrating all its components as well as vital Customer service are the part of the service delivered by Farfetch and responsible in a great part for its success.

Until now, there has not been a company able to replicate the business model of Farfetch. The huge number of boutiques aggregated in one single network and the global scale in terms of delivery (currently FF delivers in 190 countries) at such low operational costs discourage most of the companies and boutiques on going by themselves on the same kind of business. Furthermore, dealing with the amount of seasonal stock typical from this business is a major setback for the idea of increasing scale business. Another great advantage relatively to the competition is the fact that Farfetch has partnerships with many boutiques from many different cultures which allows a substantially bigger product offer.

Farfetch is a very innovative and forward thinking company, being in a constant reinvention process. Many business units were introduced. The company now sells fashion for kids as well as jewelry. Some pilot projects that resulted in expansions of the business model are also absolutely relevant. The first is the acquisition of the British boutique "Browns", which is viewed as a sample tube and works as an assessment of the performance of a boutique completely managed by FF processes. It is also useful to try out some features and evaluate the corresponding results. This project permits a deeper analysis and provides enough knowledge to implement some process improvements in the Farfetch partner boutiques. The Black and White project consists in the same business model but applied to brands. Instead of working with boutiques the objective is to partnership with brands to provide Farfetch technology to brands e-commerce. The most recent fashion brand working on this project is Manolo Blahnik.

Currently Farfetch has more than 700 employees and operates in 9 offices in 7 countries: United Kingdom (London - Headquarters), Portugal (Porto and Guimarães), Brazil (São Paulo), Tokyo (Japan), China(Shanghai), Russia(Moscow) and United States (New York and Los Angeles). The dissertation was developed in the Porto's office where all the Operations department is placed and where more than half of the Customers work. The 8 major departments in Porto are: Human Resources, Office Management, Operations, Account Management, Customer Service, Partner Service, Finance, Merchandising and Tech.

The Operations department is the most relevant department for the developed topic and is composed by the following main areas:: Customer Operations, Supply, Continuous Improvement and Black and White Operations. Customer Operations is subdivided in Delivery (Support and Development), Fraud and Payments. The Payments area is responsible to analyse the impact of the whole payment process and the different payment methods in the operational results of the

company.

1.2 Project

Every day, Farfetch Customers place new orders that require an online payment. The respective triggered transaction can be made by a variety of payment methods that are provided by the company but, for this project, the relevant method is credit card. A credit card payment transaction, from the Customer point of view, only has two final status: accepted or rejected.

The status comes from the complex payment workflow process: the authorisation. This process involves several entities which communicate among themselves in order to provide the Merchant (vendor) with the authorisation information. A transaction could be rejected by a group of various reasons from different sources. These can be Customer funding problems, fraud suspicions and other similar, but the most relevant group in this particular context is refused transactions by the issuing bank (Customer's bank).

Although most of the times the available information is not complete by the lack of integration of all entities involved, these group of reasons normally indicate that the issuer bank refused due to incompatibilities with the rest of the workflow entities. These kind of transactions are global including countless banks and countries which leads to dealing with several deviating legislation and procedural practices which ends in insurmountable discrepancies.

A substantial part of these discrepancies happen because of the payment workflow inefficiencies. Farfetch system was built as a response to the company's necessities and adversities which resulted in a capable and responsive system but not exploiting its full potential. This project aims to study the whole system, understand what are the main inefficiencies and if they are the root cause of these refused transactions, and analyse how to improve the payment workflow to a more capable, efficient and logical system that can bring better operational results to the company.

1.3 Objectives and Structure

The main objective of this dissertation is to be able to provide a new complete online credit card payment workflow that can be efficient, maximizing the percentage of authorised transactions, well structured to provide the opportunity to be used in the long term, and flexibility to improve constant alterations with future new analyses. This proposed workflow will be based on a strong analytic ground.

In order to accomplish this novel payment workflow, first we have to closely study the current workflow and to understand what are its flaws. Secondly, we have to associate each credit card with the respective issuing bank and country using the worldwide BIN system (the first 6 digits of a credit card identify the original bank). This association requires data treatment and access to an external database of bins. Thirdly, by tracking the bank and country of each transaction, we have to study the performance of each issuing bank. These analysis will be the basis for all the decisions taken concerning the new payment workflow.

Introduction

In order to fulfill all these objectives in an organized and clear way, the dissertation was structured as following: the Chapter 2 will consist in the state of the art addressing topics related with the business model and with online payment systems; Chapter 3, Current Workflow Structure, will give a detailed description of Farfetch's internal processes and how the current workflow system was built; Chapter 4, Data Collection and Analysis, will show, firstly, the necessary steps to assure the existence of quality data for the following analyses. Secondly, this chapter consists in a group of analyses regarding the performance of the system in the studied markets and the identification of improvement opportunities; Chapter 5, Redefinition of the Workflow, will focus initially in the transacted costs and their relevance for the workflow and then in all the proposed payment workflow models; in the end, Chapter 6, Conclusions and Future Work, will give a smaller overview of all the conclusions taken along the dissertation and will set the basis for the future work.

Chapter 2

State of the Art

The present chapter aims to provide a global overview of the most pertinent subjects related with the main topic.

Firstly, it will be given a quick insight in the e-commerce business along with its relationship with luxury goods' market. A slightly more detailed description of the way electronic payments are processed in this business, and the wide range of concepts associated, will be presented soon after, ending ...

2.1 E-commerce

Although E-commerce appears as a recognized modern 21st century concept “whose history is only fifteen years old” [Mohapatra, 2013], its origin dates back to the 1960s, at the time the development of EDI allowed companies to exchange information, place orders, and make electronic payments through computers. It was called the first generation of E-commerce. The second phase was characterized by the commerce of goods and services using the Internet as a commercial tool [Tian and Stewart, 2007]. Along with the rampant growth of the Internet in the two ending decades of the 20th century came its attractiveness as a business platform. In the end of 1991, with the lift of online commercial restrictions by the NSFNET, it finally overthrew the last barrier to the E-commerce world [Tian and Stewart, 2007]. E-commerce is considered “the most significant industrial revolution since the first industrial revolution” [Mohapatra, 2013].

There are several definitions of E-commerce, such as the one from OEDC as “electronic transaction which is the sale or purchase of goods or services between businesses, individuals (...) conducted over computer mediated networks.” or the US government as “E-commerce is a collection of all business activities through the Internet”. However, [Evans, 2001] states e-commerce as the shift of all traditional business operation practices to an online basis and a mean of expanding business to a global scale. It enables a wider range of supplier choice (without concerning about geographical location) and allows getting products and services being delivered to the Customer in a more efficient and flexible way, becoming at the same time more responsive and providing a better Customer service. [Siddiqui et al., 2003] states that E-commerce “not only can greatly raise

productivity, improve the efficiency of economic operations, lower economic operating costs and make possible things that were impossible before”.

Another relevant aspect is related with the customer relationship with Merchant in online business. The customer became powerful, has easy access to information and exchange it with other customers from another companies which makes the customer opinion on the company extremely important and the customer satisfaction strategy a key figure for business success.

E-commerce is seen as the new revolution and its impact will be in every single aspect of human life, reformulating everything human society knows, far beyond business. It can go from industry processes, logistics, and finance to law systems, education, government and even agriculture. It is fair to say that embracing the use of e-commerce in current businesses is already a main competitive advantage in business world [Evans, 2001].

2.2 Luxury

Defining Luxury is not always easy. Because of its unique characteristics, it represents a very specific niche that is not recognized as a product or service not even a concept but as “an identity, a philosophy and a culture” [Okonkwo, 2009]. Historically, luxury origins are assigned to France, to the royal, nobles and aristocrat classes, where the meaning was connoted with power, majesty, wealth, ostentation and, above all, social status and distinction from lower and poorer classes [Okonkwo, 2009] [Hines and Bruce, 2007] [Kapferer and Bastien, 2009]. The original concept evolved to recreation of the social stratification but in a democratic way in which who has money could achieve it [Kapferer and Bastien, 2009]. The most relevant factors sought by luxury customers are extreme quality, aesthetics, scarcity and uniqueness and high price combined with its functionality [Hines and Bruce, 2007]. One of the most relevant factors that customers are not being driven by rationality but human senses as the smell, touch and vision [Okonkwo, 2009].

As a business, this concept diverges from the most common resulting in a very particular niche where several characteristics must be attended to ensure the company success. A luxury customer should be able to perceive enough value in the product worth the high value charged [Tynan et al., 2010] and recognize the product as fashionable, stylish and even as a possible trend [Ko and Megehee, 2012].

This industry is composed by a small quantity of companies but when referring to sales and above all, influence on social behaviour, the values have a huge impact. The best materials, packaging, products and image must happen on luxury so that these brands can lead the way for the rest of the marketing way [Ko and Megehee, 2012]. Increasing competition with the appearance of new brands is evident and is becoming hard to maintain the original image and controlling the business globalization [Jung Choo et al., 2012]. Another awareness is related with bloggers and other digital consumers and its influence in masses behaviour [Petkova, 2016].

This Luxury fashion industry deals with some paradoxes that should be treated carefully. The most relevant examples are the struggle between creating “desire and exclusivity” in a wider range of customers maintaining the equity of the brand. Another important conceptual dispute lies on

the wish of increasing sales volumes without the risk of overexposure. These are some of the arguments mostly used by skeptical brands to enter the online market, placing Internet in the opposite position when referring to the core elements [Okonkwo, 2009].

What online customers want is a website experience that is pleasant, interactive and engaging [Bjørn-Andersen and Hansen, 2011] while maintaining the prestigious atmosphere of a boutique with its multi-sensory experience (visual, smell, sound, customization). The most required features for a successful online channel (from client POV) are undoubtedly aesthetics, communication by e-mail, information on products and easiness to navigate on portal [Hines and Bruce, 2007]. Another important issue to be aware of is that customers talk with each other, are more informed and want to know everything. They want to understand from other people how good the brand, product and its materials are. The same person can buy a product using more than one channel.

Luxury online customers are as much involved as when they buy in a physical place. Studies show customers tend to abandon firms that neglect the relation and not provide the required attention. The increasing role of Smartphones and Tablets is also important: circa 50 of luxury customers do search in mobile devices and there is also a strong correlation between the increase in sales and the number of web pages visited [Mosca and Casalegno, 2016].

From the retailer point-of-view, internet allows access to a greater audience, many cost savings, opportunity of doing business 24/7 and increased customisation as well as improving the customer relationship to a more detailed and customised level [Siddiqui et al., 2003].

A report of Bain and Company from 2015 states that the personal luxury goods market is evaluated in \$250 billions in 2015 which corresponds to a 13% growth comparing with 2014. In the last 20 years this value has tripled [Claudia D'Arpizio, 2015]. Regarding online business, sales of luxury products reached to \$7.5 billion, accounting for 4% of total selling and for 2017 the estimation is an increase of \$17 billion [Mosca and Casalegno, 2016].

2.3 Payments Workflow

2.3.1 Electronic Payments

Regarding electronic payments there are a great variety in the methods available. Moreover every year different types of methods appear in the market allowing each customer to choose the most suitable method. Globally, the most common electronic payments currently available are: [Khan et al., 2011]

- Electronic payment cards (credit, debit, charge)
- Virtual credit cards
- Smart cards
- E-wallets
- Electronic cash
- Wireless payments

- Loyalty cards
- Payments made kiosks or certified shops ...

These payment systems can be divided in bank card payment systems and non bank card payment systems. The first group includes credit cards, smart cards and debit cards and are payment methods widely accepted by customers and merchants, being the most popular all over the world. It works based on a cardholder account in a bank, where the customer has an account card for payments being the bank responsible for the security of the transaction and assumes fraud issues costs. As for the non bank card systems, they are digital money schemes such as e-loyalty cards, reward cards, paypal, among others. These methods usually only involves three parts: the merchants, the client and the financial institution that issues the cards and works as an intermediate between customers and merchants. Comparing the two divisions, the bank card payments corresponds to 85% of all internet purchases [Abdellaoui et al., 2011].

2.3.1.1 Security

An E-commerce company can only achieve success if the general public can trust in the virtual environment. People which participate in e-commerce transactions are willingly to take a certain risk but, it must stand below the personal threshold [Yao-Hua Tan, 2000]. Transactions can occur without any prior human contact which creates a circumstance of security threat. The phase of electronic payment is confidential when all phases of the process are capable to satisfy the needs of participants and their security expectations [Tsiakis and Sthephanides, 2005]. All the procedure involves collecting, storing and sending information from a huge amount of customers and their cards and transactions between all the actors in the process. Therefore if any security breach happens the damages to card users and merchants can be catastrophic [Liu et al., 2010]. A secure e-payment system should provide security against fraudulent activities and must protect the privacy of consumers with the most important values being integrity, payment confidentiality, payment anonymity, and payer traceability [Kim et al., 2010]. To meet these market security needs, there are security protocols for e-commerce transactions [Khan et al., 2011].

Security Socket Layer is a set of cryptographic protocols that provide communication safety through the Internet and it was developed by Netscape Communications Corporation. It permits to client and server to define previously their private keys for communication and turns possible to use the public Web server with a high level of encryption during the transaction. [Khan et al., 2011].

The huge amount of data managed by the merchants and providers increases the risk of exposure to a security breach. For some years the card brands developed their own security programs and the compliance programs among all were not organized and fractured. In order to prevent new security breaches, the major card brands created together a standardized group of security standards (Payment Card Industry Data Security Standard) managed by a council formed by them (PCI Security Standards Council). The PCI DSS guides all entities involved through a set of a mandatory practices to protect cardholder data and to avoid fraud issues [Liu et al., 2010]. The merchants to be able of doing this kind of transaction must acquire the compliance certificate

that requires endowing the payment system with high security levels which may be expensive [Abdellaoui et al., 2011].

2.3.2 Transaction Flow

There has been a great effort in standardize electronic payment systems. Most of them consist in a solid common basis involving 5 major entities: The client or customer (C), the merchant or retailer (M), the financial entities Acquiring Bank (A) and Issuing Bank (I) and finally a payment system provider (PSP) [Carbonell et al., 2008].

A credit card payment is a complex multi-staged process involving every entity mentioned before. Right after the customer makes the payment his card authenticity is verified by the card issuer via the merchant acquirer together with the corresponding card network. If the procedure runs successfully the purchase amount eventually is debited from the original account [Liu et al., 2010].

Authorisation and Settlement

The payment processing is composed by two distinct main steps: the authorisation and the clearing/settlement. The authorisation is essentially a flow of information between all parts involved. It starts at the moment the client places the card details on the E-commerce website. It is then recorded the type of card, account number, expiry date and security codes by the merchant. Then the payment request is redirected to the merchant acquiring bank or payment processor through a payment provider or simply a payment gateway. The card network reads the card number, determines the issuing bank and sends the relevant information to it. The issuing bank, verifies the account details and whether the referred amount is within the line of credit allowed to the client. Lastly, the acquirer is responsible to send the final authorization code to the merchant. [Liu et al., 2010][Kossler, 2013].

The settlement process happens immediately after the acquirer receives transaction details. The card networks conduct the transaction data to the issuers which are responsible of charging their own clients. The merchant, in a defined periodic time frame, sends the batch of transactions to its acquirer or payment processor. The batch is then divided by the card network being all the transactions sent to the correspondent issuing banks. Here the banks issue the purchase to the cardholder and the payment is sent to the acquirer. The acquirer then deposits the due amount to the personal account of the company less the processing fees [Liu et al., 2010][Kossler, 2013]. The whole process is schemed in Figure 2.1.

2.3.3 Entities

2.3.3.1 Client and Merchant

These two entities are the main responsables for the transaction. The client requests a service/product provided by the merchant and for that a payment must be done. The Client is viewed as the entity who places the order and pays for the goods or services provided by the merchant. It is the

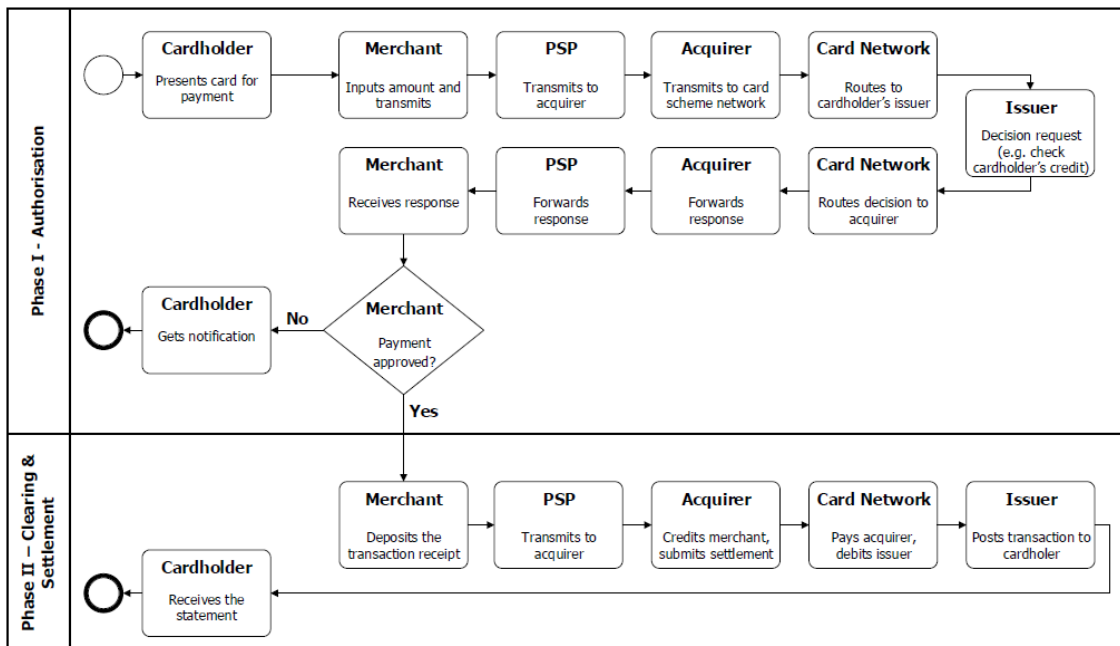


Figure 2.1: Authorisation and Settlement - Payment Processing [Van der Valk, 2015]

entity who triggers the whole process [Carbonell et al., 2008]. The Merchant is the entity responsible to provide goods and services for which the customer actually paid [Carbonell et al., 2008].

2.3.3.2 Issuer

The Issuer is the financial organization that issues the validity of the payment. It is the customer's bank and the responsible for the alleged account. Afterwards it transfers the respective funds to the Acquirer [Carbonell et al., 2008].

2.3.3.3 Payment Service Provider (PSP)

PSP is the pivot element in payment flow. It is a company that enables the connection between the Merchant and the other market entities, the Issuer and the Acquirer [Sellxed, 2016]. Primarily the Provider is the responsible for processing the payment, on behalf of the Merchant and then to communicate with the Issuer obtaining response about the Merchant payment authorization request. If this authorization is successful it is then forwarded to the Acquirer (financial entity responsible to communicate with the customer bank - Issuer)[Carbonell et al., 2008].

PSP became a cornerstone of the payment flow because it allowed Merchant to capitalize main business issues like Risk Management, Reporting or even Fraud Protection, all provided as services by the Provider. Furthermore, it relieved Merchants from the strict safety requirement issues from the card industry[Sellxed, 2016].

The Provider usually integrates a wide range of payment methods (debit and credit cards, bank payment, e-banking or e-wallet) and offers the possibility to work with multiple currencies which

can be used as a competitive advantage. There is no strict bound to any Acquirer which permits the integration with multinational payment methods in only one provide [Sellxed, 2016].

The relevance of the PSP does not end here. Banks have normally conservative standards for merchants in terms of age in the business, level of capital, past credit record with vendors and other business viability measures. Many new and small companies had trouble to cope with these demand requirements and were forced to accepting only cash. The PSP's brought the opportunity of being themselves to represent the firm in the bankcard payment system. It's the natural best option for brand new start-ups[Kossler, 2013]. With the growth of the small firms and with the respective higher sales volumes, PSP usually keep processing the company payments, allowing simultaneously the transition for the company to behave as a full merchant in a direct relationship with Acquirer [Kossler, 2013].

[Abdellaoui et al., 2011] notes that, in absence of a PSP in the system, the online shop must incorporate the payment functions directly in the platform. The merchant must guarantee a high level of security, ability to manage fraud and technology capacity to handle all the transactions and the PCI compliance must be assured. Most online businesses with this traditional payment system, must use Payment Gateways.

A Payment Gateway authenticates and routes payment details in an extremely secure environment between various parties and related banks. The Payment Gateway functions in essence as an encrypted channel, which securely passes transaction details from the buyer's Personal Computer to banks for authorisation and approval. By handling the two key parts of credit card processing, authorization and payment settlement, the Payment Gateway is the key link in an online transaction. These kind of software and servers allow the Merchant to process credit cards, otherwise it would be not possible. In case of the use of a PSP, a Payment Gateway is already integrated in the service provided [Gulati and Srivastava, 2007] [Lowry et al., 2006].

2.3.3.4 Acquirer

It is defined as the financial institution of the Merchant. The Acquirer is the main responsible to communicate with the Issuer and to assess the validity of the requested payment. It communicates directly with the Provider which in turn informs the Merchant [Carbonell et al., 2008]. It has a buffer function which enables the protection of the Merchant from having to deal with constantly changing legislation, card schemes, among other issues [Sellxed, 2016]. In some markets, Acquirer could be confused with Payment Processor. Payment Processors enable Merchants to receive credit card payments online by providing a connection to an acquiring bank. These are the interface that in reality process the transaction with the card networks and Issuers. Processors are held to standards and regulations organized by credit card associations. In many cases the acquiring bank is already the Payment Processor [2Checkout, 2016].

For card networks such Visa and Mastercard, the Merchant Acquirer is defined as the member financial institution responsible for its merchant-customers' transactions with the network. It is important to note that it is the network member financial institution that is ultimately responsible for the underlying transactions, issued through the customers member financial institutions. The

common name for this model is four-party card schemes. Other card networks involve other acquiring models. Most significant among these are American Express and Discover which are not based on a bank-member structure but operate as independent entities. As such, they maintain the contract relationship with cardholders as issuers and similar direct relationships with the Merchant that accepts their cards as Acquirers. In other words, Discover and American Express play two roles: Merchant-Acquirer and payment network. These are called third-party card schemes [Kjos, 2007] [Liu et al., 2010].

However, not all payment systems work with a traditional Acquirer with a Merchant account. Internet Merchant accounts can be hard to obtain. This is because of increased security risks as no signatures are involved, nor is a card physically presented at the point of sale. Another option may be to use a Third Party Processor, which is basically a Payment Gateway and Merchant account rolled into one. A Third Party credit card Processor is a company that accepts credit card orders on behalf of other online businesses [VPSource, 2016]. It lets Merchant accepting online payments without a merchant account their own. Instead, they let Merchants use the Payment Processor account under their own terms of service, usually with very little setup required [Shopify, 2016].

2.3.3.5 Card Networks

Credit card networks provide all the credit cards for the banks as well as other products and can be classified as two types: proprietary and open networks. Proprietary networks, such as American Express and Discover, operate as Issuer, Acquirer, and network operator. Open networks are comprised of member banks that can be Issuers, Acquirers or both. The main purpose of these organizations is to meet the needs of their members by providing a set of rules, underlying infrastructure, and some level of research and development to improve their networks [Chakravorti, 2003]. According to [Mead et al., 2011], based on debit and credit card purchase volume in 2010, Visa maintained about 57% of the market, followed by MasterCard at 25%, American Express at 15%, and Discover at 3%. In other words, all credit and signature debit card transactions are routed through one of the four major card networks. For the majority of card transactions, those involving the Visa and MasterCard networks, four parties are involved: the Consumer, Merchant, Issuers and Acquirers. The latter is an institution that provides card payment processing services, for which it charges the Merchant.

Processing Fees

In a bank credit card transaction, the network collects a switch fee (or card scheme fee) from the acquirer and the issuer. The acquirer charges the merchant a Merchant discount (markup), which is the difference between the face value of the transaction and the amount the acquirer transfers to the merchant [Prager et al., 2009]. When the Issuer and Acquirer are different, the acquirer pays the issuer an interchange fee, set collectively by the banks that belong to the system. In recent years, interchange fees in the Visa and MasterCard systems have averaged between one and two percent of transaction value [Schmalensee, 2002]. An interchange fee is one way to ensure that network participants are able to recover their costs. Even though consumers do not directly

pay the interchange fee, it often affects the cost and benefits of using a payment card [Hunt, 2003].

Chargebacks

After a sale, some problems can occur with the card holder that can result in retrievals and chargebacks. Chargebacks represent a reversal of a purchase and can occur when the client does not recognize a purchase on his card statement. The reasons can be many and include a deliberate or inadvertent violation of the card acceptance rules by the Merchant, like a fraudulent transaction accepted by the merchant. There are some grey areas difficult to dispute like cards used by family members without permission. There are always space for disputing the chargeback by the Merchant and the final result will decide if the chargeback is reversed or not. Payment system participants take chargebacks very seriously. There are extensive rules and regulations pertaining to chargebacks that Acquirers and Merchants must follow. Programs rapidly identify Merchants that do not properly process sales or respond to disputes [Kossler, 2013].

2.4 BIN-based Payment Workflow Optimization Solutions

BIN

A Bank Identification Number (BIN) is the first sequence in a payment card number (4-6 digits) and is used to identify the card's issuer. It is also known as Issuer Identification Number due to the rising weight of non-bank institutions like American Express. It identifies the bank which issued the particular card and it is a great help to the Merchants identifying the issuing bank [Chargebacktech, 2016].

The anatomy of the card number permits to retrieve some useful information. The first digit (Major Industry Identifier) identifies the industry that issued the card, the two digits (the MII plus one) identify the brand (Visa - 4*; American Express - 35 or 37; Diners - 36; Mastercard - 51 or 55). These combined with two or four more digits identify the bank. The remaining numbers are the account identification number [Chargebacktech, 2016].

The optimization of payment systems based on BIN routing are not common and they are still little explored in this scientific area. However there are some examples with interesting approaches which can be a good starting point to this project:

Implementing a global acquiring strategy with country approach

[Dunn, 2012] states that global online Merchants need to take into account country specificities related to card acquiring, such as domestic regulations or national payments infrastructure, that can have a direct influence on authorization rates and therefore on conversion rates. The online Merchants have only two main options for card acquiring: to utilize local acquiring or to utilize international acquiring (multi-national acquiring license). In some countries like Brazil, France and India, adopting a local acquiring approach will have a positive impact on authorization rates.

State of the Art

It proposes a solution with five main key components: Global Visa and Mastercard acquiring license increasing the granularity of the refusal reasons available; Local licenses for domestic schemes in some countries like France where there is a local card scheme (Cart Bancaire) with the assumption that authorisation rate decreases with Acquirers with international licenses instead of local; Partnerships with domestic Acquirers because in selected countries, based on bin identification, processing with local Acquirers leads to higher authorisation rates; Multi-Acquirer with the transactions declined in one Acquirer being resent to another Acquirer set up in the model; One-stop shop contract with Provider which is based on establishing a unique partnership with one Provider in order to benefit from the integration, reporting and a unique technology platform [Dunn, 2012].

BIN Routing for payment processing

[Fernandez, 2009] presents a BIN routing method that includes receiving a proposed transaction as payment for a purchase from a Merchant at a card processing terminal configured to identify a cardnumber and then routing the transaction to the determined financial institution related to the BIN. The method provides transaction optimization for payment processing and the criteria for the optimization should be defined by the Merchant. The optimization criteria is mapped to the data required and the Merchant is responsible to provide all the information through the card processing terminal.

BIN routing optimization module can select a one bank from the 140 banks available to receive the transaction according to a BIN identified for the card. Similarly, cash management optimization module can route the transaction to a particular one of the banks according to pre-specified preferential banking relationships. In this regard, the Merchant can determine which transactions are routed to which of the banks based on defined parameters, including Merchant or Customer identification, device type used to process the transaction, product type (Visa, Mastercard, credit card, debit card) or currency [Fernandez, 2009].

These models help to understand what has been done in this kind of payment optimization and will serve as term of comparison in some cases.

Chapter 3

Current Workflow Structure

The following chapter serves to demonstrate what are the most relevant processes in the company that directly or indirectly affect the payment procedure.

Firstly a quick overview of the order processing system will be given. Afterward the focus will be the whole payment system with a detailed description of all entities involved and the most important process steps emphasizing the most critical points with potential to be improved. Afterwards, the multi layer decision process is clarified with the relevant variables in each step. Lastly, it is given a quick overview on the relevant performance indicators and the way they are calculated which will be crucial for the analyses of the following chapter.

Order Processing

The order processing is triggered when the customer confirms the order placement in the website portal. The order must contemplate one or more items added to the shopping bag. Until the confirmation page the client must fill all required fields like shipping details and payment details. Shipping details include the desired delivery address that should be error free to avoid operational problems in the following processes. Concerning payment details, the payment method needs to be chosen as well as the method correspondent details (card number and security code in credit card method) must be introduced. A bad data entry can result in a payment failure by customer issue.

As soon as an order is placed the system creates a Portal Order code identifying it. At the same time, for each group of articles from different boutiques is created a Boutique Order code. Each Boutique Order code is processed independently though the different steps but, in the end, all must be aggregated again under one single Portal Order and delivered at the same time to the customer.

All the order processing steps are quickly described below:

Step 1 - Check Stock

Current Workflow Structure

In this step the boutique is responsible for checking if the product is still physically available in the store. It may happen that the customer buys something in the portal that was already bought in the physical store and because the boutique did not update the item status or due to a lack of synchronization it becomes a problem of No Stock.

Step 2 - Approve Payment

This step purpose is to evaluate the customer and order details and assess the degree of trustworthiness each order deserves. The Fraud team manages this step entirely and approves or rejects the orders following a group of standard procedures and indicators. If there are suspects of fraud there are two options: the order is immediately rejected or further investigation is made and more supporting documents are requested to the client.

To avoid the embarrassment of having to contact the client informing the inability to deliver an item already bought this step aims to happen, as far as possible, in parallel with Step 1.

There are a percentage of orders automatically approved or rejected based on the history of the customers using a system of coloured flags. These flags are clusters of customers with different probabilities varying from very good customers to historically fraudulent customers.

Step 3 - Decide Packaging

Once the order passes by step 1 and 2, the boutique chooses the packaging in which each item will be delivered to the client. The boxes are designed by Farfetch and are stored directly in each partner boutique. The boutiques can personalize each box to improve the customer experience.

Step 4 - Create Shipping Label

Step 4 is most of the times an automatic step. This step consists of the creation of the airwaybill (AWB) which is the transport document that is fundamental to the courier provider to deliver correctly the package to the customer.

Sometimes this process cannot be automatic due to various mistakes that go from misspelling of shipping addresses to duplicate AWB. The Delivery Team present in Portugal, United States, Brazil and Japan's offices are responsible for this step.

Step 5 - Send Parcel

After the package is ready to be sent, it awaits in this step to be picked up by the courier. In boutiques with many sales the pick up is made daily. The others need to manually schedule pick up using Farfetch managing tools.

Step 6 - In transit

The parcel remains in transit from the moment that it is picked up until the exact moment the package is delivered to the final customer. As soon as the parcel is registered by the courier, it is sent an e-mail to the customer with a link to track the order.

Current Workflow Structure

Should something go wrong during this process it is possible to create a RTO (Return to Origin) where the process is inverted and the package returns to the boutique. This could happen if the parcel is held at customs or if during the process it is cancelled by several motives.

The whole order processing system is visually described in Figure 3.1:



Figure 3.1: Order Processing Steps

3.1 Payment System

The payment process is a crucial step both for customers and Farfetch. For the most part it is what separates the ability of the customer to place an order. It is then extremely important to assess each relevant element in the process and decide what can be made to improve customer experience and Farfetch's success.

3.1.1 Payment Methods

Currently, the breadth of payment methods offered to the customer is very diverse and complete with a growing trend. The most common and global methods are credit card payments followed by Paypal. However the vicissitudes of some markets required the flexibility to innovate and to bring new solutions. Therefore local payments were introduced in some specific but very important markets like Brazil and China. Others were introduced due to its popularity in German speaking countries and Netherlands.

3.1.1.1 Credit Cards

The credit card payment method is the most common payment method used at Farfetch, representing almost 80% of all transactions made in the last 4 years without any significant decreasing trend, even with the new local payments introduced more recently. This method is globally used because it groups, in the same integrated system, countless financial institutions and card networks providing a comfortable payment method to any user. The payment methods evolution in the last 4 years can be checked in Figure 3.2.

From the customer perspective, this payment method is triggered as soon as the customer chooses this option in the portal payment page (when making the checkout) and introduces the card details: card number, cardholder name and security code. When the customer tries to conclude the transaction, he only sees two final results: Success or Failure.

Current Workflow Structure

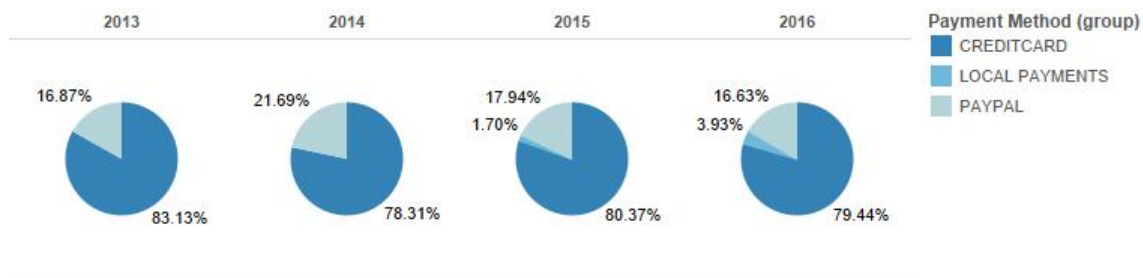


Figure 3.2: Weight of the different Payment Methods in Farfetch in the last years

On the other hand, in the background processes, in a time frame of a few seconds, many entities are involved, even more messages are transmitted, authentication and fraud verification need to happen and bureaucracy is always present. It is then relevant to explore how Farfetch has built its credit card payment system.

3.1.1.2 Paypal

Paypal is the second payment method mostly used in Farfetch purchases. This method differs from credit cards by working itself as a Third Party Payment Processor. This method allows the Customer to directly transfer electronic funds to the vendor, from a Paypal account, operating as an intermediate between Merchant and Customer, in the exchange of a fee. It is a global business that is present in most of the countries and is recognized as one of the most reliable payment methods.

In Farfetch, Paypal has revealed to be an important strategic asset representing a value close to 17% of all transactions and representing a group of Customers who still do not rely on the credit card system and looks for another reliable and quick method of making online payments. As most of the times the Customer has his own account where the funds are managed by him it becomes more appealing to this certain group. One of the most relevant features in Farfetch is the possibility for the Customer paying with Paypal to save his details in the system in such a way that allow the next payment to be quicker. It is called the billing agreement.

3.1.1.3 Local Payments

Local Payments are payment methods only available in particular countries. Mostly these methods were developed based on the singularities of each market and some of them reached to high levels of popularity and started to compete strongly with the other payment methods. Therefore it became important to provide these methods to the countries in the respective countries. A brief description of each one it is given in Appendix A.

3.1.2 Payment System Architecture

Farfetch credit card payment system has suffered several mutations since the company was created a few years ago. Currently, the existing model includes 4 major entities: The Merchant (Farfetch), the main Payment System Provider, the Merchant's Acquirer and all the issuing banks representing the final Customer.

The system is not universal. Some variations were introduced to improve efficiency and to remove recurrent problems that the company was facing in some markets. Thus the system was divided in three main divisions: United States, Europe and Rest of the World (includes Asia) and Brazil. This division is made based on the shipping country of an order, i.e., accordingly to the country where the order will be delivered. Each division process will be described shortly.

3.1.2.1 Europe and Rest of the World (EU & ROW)

From the three divisions this is the one that has the widest geographic coverage, being the most common process.

It is the simplest process because the main PSP P-A has an integrated solution for payment processing and works also as an Acquirer (A-A). Therefore despite having two different institutions as Provider and Acquirer, the same institution delivers both tasks. This solution reduces communication problems and removes the bureaucracy and inefficiency between the process elements.

Regarding the process itself. As Provider A is an integrated solution it works also as gateway for the payment, sending it automatically to the Processor. From this moment on, the Acquirer (Payment Processor in this case) is responsible to interact with the Issuer (the customer bank) in order to proceed with the Customer details verification. The last step is to inform if the information given checks and the transaction could be accepted.

3.1.2.2 United States

Payment processes can reveal themselves to be very bureaucratic. The American Banking market is a very selective and singular one. The system is composed by their own rules that most of the times are quite different from the rest of the world. In many cases this results in incompatibilities hard to overcome when it comes to accepting a transaction.

The US market is currently the biggest and most important market for the company, representing circa 30% of sales volume. Due to this incontestable importance and for the reasons stated before the system was built to include the US division.

The most relevant difference from the first model is the introduction of an American Acquirer. Maintaining the same Provider (P-A), there are now two separate entities as Provider and Acquirer. Having an American Acquirer fully established and in accordance with the specific market rules it became easier to communicate with Issuers and for them to provide a higher rate of transactions authorisation. For this model the Acquirer chosen was A-B.

3.1.2.3 Brazil

Brazil is even a more specific and complex market than the United States. The way payment systems work in this country is particularly different and it has some very characteristic rules that many times prevent from doing business with Brazilian Customers.

Another singularity is the allowance of paying with installments. Installments are multi-staged payments that permit Customer not to pay the full amount at once. This is a very common procedure in Brazil but not accepted worldwide.

In order to be able to explore this market's potential, a third payment system division was created for Brazil. This system is adapted to the requirements allowing installments. Its structure is quite similar to the United States having the same main Provider (P-A) but a different Brazilian Acquirer already used to lead with installments and other market issues. More recently, with the final objective of a better integration with the Provider, the Acquirer A-OBR was changed to A-C.

3.1.2.4 Fallback

The common point linking these three structural divisions is the main provider: A. However, depending on only one provider for the whole structure carries some major risks. First of all, having one institution managing such huge amount of data could put the Merchant in a vulnerable position. Secondly, in case of system failure or any other kind of problem of the main Provider becomes impossible to process any payment transaction.

Therefore Farfetch decided to build a background Fallback model. The concept of this model is to use other providers and Acquirers to process transactions that did not go through the main system. Thereby the dependency on the main flow can be reduced and the ability to process the payment orders emerges strengthened.

Concerning this structure, there are three different options to the three divisions. For EU & ROW the PSP used is P-FEU together with A-FEU as Acquirer. For United States the model is the same with P-FUS as PSP and A-FUS as Acquirer. For Brazil the PSP is P-FBR and the Acquirer is A-FBR.

3.1.2.5 AMEX Parallel Flow

Within the existing card networks available (Visa, Mastercard, Discover,...) there is one special case that has structural implications in what concerns the payment workflow. This card network is American Express. Besides working as one of the main card networks, it is also a big financial institution. As a financial institution, American Express (AMEX) can work as an integrated Acquirer-Issuer, working in a three party card scheme. Therefore, when card type is American Express the process changes drastically: the initial role of the PSP keeps the same and what changes is that American Express manages the rest of the acquiring process by itself.

For these reasons, the AMEX workflow is considered as being in parallel and not connected directly to the general creditcard workflow presented in this project. This special case diverges in a great extension from the scope of the study and so it will be skipped during the rest of the

Current Workflow Structure

dissertation.

After a detailed description of the whole payment process structure, the schematic Figure 3.3 summarizes all divisions synthetically.

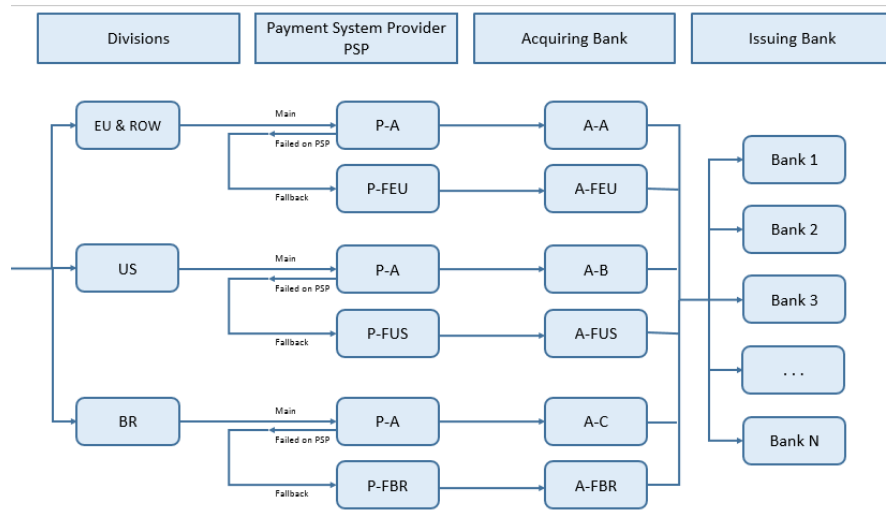


Figure 3.3: Current payment workflow at Farfetch

3.1.3 Multilayer decision

One of the key aspects of the payment workflow is how to decide to which flow division must forward each transaction be forwarded. As before, the decision process is not simple and, in this case, it involves more than one layer decision.

3.1.3.1 Currency

The first and most important is the currency layer. Each Acquirer only processes a defined quantity of currencies. Currently, Farfetch allows customers to pay in 11 different currencies: GBP, USD, EUR, BRL, AUD, CAD, SGD, HKD, KRW, CHF, RUB. The currency is a static variable and automatically determined by the shipping details inserted by the customer (if the shipping indicates United States the currency must be USD. On the other hand, if the shipping country is France the currency paid must be EUR).

The Acquirer B, responsible for US market, only processes USD and the Brazilian one, C, only BRL. The Acquirer for the rest of the world, A, processes all the other currencies (including USD) with the respective conversion fees (rates, taxes). With these restrictions, the first layer already decides that each transaction in BRL goes through Brazilian division and each transaction in a currency different from USD has to go through the EU & ROW division. As for USD transactions, there is another decision step to determine which flow is most suitable.

Current Workflow Structure

3.1.3.2 Billing/Shipping

The second layer is the billing address. Billing address is the address that each customer introduces in order to verify the validity of card details. The problem is that clients can type anything they want which sometimes results in matching errors due to wrong inserted information. However, this was the most practical way to find the card origin country and to define the best payment flow.

The billing decision consisted in based on the card country information, introduced by the customer, choosing the most suitable division. As only USD transactions were subjected to this second decision step, all transactions from American cards would go to the US division while the others would go to the EU & RoW division.

Nevertheless, the appearance of the local payments required a remodeling of this layer. The local payments can only be shown as options for the available countries. So, for countries like China, Germany or Netherlands, as soon as shipping details are introduced, payment options are filtered for the available payment methods. Therefore the system was changed in this layer to attend only to the shipping country.

In terms of process decision it remains exactly the same, only changing the criterion from directing the transaction through the bank country criterion (billing) to forwarding it through the shipping country. The consequences of this criterion is that in cases that the shipping country differs from the acquiring bank country (characteristic of the flow) it decreases the efficiency of the flow and it has impacts on the transactions success as will be demonstrated in the next chapter.

The described multilayer decision system is presented in Figure 3.4.

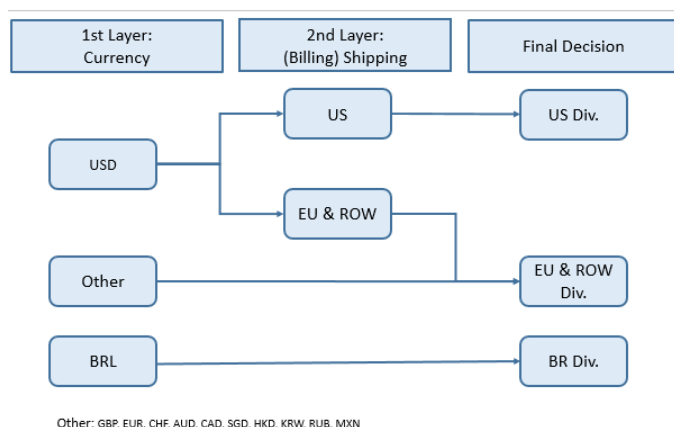


Figure 3.4: Multilayer payment workflow decision system

For evaluating the payment system behaviour and its performance in the company results, it is crucial to have very clear and pertinent metrics. Farfetch assigns the highest significance to the metric Authorisation rate, being the most monitored metric in the area.

3.1.4 Payment Authorisation

Every payment attempt is accepted or rejected. This information must be given as a response from the provider where the transaction was previously directed. Besides this essential information, it is also given the standardized reason why the transaction essentially failed. In the scope of this project, this is the most relevant information because the amount of transactions accepted or rejected end up to be the key variables.

Thereby for evaluating the payment system behaviour and its performance in the company results, it is crucial to have very clear and pertinent metric about authorisation performance. This metric is Authorisation Rate (AR) and roughly indicates the percentage of transactions which have been successfully approved by the system. It is calculated by dividing the number of successes by the number of attempts.

However every attempt can be rejected based on several reasons. There are around 300 different reasons that could trace the root cause to many different sources. The closer the relation between the Merchant and the Provider and the highest the degree of integration between the entities, the more details are given in the responses. These responses are fundamental to understand why did the transaction failed and who is the main responsible for it: the Customer, the Merchant or the Issuer/Acquirer.

The most common reasons come from Issuer Banks that simply do not allow the transaction to be successful. But for the other cases many fail only because the customers commit errors typing information, have problems with the card validity or have lack of funds. Other reasons could be related with fraud suspicions from the system, which have a considerable weight, or even Merchant giving wrong information in transaction details or simply system errors.

For assessing where are the major flaws and the elements to improve in the established payment systems it is necessary to filter the real motives why the transaction is being rejected. In this case, the most important reasons and the ones that have relevant impact are directly linked with the issuer forbidding the payment.

Understanding the authorisation rate and its relevance for the payment system performance is fundamental but screening all the main refusal reasons and complement metrics with this information becomes the cornerstone of a correct analysis. So a new adapted and modified authorisation rate metric is calculated in the company analysis. This is based on the same principle of calculating the ratio of authorised transactions but now excluding all transactions which are not directly linked to a Issuer refusal. The refusal reasons mapping and this metric construction is demonstrated in the next chapter.

The authorisation rate evolution since the last years for credit card payments is given in the Figure 3.5. The overall authorisation rate performance is 75% and with a stable trend during the years which is not sufficiently good. However attending to the metric calculated only with issuer reasons the numbers are higher, close to 85% but still with a good margin to improve. In the next chapter the method for studying these indicators will be presented to further understand the situation.

Current Workflow Structure

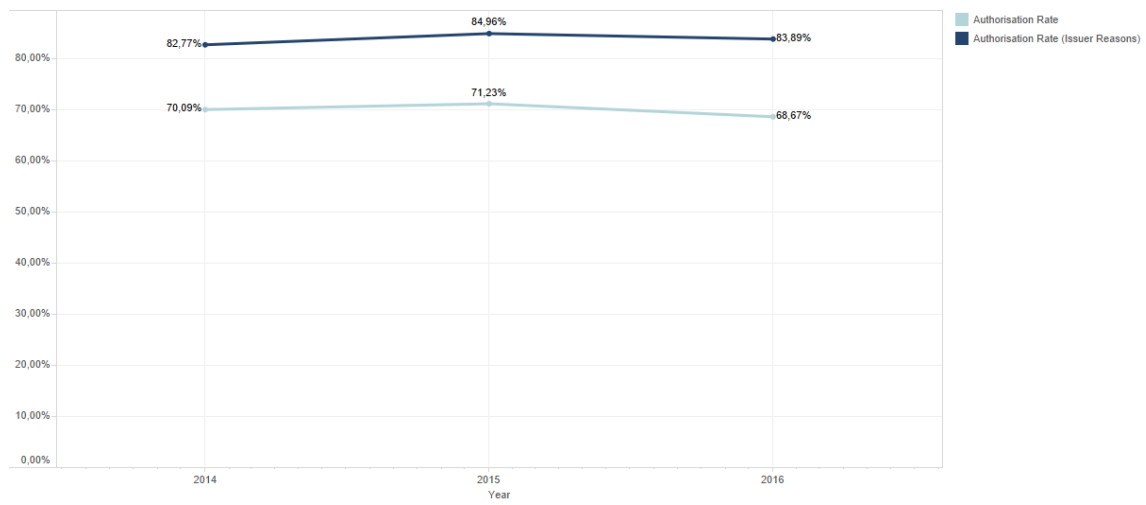


Figure 3.5: Authorisation Rate evolution - two calculation methods

Chapter 4

Data Collection and Analysis

The next phase will focus initially on the necessary steps to improve the available data to allow an accurate analysis and after in the actual diagnose identifying which major points of the system could be enhanced. The principal hypothesis for the system reformulation was to change the multilayer decision to a BIN criterion decision. BINs allow to associate each transaction cardnumber to the respective Issuer.

With that in mind, several procedures emerged in order to assess its viability. The initial phase starts by the study of the company database of BINs, its reliability and the correspondent coverage of the historical transactions. Then the next phase consists of having a clear mapping by main groups of the usual refusal reasons. In the third phase, the two main markets (United States and United Kingdom) will be subject to evaluation in which concerns the authorisation rate performance. Here crossing information with both databases previously referred allows having information on the granularly of issuing banks and bank countries. Arriving at this point, it becomes possible to draw the first conclusions where things can be restructured and measuring the gains and costs of each solution.

4.1 BIN Assessment

As explained before BIN (Bank Identification Number) is the six first numbers of a credit/debit card. This number identifies the bank name as well as the type and country. However this information is not free. Globally there are a huge amount of cards referring to inumerous banks and entities. Moreover not every institution or country is open to easily deliver their information to the system thus making this collection of information a extremely hard task.

For these reasons, there are professional institutions dedicated to managing and retrieving banks and cards information, building therefore complete databases available for purchase. Farfetch, due to the key role of the payment system, has large interest on having information of where are its transactions from and bought a database in the beginning of the company activity.

Although it had some use to the company, this database was never a key asset for the business operational activities. Furthermore currently it is estimated that the database is outdated. Firstly,

Data Collection and Analysis

a quick assessment of the quantity of valid card numbers in Farfetch possession must be done. Looking through all transactions since 2015 until the end of May 2016 there were some interesting results regarding card number information. They are discriminated in Table 4.1.

Table 4.1: Card Numbers Coverage

Card Number	531.664	90.51%
Only Token	52.161	8.88%
Typing Error	3.580	0,61%
Total	587.405	

The most standing out conclusion is the significant amount of transactions without card number, accounting for 8,88% of all transactions. This happens in token usage cases. A token is a unique number created as soon as the client introduces card details and requests the system for saving the data in order not to repeat the process in a next occasion. So, for each time a recurring token is used, only that number stays registered in the system, becoming the only information the company has on the customer payment details. This happens due to the dependency on the provider that manages all the information and only transmits partial details, letting the company sometimes in a difficult situation.

Nevertheless, it is possible to recover part of this information. Having as conceptual basis that every token was once created with the whole card information, every current token record must be associated with the data from its first appearance in past transactions. This task could be done with a simple query that generated the results from Table 4.2:

Table 4.2: Card Number Coverage - After Token Recovery

Card Number	549.697	93,58%
Only Token	34.007	5.79%
Typing Error	3.701	0,63%
Total	516.243	

Firstly it is notorious the task success. It was accomplished a good reduction of the absence of card information in token cases, recovering 18 thousand card numbers (from 8,88% to 5,79%). Nevertheless, the number of typing errors increased. This happened because some of the card numbers recovered from tokens were already misspelled and thus, useless in which data validity concerns.

Looking to all transactions in the studied period and matching the cardnumbers with the bin database in the company possession it is possible to distinguish the following groups: Entries with correspondence, without card number information, without readable card number due to typing errors or simply with no bin correspondence.

Besides these groups it is necessary to take a closer look at the bin matching entries. Within this group there must be a separation between the ones with information of the bank name and

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the others. This happens because bin database has near half the entries without any details about the name of the bank but only the country origin and card type. The Table 4.3 shows the relevant numbers obtained for the identified groups.

Table 4.3: BIN Match Assessment

Match	BIN match & bank name	488.393	83,14%	93,50%
	Only BIN match	60.856	10,36%	
No Match	No BIN match	448	0,08%	0,08%
No Card Info	Only Token	34.007	5,79%	6,42%
	Typing Errors	3.071	0,63%	
Total		587.405		

The most meaningful indicator is the percentage of transactions with bank name covered, 83,14% is good but with a large improvement margin. Going to a second indicator it is easily observed the extraordinary low weight of transactions with no BIN match, 0,08%. This shows that the problem is not definitely here. Finally, the total percentage of BIN match is very high 93,50% and most of the non matching are related to lack of card valid numbers. Nevertheless there are 10% of BIN matches with no information on the bank name which is crucial to future analyses.

Observing the current database, there are 123.021 distinct BIN entries and 783 duplicate values (the same BIN makes reference to two different institutions). From these last ones can one assume as errors. About the distinct values a simple gauging test was made assessing the quality of the information. With a sample of 100 values randomly chosen, they were check in several databases online. The test resulted in 90% of correct entries.

With these results as background, the next step is evaluating the necessity of acquiring a new larger and more updated BIN database. Thereby a specialized BIN database company was chosen based on a sample test of 100 unknown records with a retrieved result of 96% entries. The huge necessity of developing projects around BIN information, allied to the results enunciated before led to the acquisition of a new database. Having the new product is necessary now to test which are the results. In Table 4.4 it is possible to verify its success.

Table 4.4: BIN Match assessment - New Database

Match	BIN match & bank name	548.178	93,32%	93,53%
	Only BIN match	1.205	0,21%	
No Match	No BIN match	314	0,05%	0,05%
No Card Info	Only Token	34.007	5,79%	6,42%
	Typing Errors	3.701	0,63%	
Total		587.405		

The new database results were impressive. The best result was the possibility of shrinking the

BIN match without bank information to a residual number of 0,21%. Even the no BIN match at all was reduced to 0,54%. It became possible to observe that almost 99,8% of all valid card numbers are now covered by the new BIN database.

With this stage complete, a more complete analysis on the payment system could be provided. Before this analysis, a closer look to the refusal reasons structure is given in the next chapter.

4.2 Mapping of Refusal Reasons

The importance of the payment refusal reasons was already mentioned in the previous chapter. Indeed these play an essential part on the payment data collection. This kind of information permits the company to have a further insight on the behaviour of each transaction. However these reasons can be widely divergent and difficult to understand. Therefore creating a defined and clear structure of a few main groups became indispensable. The refusal reasons mapping was built in five main categories: Customer Issues, Fraud Issues, Company Issues, Unknown Errors and Issuer Responses.

Customer Issues

This group includes all the motives that resulted from customer problems. They can be *invalid card details, expired cards, insufficient funds* or *credit limits already surpassed*. Having this particular group defined is extremely useful. It allows to cluster transactions which are being lost not for directly company fault but for mistakes made by customers. Therefore it is possible to understand which profit could the company obtain for shielding the customer interface against simple errors.

Fraud Issues

Fraud is one of the most particular and relevant issues in e-commerce. There are a dedicated team evaluating potential fraud customers. However, as part of the service, the Provider has its own fraud detection system (sometimes fallible) providing the Merchant with refusals due to these kind of reasons. Thus this group becomes a clear and static one having the respective reasons being well-defined. These can go from simply *Fraud*, to *Stolen Card*, *Pick-up card* and *Blocked card*

Farfetch Issues

Company issues essentially concerns questions that could be considered as result of some internal process failure. In order processing there are many details inserted by the customer and validated by company operational agents which are then forwarded to the payment processes agents. Sometimes there are incompatibilities that make the transaction being refused. Some of them are included in this group such as *Unsupported currency*, *Billing address invalid* or *transaction cannot be processed*.

Unknown Issues

Globally this is the most generic group. Here all system errors and unknown reasons or without sufficient information on the problem are included. Some of them are *timeouts*, *internal errors* or *unknown*.

Issuer Response

Here there is the most relevant group for the company and for this project in particular. These reasons are given entirely by the customer bank. Most of the times the information is unclear, due to lack of integration with that part of the process chain and having origin in internal processes of the bank. However these kind of reasons usually indicate the transactions are denied for lack of trust on the transaction and on the entities involved.

This group will be essential in the following analysis because they allow to understand which orders are being rejected by issuer decision that sometimes is related with bureaucratic aspects. The most usual reason is *Do not honour*, *Transaction not allowed* or *Declined*, *contact issue*.

4.2.1 Global Weight

It is also relevant to understand what reasons are the most frequent and have higher impact on lost transactions. Thereby a simple overview of the main refusal reasons groups numbers is presented in the graphic from Figure 4.1.

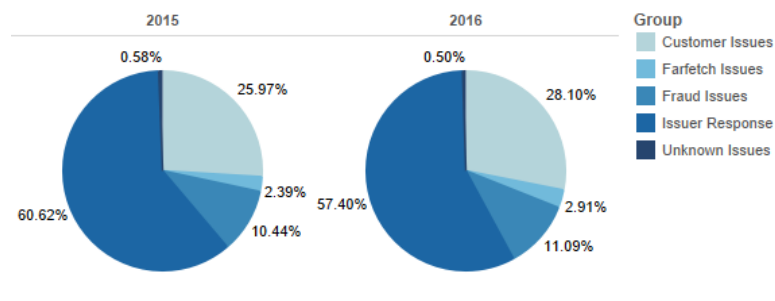


Figure 4.1: Impact of payment refusal reasons by main groups

As can be observed, Issuer responses accounts for almost half the the motives, having the hugest impact. It is followed by Customer issues (28%) which have a significant impact as well as the third: Fraud Issues (11%). Company Issues and Unknown Issues have not sufficient impact on the refused transactions.

4.3 Authorisation Performance Diagnosis

This section describes how the current workflow has behaved in the last year and a half (from 01/01/2015 to 15/06/2016). The main indicator, as explained before, is the authorisation rate. The importance of the analysis is to use the BIN database and refusal reasons mapping to extend the

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level of the detail of the system performance to entities like Issuing banks and the card countries and therefore identifying the major flaw points and which are the best opportunities to improve. Note for the Fallback process that will not be present in the redefinition of the workflow and for that reason its analysis is not done in this chapter but in appendix D.

In this part, the methodology applied consisted in choosing two particular markets to study. The criteria for this choice was firstly the impact of these markets on the company sales volumes and secondly ensuring the choice of two markets with different payment workflows. Thus, the chosen markets were the United States and the United Kingdom. These fulfill the criteria defined: combined represent 40% of Farfetch sales volumes and, for the first, the payment goes through the US division while the British market is included in the Europe and RoW flow. The impact of the main markets on Farfetch sales can be observed in Figure 4.2.

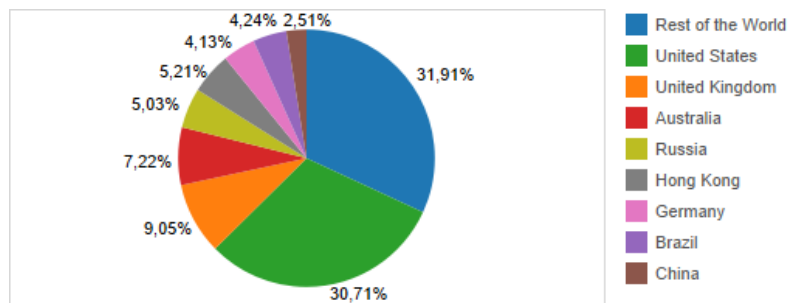


Figure 4.2: Weight of global sales in the most relevant markets

Some features from these two markets must be clarified before proceeding. Attending to the existing layer decision system there are specific currencies for each market: USD for United States and GBP for United Kingdom. Having in mind that the Customer is forced to pay using the currency of the shipping country chosen before, due to system restrictions, it becomes clear that every order shipped to the United States goes through the division where A-B works as an Acquirer and in the case of United Kingdom it goes through the system with the integrated Provider/Acquirer. In practice, what mostly happens in reality is that if the customer has the desire of sending a package to a different country from his own bank account it has two direct consequences: firstly the currency could not be the desired by the customer and from the company perspective it implies sometimes going through undesired workflows and having incompatible entities processing the transaction. This can also happen with customers living in the shipping country indicated but with external accounts in other countries.

One of the main consequences of the system presented above is that the decision criterion does not take in account the importance of a good communication between the entities involved. In the current flow issuing banks from several geographic regions all over the globe discuss transactions completion with Acquirers from a different reality, most of the times with different processing directives which increases the amount of transactions rejected by entities incompatibilities. Nevertheless, this is not only a geographical issue and even with entities (Acquirer - Issuer) from the

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same geographical region and financial system, procedural compatibility and a good relationship have a very significant impact in the success of the carried activities.

In this sense, it is necessary to make the point of situation about these two markets relatively to the metrics established and to explicitly state what are the current results, whether there are good margins to improve and which amount could be gained as revenues with future improvements. Table 4.5 makes a summary of the global results from the last year and a half. The results are divided in US, UK and both markets combined and include the rate of payments authorised (general and only accounting for rejected payments with Issuer response refusal reasons), the amount in GBP settled due to authorised transactions and the correspondent lost revenues due to refused transactions as well as its weight on the total settled amount.

Table 4.5: Summary Table - Current KPI's results and improvement margins

	UNITED KINGDOM	UNITED STATES	BOTH
Authorisation Rate	78,48%	84,31%	82,16%
Authorisation Rate (IR Issues)	82,61%	90,08%	88,71%
Amount Settled	£ 24.312.630	£ 75.550.395	£ 100.039.959
Amount Lost	£ 7.077.116	£ 11.493.118	£ 18.850.452
% Losses	30,04%	15,21%	18,84%

The results show that gross authorisation rate has a large margin to improve. Almost 20% on both cases. However for the project scope this is not a sufficient measure. It is then relevant to take a look to the the rate considering only rejections by the Issuer. In this situation the improvement margin is smaller but also very considerable, having at least 10% to recover. Comparing the two markets combined this represents a settled amount of £100 million while the amount lost was nearly £19 million (representing 18,84% of the settled amount).

However there should be a separate analysis to both markets. UK although represents a smaller portion of sales volumes has lower authorisation rate than US. Therefore there are a larger margin to improve (30%) and to recover great part of the lost amount (£7 million). In US case the margin is lower (15,21%) but represents a bigger amount (£11 million) due to the larger quantities involved in terms of sales.

Concluding, the table shows that despite the authorisation rate performance being satisfactory there are still a good margin susceptible to be enhanced. The size of the amounts lost due are remarkably appealing as well as the prospect of transforming them in future revenues just by rendering the whole process efficient. The objective of further analyses will be to understand where these results are significant and in what way could we take actions.

4.3.1 Authorisation Rate Analysis - Issuing Bank Country

Attending to the inherent inefficiencies of this specific part of the payment system, the first part of the analysis will focus on the country of the issuing bank. Going into further detail, understanding

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whether having foreigner issuing banks communicating with the division Acquirer has any relevant impact on failed transactions is the main goal of this first step.

The analysis is done simultaneously for both markets and a rigorous comparison between them will be also presented in order to check which is the performance of some bank countries in both payment flow divisions. This will permit to draw conclusions on what division is more appropriate for each case.

Table 4.6 starts with an overview of the weight of national and foreign banks on each division transactions National banks have a major impact in the payments processed in the correspondent market which is natural because national banks have a higher incidence in the respective countries. This impact however only considers the number of transactions and not the amount value . With Amount Weight it is visible the weight of national banks in United States is even stronger (each order has a higher value) . On the other hand in United Kingdom case the impact tends to increase to the foreign banks side with an higher average order value.

From now on the weight criterion will be % Amount Weight because it represents the transacted quantities and that is the most important to the company, recovering the maximum possible revenues. Therefore the weight for American market is 84,94% for national banks and 15,06% for foreign banks whereas for British market the weight of national banks is 86,66% and foreign banks 13,34%.

Table 4.6: Summary table describing the performance of both markets and the differences between national and foreign banks

Market	UNITED STATES		UNITED KINGDOM	
	US	Other Countries	UK	Other Countries
Card Country				
Nr of Orders	205.310	41.329	74.051	10.472
Orders Weight	83,24%	16,76%	87,61%	12,39%
AR	85,84%	79,03%	80,14%	71,50%
AR (IR Issues)	90,18%	87,98%	82,81%	81,14%
Amount Settled	£ 68.485.256	£ 12.138.155	£ 21.224.891	£ 3.264.673
Amount Lost	£ 11.128.447	£ 2.033.277	£ 6.238.877	£ 1.118.457
% Amount Weight	84,94%	15,06%	86,66%	13,34 %
AOV	£ 333,57	£ 293,80	£ 286,63	£ 312,07
% Losses	16,25%	16,75%	22,72%	34,26%

About authorisation rate the first conclusion is that in both cases it is higher in the national banks than the foreigners. However, after filtering by Issuer Response issues although the conclusion remains the same, there is a significant lower difference. This states that national banks have more Issuer denial transactions.

As expected the authorisation rate with issuer response reasons is lower in foreign countries banks which turns this point a relevant one to study modifications. Nevertheless, acting on national banks has an increased relevancy by representing an a much higher value.

Concluding, there are specific points with a good margin to get better results. There is a necessity to separate each case and act differently. A final note for foreign countries in United Kingdom

by having the largest improvement margin for lost amount recovery, 34,26% representing an absolute value of £1.12 million.

4.3.1.1 United States

The biggest market is US, as shown before and thus will be the first to be analysed. Regarding the aforementioned division between national and foreign banks the metrics about US banks are already stated in Table 4.6 but a deeper analysis about foreign countries is still missing. The first relevant thing to be identified is which countries have the largest impact in US sales. In order to reduce the large number of existing countries, there was a selection based on the criterion of the top 15 countries with the higher value of processed transactions.

Having the data collected and represented in the Figure 4.3 it is possible to identify one country with a heavy impact on this particular market: China. This country represents 9,5% of all US transactions value which combining with US banks weight goes for 95% of all. As for the remaining countries, all combined only represent 3,73% with the leading countries being Republic of Korea 0,85%, Canada 0,7%, Hong Kong 0,31% and Saudi Arabia 0,21%.

In the graphics presented in Figures 4.4 and 4.5 it is given a visual representation of the settled amounts and the respective lost amounts in refused transactions by issuer, in the top 15 countries previously defined. Firstly a quick note on existing two different graphics. Due to the big difference of weights between China and the other countries a small separation had to be done to allow a clear visualization. Starting by China there is a great amount at stake, more than £8 million. However, as the graphic shows the recoverable amount is not so significant because of the high performance of the authorisation rate in chinese banks. Concerning the remaining countries, the maximum settled amount for the third biggest bank country in this market, Republic of Korea, has only settled £708 thousand followed by Canada with £489 thousand. The difference here is the existence of several cases with prominent recovery margins. Canada, Australia, United Kingdom and Denmark are evident examples where the amount lost has a great weight compared with the settled amount.

Even though figure 4.5 already gives a good idea about what are the critic countries which can be mostly improved it is fundamental to have an overview of the evolution of the authorisation rate in periods studied. This analysis could be checked in B

Summing up, there is a compelling necessity to improve the payments acceptance on American national banks because there is still a good margin to improve and because it results in huge gains for the company. About foreign countries it should be reinforced the outstanding performance of mainly chinese banks but also the other APAC countries. Nevertheless, there should be paid some attention to them due to the significant impact in overall transaction in these markets. About other countries, although they do not represent a relevant impact in the market there are a few identified countries with enormous inefficiencies that should be taken care by the redefinition of the payment workflow.

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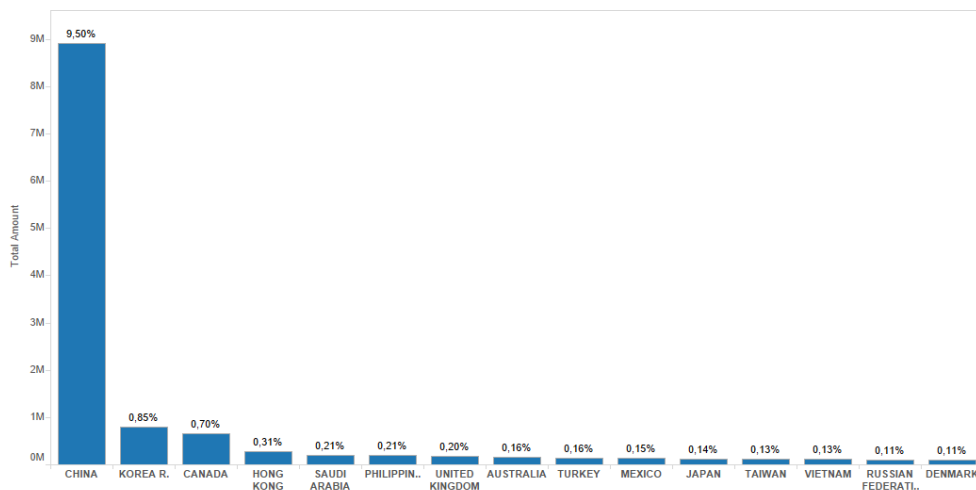


Figure 4.3: Weight of foreign bank countries transactions in US market

4.3.1.2 United Kingdom

United Kingdom is the second most important market for Farfetch, representing approximately 7% of all orders. Proceeding with a very similar analysis as it was done for the US market, the first step is to assess the most relevant bank countries regarding the defined criterion sales volume amount.

After getting the first results for UK, it became perceptible that a quick overview of the weight of bank countries should be done with two separate criteria: number of orders and sales amount value. This explanation is expressed in Appendix C

The first big difference expressed in the figure 4.6 stating the various foreign country weights, is the non-existence of a main dominant country as in the United States. The two countries with a more prominent impact are China and United States with more than 2.4% of all sales amount value. In third place comes Saudi Arabia with more than 0,4% followed by Hong Kong and Russia with almost 0,4%. The graphic also shows many different countries with similar weight in this market not having a significant differentiation.

Attending now to the comparison between the amount settled and lost, in the figure 4.7 for these top 15 countries the major differences are now remarkable. Firstly a note for the values discrepancy from one market to the other. In British market the amount transacted are from a smaller order of magnitude. With this in mind a similar comparison for all countries will be done.

Starting by the two top countries there is a huge difference. China, just like in the US market, keeps a good performance being the amount recoverable not so significant whereas its amount settled ascends to £800 thousand. United States, in contrast, has a large recoverable margin being (£482 thousand) even bigger than the quantity actually settled (£311 thousand). It is then a relevant point for further modifications.

The other countries that attract more attention due to their recoverable margins are Hong Kong, Australia, France or Canada but, in general, it is not so significant. Note for the good performance

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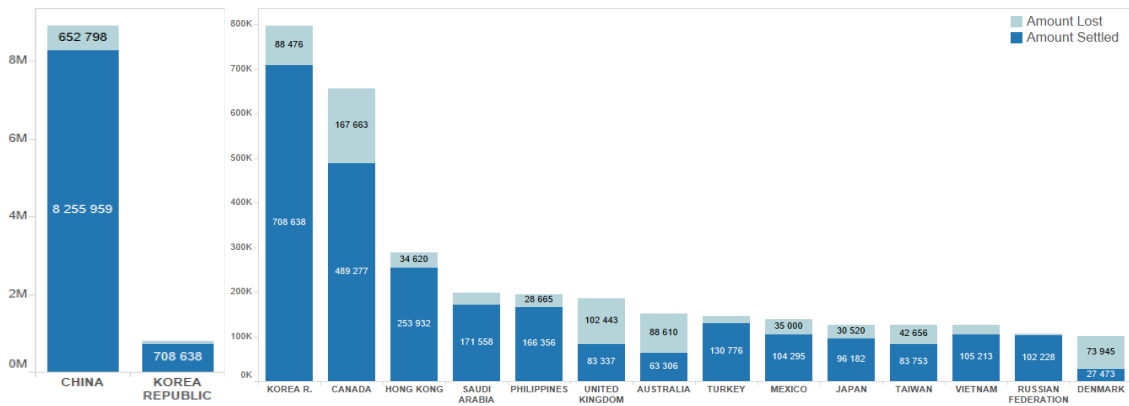


Figure 4.4

Figure 4.5: Amounts Settled/Lost - Other countries - US Market

of countries like Russia, United Arab Emirates or Qatar that settled almost everything.

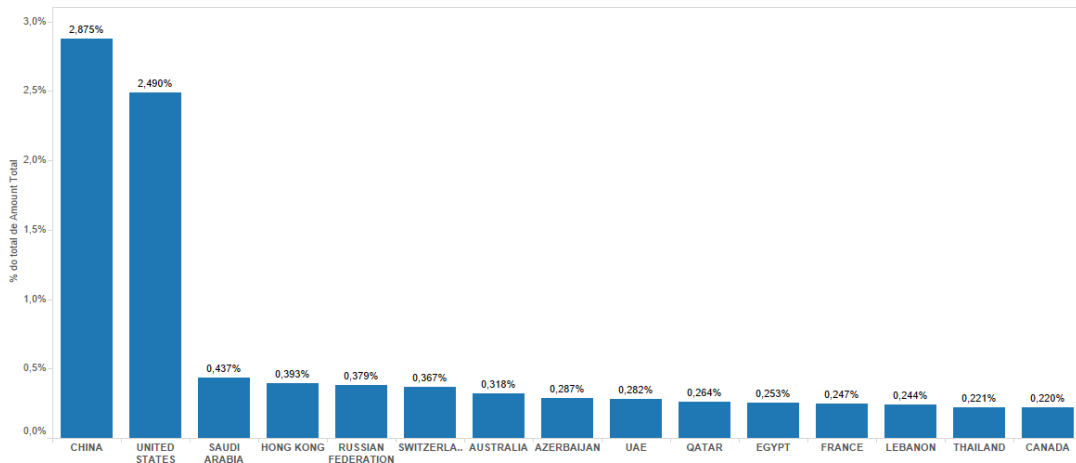


Figure 4.6: Weight of foreign bank countries transactions in UK market

Like in the US analysis, the numbers about the settled and lost amounts are not sufficient. Thus, the authorisation rate (only with issuer rejections) performance must be evaluated for the top 8 countries in Appendix B. Making now a brief overview about this market, the first note goes to the national banks. With a good margin to improvements, almost 18%, and with the majority of sales volume here concentrated, every gain is important to the company. About foreign countries, China and United States are the most relevant countries and cannot be despised but the United States assumes a more crucial role due to its unusual performance. Other countries with good space to enhancement are Saudi Arabia and Hong Kong due to their weight in this market and Australia and Switzerland because of their not so satisfactory performances.

4.3.1.3 Markets Comparison - Bank Countries

In this section a comparison between the two chosen markets is done. Firstly, and for combining the two markets, the total amount (settled + lost) for both was summed. From this point bank

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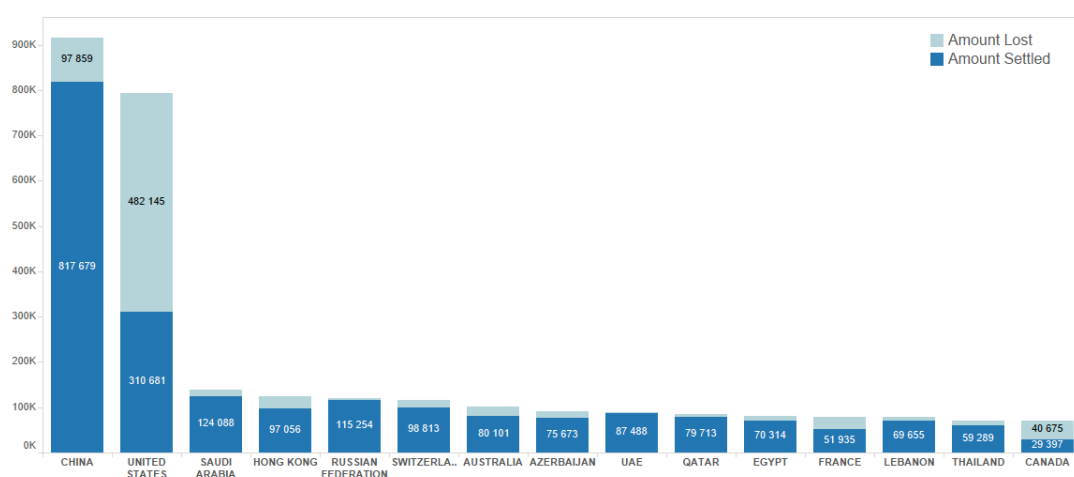


Figure 4.7: Amounts Settled/Lost - Other countries - UK Market

countries were ordered based on this criterion creating a ranking of importance for the combined market.

Here, the AR for US and UK markets are compared. This information is represented in Table C.1. For each bank country the authorisation rate was identified in both markets and the difference was calculated. From this calculation it was possible to get the best division for each market. This represents the flow division where the transactions associated to a particular bank country works better. In the remaining analysis there were only chosen the top 10 countries. In Table 4.8 the comparison is done for each bank in both markets and the market with best performance in each bank is identified.

Table 4.7: AR Comparison between US and UK markets

	Total Amount Both	AR US	AR UK	Difference	Best Division	Best Rate
UNITED STATES	£ 80.406.530	90,18%	40,23%	49,96%	US	90,18%
UNITED KINGDOM	£ 27.649.549	48,38%	82,81%	-34,43%	UK	82,81%
CHINA	£ 9.824.295	94,15%	92,80%	1,35%	US	94,15%
KOREA REPUBLIC	£ 848.510	91,08%	93,55%	-2,47%	UK	93,55%
CANADA	£ 727.012	75,34%	48,68%	26,66%	US	75,34%
HONG KONG	£ 413.571	92,59%	85,98%	6,61%	US	92,59%
SAUDI ARABIA	£ 337.714	88,40%	87,94%	0,45%	US	88,40%
AUSTRALIA	£ 253.286	46,30%	78,38%	-32,08%	UK	78,38%
RUSSIA	£ 226.953	95,57%	94,55%	1,02%	US	95,57%
TURKEY	£ 206.687	85,37%	88,00%	2,63%	US	88,00%

For a good estimation of how much could we gain with this banks working in the suitable division it was necessary to create another metric - ARV (Authorisation Rate Value). This metric calculates the ratio between the amount settled and the total amount (settled + lost). The original AR calculation is based on the number of transactions and not its value. Therefore for estimating

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possible revenues it is not accurate. For that is necessary to make a proportional relation between the ratio of amount settled with the old AR and with the new AR chosen by the best division. Below are the equations that explain how the metric is calculated:

$$ARV = \frac{SettledAmount}{TotalAmount} \quad (4.1)$$

$$ARV_N = \frac{AR_N \times ARV_O}{AR_O S} \quad (4.2)$$

In the Equations 4.1 and 4.2 ARV stands for Authorisation Rate by Value while N and O stand for New and Old. In Table 4.8 this new indicator was calculated for the top 10 countries for both markets. The ARV is calculated with the new AR adopted which is the best in each case between the two markets. That's way the new authorisation rate value (ARVn) is only calculated for the affected division where the hypothetically authorisation rate would be real. The affected divisions could be identified in Table 4.8 being, for each bank, the worst division concerning its performance. To fully understand how the values were obtained, the Appendix E has more detailed information.

Table 4.8: Authorisation Rate Value Calculation for both markets and each bank country

	New AR	ARV - US	Total Amount - US	ARV - UK	Total Amount UK
UNITED STATES	90,18%	86,02%	£ 79.613.704	87,85%	£ 792.826
UNITED KINGDOM	82,81%	76,78%	£ 185.781	77,28%	£ 27.463.768
CHINA	94,15%	92,67%	£ 8.908.757	90,61%	£ 915.538
KOREA REPUBLIC	93,55%	91,31%	£ 797.114	92,54%	£ 51.395
CANADA	75,34%	74,48%	£ 656.940	64,93%	£ 70.072
HONG KONG	92,59%	88,00%	£ 288.553	83,60%	£ 125.018
SAUDI ARABIA	88,40%	86,36%	£ 198.653	89,69%	£ 139.061
AUSTRALIA	78,38%	70,54%	£ 151.917	79,02%	£ 101.369
RUSSIA	95,57%	96,26%	£ 106.199	96,48%	£ 120.754
TURKEY	88,00%	89,57%	£ 146.005	91,36%	£ 60.682
TOTAL			£ 91.053.623		£ 29.840.484

After getting the new ARV well calculated it is possible to have a good estimate about what would be the the new revenues with this increasing of performance from some bank countries. The new settled amount is calculated multiplying the respective ARV by the total amount of each market as shown in the equation below:

$$NewSettled = ARV_{US} \times OldSettled_{US} + ARV_{UK} \times NewSettled_{UK} \quad (4.3)$$

Having now the new settled amount estimated, a brief overview of the possible gains obtained with this AR for each bank country should be given. Table 4.9 discriminates the already known combined settled amount as well as the new estimation for the combined settle amount. This table also shows gains that correspond to the difference between the previous. For this top 10 the total recoverable amount is almost £550 thousand. However with all countries measured the value went to almost £840 thousand.

Table 4.9: Comparison between the current settled amount and the new estimated for both combined markets - with maximized AR

	Old Settled Amount	New Settled Amount	Gains
UNITED STATES	£ 68.795.937,37	£ 69.181.769,48	£ 385.832,11
UNITED KINGDOM	£ 21.308.229	£ 21.367.536	£ 59.307
CHINA	£ 9.073.638	£ 9.085.549	£ 11.911
KOREA REPUBLIC	£ 756.200	£ 775.424	£ 19.225
CANADA	£ 518.674	£ 534.772	£ 16.097
HONG KONG	£ 350.989	£ 358.450	£ 7.461
SAUDI ARABIA	£ 295.646	£ 296.284	£ 637
AUSTRALIA	£ 143.408	£ 187.265	£ 43.858
RUSSIA	£ 217.482	£ 218.727	£ 1.245
TURKEY	£ 184.555	£ 186.215	£ 1.659
TOTAL	£ 101.644.758	£ 102.191.991	£ 547.233

This bank country analysis ended up to help understanding the flaws of the workflow in what concerns the communication between Issuers and the system. It is proven by the tables above and below that for different markets it is profitable to send the transactions for issuers with more acceptability because it will come around with better results.

4.3.2 Authorisation Rate Analysis - Issuing Bank Name

After a profound analysis on the bank country for both markets the granularity will go deeper and be transferred to the banks themselves. For both US and UK markets exist a large group of banks that have been involved at least once in a Farfetch transaction. Therefore it is considered relevant to study what has been the authorisation performance for these banks. As a matter of simplicity this analysis will only be done in a TOP 10 banks basis (with amount value as primary criterion). Starting with a small comparison overview about the most relevant indicators between the two markets there are some interesting conclusions to be taken. First of all the huge weight the top 10 banks have in both markets. For US the weight calculated based on number of transactions and calculated by the amount transacted have both near 80% which for so few banks is quite relevant. The numbers for UK are smaller, reaching an estimated value of 75% but also very significant. Another relevant characteristic is the number of national banks in the top 10. In the US case 8/10 are American banks with two Chinese banks also in this list. As for UK market only national banks dominate the list.

About authorisation performance, for US market this top 10 have a good rate with 90% but still with a margin to improve while in UK the rate is lower with considerable space to increase the performance. About recoverable gains, which becomes relevant in a hypothetical action in these banks, in the US market there are more than £9 million susceptible to be recovered and in the UK this value ascends to £5.5 million. This data can be checked on the summary table below: [4.10](#)

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Table 4.10: Top 10 Banks - US and UK markets - Main indicators performance and characterization

TOP 10 Banks	US Market	UK Market
ISO Country	US - 8 ; China - 2	UK - 10
% Nr Orders	79,56%	76,56%
AR	90,78%	82,29%
Amount Settled	£ 62.356.991	£ 18.183.192
Amount Lost	£ 9.434.749	£ 5.573.881
% Lost	15,13%	30,65%
Amount Total	£ 71.791.740	£ 23.757.074
% Amount	81,22%	74,76%

4.3.2.1 United States

The intention of this section is to provide some insight on the most important banks in American market and to understand where are the biggest inefficiencies and worst performances. Table 4.11 there are discriminated the top 10 national banks on the left side and the top 10 foreign banks on the right side.

Starting with the impact on transactions value, top 10 American banks represent 78% of all banks while foreign banks represent almost 10% which is very considerable. Here note for the huge impact of the Chinese banks as seen in the previous section. The total recoverable amount combined is almost £10 million, most of them in the American banks. About performance the foreign banks have higher indices with values close to 94% whereas American banks have values slightly higher than 90%.

Table 4.11: Top 10 national and foreign banks in the US market and their performance relatively to the payment workflow metrics

	Bank Country	%Amount Weight	AR	Lost(£)		Bank Country	%Amount Weight	AR	Lost (£)
JPMORGAN CHASE BANK N.A.	UNITED STATES	31,00%	88,10%	4.614.559	BANK OF CHINA LTD.	CHINA	2,57%	92,35%	200.302
BANK OF AMERICA	UNITED STATES	20,10%	95,05%	1.240.210	CHINA MERCHANTS BANK	CHINA	2,10%	96,86%	79.507
CITIBANK N.A.	UNITED STATES	10,39%	93,09%	970.884	CHINA CONSTR. BANK	CHINA	1,58%	95,79%	66.400
WELLS FARGO BANK N.A.	UNITED STATES	6,30%	86,65%	1.031.406	INDUSTRIAL & COMMERCIAL BANK OF CHINA LTD	CHINA	1,34%	90,01%	169.300
CAPITAL BANK N.A.	UNITED STATES	3,66%	84,78%	634.971	CHINA CITIC BANK	CHINA	0,64%	94,67%	31.028
U.S. BANK N.A.	UNITED STATES	1,99%	89,44%	264.054	BANK OF COMMUNICATIONS	CHINA	0,54%	98,04%	12.570
PNC BANK N.A.	UNITED STATES	1,70%	91,20%	200.743	AGRICULTURAL BANK OF CHINA	CHINA	0,36%	96,24%	16.551
BARCLAYS BANK DELAWARE	UNITED STATES	1,41%	87,77%	198.113	BANK OF MONTREAL	CANADA	0,22%	80,20%	21.438
TD BANK N.A.	UNITED STATES	0,97%	92,46%	104.591	SHINHAN CARD CO. LTD.	KOREA	0,17%	94,63%	10.072
HSBC BANK N.A.	UNITED STATES	0,81%	94,54%	65.100	THE TORONTO-DOMINION BANK	CANADA	0,15%	83,28%	29.129
TOTAL		78,33%	90,49%	9.324.631	TOTAL		9,67%	93,81%	636.297

Note for the impact of the two major banks in US: *JPMorgan Chase Bank* and *Bank of America*. Both combined represent 51% and the first alone represent 31% which is a major value with

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a recoverable amount of more than £4.5 million and a not so astonishing AR of 88%. In this chapter, *Bank of America* has a better performance with an AR of 95% and a lower lost amount. *Wells Fargo Bank* also deserves a mention by the not so high AR (87%) and a considerable amount of £1 million.

About Chinese Banks, all of them have good performances, some above 95%. *Bank of China* and *Industrial & Commercial Bank of China* have lower performances and so these can be opportunities to improve. The Canadian banks are the ones with lower performances (80% numbers) but with not so significant amounts.

4.3.2.2 United Kingdom

Table 4.12 shows the top 10 national and foreign banks and what was the performances for the period considered in this project.

Comparing these two different sides, what most attracts the attention is the disparities between national and foreign banks impact: 75% against 3,78%. This is also reflected in the recoverable amount: £5,5 million against £309 million. Regarding the performance, the foreign banks have a better performance: 80% versus 75% but in the right side is clear that Chinese banks have a lot better performance than American banks that have very low indicators.

Table 4.12: Top 10 national and foreign banks in the UK market and their performance relatively to the payment workflow metrics

	Bank Country	%Amount Weight	AR	Lost(£)		Bank Country	%Amount Weight	AR	Lost (£)
BARCLAYS BANK PLC.	UK	18,92%	89,30%	887.197	BANK OF CHINA LTD.	CHINA	0,96%	95,01%	10.771
HSBC BANK PLC	UK	15,72%	80,63%	1.266.919	JPMORGAN CHASE BANK N.A.	UNITED STATES	0,63%	50,40%	103.393
NATIONAL WESTMINSTER BANK PLC	UK	11,65%	85,48%	783.233	BOC CREDIT CARD LTD.	CHINA	0,41%	97,42%	6.485
LLOYDS BANK PLC	UK	10,83%	83,05%	821.205	CAPITAL BANK N.A	UNITED STATES	0,33%	20,73%	87.718
SANTANDER UK PLC	UK	4,58%	64,40%	619.565	CHINA MERCHANTS BANK	CHINA	0,32%	95,56%	4.163
THE ROYAL BANK OF SCOTLAND PLC.	UK	2,95%	85,95%	193.246	BANK OF AMERICA	UNITED STATES	0,27%	48,97%	55.434
BANK OF SCOTLAND PLC	UK	2,77%	85,83%	182.453	CHINA CONSTR. BANK CORPORATION	CHINA	0,27%	98,31%	1.123
HALIFAX BANK	UK	2,77%	82,65%	257.662	BANK OF COMMUNICATIONS	CHINA	0,21%	92,86%	7.840
NATIONWIDE BUILDING SOCIETY	UK	2,31%	54,23%	381.553	CITIBANK N.A.	UNITED STATES	0,20%	60,75%	21.594
TSB BANK PLC	UK	2,25%	82,55%	180.849	INTERNATIONAL BANK OF AZERBAIJAN	AZERBAIJAN	0,19%	92,59%	11.116
TOTAL		74,76%	82,29%	5.573.881	TOTAL		3,78%	79,75%	309.638

It is evident that the most appealing banks to take action on are the British banks, mainly the first five because they represent 50% of all the transactions value. Here, the bank with the worst performance is *Santander UK PLC* but the one with an higher recoverable amount is *HSBC*

BankPLC. However, every bank in this list could mean good improvements in terms of gains for the company and so attention must be taken to all.

4.3.2.3 Foreign Banks comparison

The analysis relating the issuing bank country and the performance on both markets was already made. However, going into the issuing banks granularity, there could be some exceptions worth to be spotted. Therefore a quick comparison overview in the difference of the performance of the top combined banks in the two markets was done. Table 4.13 illustrates this situation.

Table 4.13: Foreign Banks performance comparison for US and UK markets

Issuing Bank	Bank Country	AR UK	AR US	Difference (US-UK)	Div Chosen
BANK OF CHINA LTD.	China	95,01%	92,35%	-2,67%	UK
CHINA MERCHANTS BANK	China	95,56%	96,86%	1,31%	US
CHINA CONSTRUCTION BANK CORPORATION	China	97,48%	95,79%	-1,70%	UK
CHINA CITIC BANK	China	81,82%	94,67%	12,85%	US
BANK OF COMMUNICATIONS	China	92,97%	98,04%	5,07%	US
INDUSTRIAL & COMMERCIAL BANK OF CHINA LTD	China	78,62%	90,01%	11,38%	US
AGRICULTURAL BANK OF CHINA	China	89,74%	96,24%	6,50%	US
BOC CREDIT CARD LTD.	Hong Kong	97,48%	96,34%	-1,14%	UK
BANK OF MONTREAL	Canada	57,14%	80,20%	23,06%	US
THE TORONTO-DOMINION BANK	Canada	58,33%	83,28%	24,95%	US
BC CARD COMPANY LTD	Rep. Korea	92,31%	89,14%	-3,17%	UK

Most of the results reinforce the idea already stated in the bank countries analysis. Nonetheless, there are some exceptions that show that work well in the other market. Examples of this are *Bank of China LTD.* and *China Construction Bank* from China that had better performances in EU division or *BOC Credit Card LTD* in Hong Kong with the same result. The other confirmed the previous analysis, like Canada banks that definitely work better in US division.

4.3.3 Two Acquirers Performance - US Market test

Every transaction with shipping country being United States goes through the US division as already described. This division has the Provider P-A and the Acquirer B and works mandatorily

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like this. During the month of May of 2016 the possibility of introducing a new Acquirer appeared. This solution was created by the Provider P-A and the possibility of having its own Acquirer working for US market. This Acquirer as for the EU and ROW division is called Acquirer A.

In a first stage it was introduced so that the flow could be split in two heterogeneous parts with a ratio of 80/20 for the already existing Acquirer B and the new A. For 12 days the results were monitored and the output was very favorable. Therefore it was decided to change the splitting ratio to a equal division of 50/50 for each Acquirer. This Acquirer introduction came to help to understand the performance of the authorisation rate in an Acquirer level. Studying it associated with the principal issuing banks in the US market allows to understand what is the best Acquirer-Issuer relationship for each case and from there on to increase the flow efficiency. The results for this second phase were taken for a period of exactly three weeks.

The results of this assessment are clearly expressed in the Table 4.14. It presents results for the top 15 countries by sales amount value and for each issuing bank it was calculated the authorisation rate (by issuing reasons rejections) for both Acquirers in the two phases of the new Acquirer implementation.

Table 4.14: TOP 15 Banks - US Market - 2 acquirers system performance comparison

Issuing Bank	Bank Country	1st Phase - 80% B - 20% A			2nd Phase - 50% B - 50% A		
		A	B	Diff	A	B	Diff
JPMORGAN CHASE BANK N.A.	UNITED STATES	81,15%	88,12%	-6,97%	89,26%	89,94%	-0,68%
BANK OF AMERICA	UNITED STATES	92,43%	95,66%	-3,22%	93,54%	93,53%	0,02%
CITIBANK N.A.	UNITED STATES	88,21%	93,26%	-5,04%	92,72%	91,73%	0,99%
WELLS FARGO BANK N.A.	UNITED STATES	93,62%	87,79%	5,83%	91,14%	87,39%	3,75%
CHINA MERCHANTS BANK	CHINA	98,35%	97,75%	0,59%	98,61%	97,33%	1,28%
CAPITAL BANK N.A	UNITED STATES	86,49%	84,31%	2,18%	84,17%	83,06%	1,11%
BANK OF CHINA LTD.	CHINA	90,35%	93,82%	-3,47%	93,68%	91,32%	2,35%
CHINA CONSTRUCTION BANK CORPORATION	CHINA	68,63%	81,11%	-12,48%	91,45%	91,84%	-0,38%
INDUSTRIAL & COMMERCIAL BANK OF CHINA LIMITED	CHINA	83,67%	85,38%	-1,70%	85,29%	81,08%	4,21%
U.S. BANK N.A.	UNITED STATES	82,22%	87,22%	-5,00%	90,05%	87,50%	2,55%
BARCLAYS BANK DELAWARE	UNITED STATES	90,91%	92,21%	-1,30%	90,97%	89,23%	1,74%
PNC BANK N.A.	UNITED STATES	79,59%	76,54%	3,06%	89,05%	87,12%	1,93%
CAPITAL ONE N.A.	UNITED STATES	76,92%	91,53%	-14,60%	85,88%	96,25%	-10,37%
TD BANK N.A.	UNITED STATES	95,83%	90,32%	5,51%	86,72%	91,67%	-4,95%

Looking for the first phase and for the difference column (comparison between the AR's of both acquirers) it identified that the existing Acquirer had best performance results than the new ones with 11/15 banks. However, these results could be misleading because of the amount of transactions processed by both being different and therefore the sample for the new Acquirer might not be big enough.

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The second phase already gives better and more solid data. Here the results inverted and the new Acquirer had the best performance in exactly 11/15 issuing banks although in some cases the difference is very close to zero and thus not significant. The best cases with differences higher than 2,5% for Acquirer A were *Wells Fargo Bank, U.S. Bank* and for Acquirer B the best results were obtained in *Capital One* and *TD Bank*.

After having the results of the authorisation rate for both Acquirers another interesting exercise is to simulate what would be the gains for the company if each Issuing Bank could be attached to one Acquirer in a 100% flow basis accordingly to this study results. This is similar to what was done before with the issuing country analysis for both markets. Therefore for a matter of exercise simulation the best Acquirer for each bank is the one with the best authorisation rate regardless its statistical significance.

It is necessary to understand how the following estimation process will proceed. As the flow was divided 50% for each Acquirer, it is assumed that the half part of the revenues already covered by the chosen Acquirer for each bank will be remain untouched. Thus, only the remaining half, will be recalculated in order to get an estimation of the gains in this operation, based on the authorisation rate of the chosen acquirer. This process is done for every bank. The estimation is calculated exactly with the equations 4.1, 4.2 and 4.3 just like in the issuing countries comparison.

Table 4.15 has all these indicators demonstrated. Firstly the chosen Acquirer and the respective AR. The real settled amount with the 50% of the old Acquirer and the new hypothetically settled amount with the introduced situation. The difference with optimized situation is clearly expressed in the last column. Therefore it is possible to draw some relevant conclusions.

Table 4.15: TOP 15 countries - US Market - Possible gains with the optimal acquirer solution for each bank

Issuing Bank	New Acquirer	AR	Settled - Old Acquirer	Settled - New Acquirer	Gains
JPMORGAN CHASE BANK N.A.	B	89,94%	£ 1.058.462	£ 1.066.570	£ 8.107
BANK OF AMERICA	A	93,54%	£ 750.514	£ 750.650	£ 136
CITIBANK N.A.	A	92,72%	£ 397.455	£ 401.748	£ 4.294
WELLS FARGO BANK N.A.	A	91,14%	£ 217.534	£ 226.860	£ 9.326
CHINA MERCHANTS BANK	A	98,61%	£ 157.512	£ 159.580	£ 2.068
CAPITAL BANK N.A	A	84,17%	£ 75.892	£ 76.902	£ 1.010
BANK OF CHINA LTD.	A	93,68%	£ 69.813	£ 71.612	£ 1.798
CHINA CONSTRUCTION BANK CORPORATION	B	91,84%	£ 72.918	£ 73.224	£ 306
INDUSTRIAL & COMMERCIAL BANK OF CHINA LIMITED	A	85,29%	£ 48.610	£ 51.136	£ 2.526
U.S. BANK N.A.	A	90,05%	£ 51.498	£ 52.996	£ 1.498
BARCLAYS BANK DELAWARE	A	90,97%	£ 45.054	£ 45.931	£ 877
PNC BANK N.A.	A	89,05%	£ 36.475	£ 37.285	£ 810
CAPITAL ONE N.A.	B	96,25%	£ 27.189	£ 30.471	£ 3.282
TD BANK N.A.	B	91,67%	£ 38.520	£ 40.717	£ 2.198
TOTAL			£ 3.047.445	£ 3.090.972	£ 43.527

Looking with further detail to the table, the obtained gains with the created scenario indicates that in 3 weeks the amount recoverable for the top 15 banks in the US market is £43,5 thousand. With a direct proportionality, for a year the recoverable amount could ascend to almost £700 thousand. Logically, the banks with the higher difference in the authorisation rate had the best results. Concluding, this analysis shows the existing possibilities for redefining the workflow also based on the Acquirers and the consequent earnings and should be held as an strategic point in the next discussions about the new proposed model.

4.4 Costs Analysis

The cost structure of the payment workflow is relatively simple. Since in the project only credit card transactions are tackled, the transaction costs could be explained as Interchange system where all entities provide a service to the company and therefore all charge a defined feed to the Merchant. The Provider has always a marked fee destined for every transaction processed (accepted or not). As for the acquiring processing, the acquirer receives always a static percentage of the settled value (markup) while the card networks processors receive another variable percentage (scheme fee) and at last there is the interchange fee. This fee represents a part of the settled value taken for the issuers where the transaction has to be processed. This fee is relative to the costs of the process between the Acquirer and Issuer where the transacted amount passes through different unknown intermediates that charge their fee for the service.

All the costs given hereinafter do not correspond to the real costs and are only used for academic purposes. However, the proportionality and the relevant differences were assured. The provider costs will not be relevant for the analysis because they are completely static. Their values are £0,20 per transaction for P-A, £0,60 for P-FEU and £0,70 for P-FUS.

As for the rest of the flow, markup is the only static percentage and its value is 0,58% per transaction. A quick overview of the rest variable costs is given in Table 4.16 for the two markets studied where the most relevant differences are illustrated.

Table 4.16: Transaction Costs Overview for US and UK markets

Market	Banks Country	Acquirer	Markup	Interchange	Scheme	Total Fees	
UK	National Banks	A	0,58%	0,38%	0,11%	1,07%	1.36%
	Foreign Banks	A	0,58%	2,29%	0,72%	3,58%	
US	National Banks	A	0,58%	2,82%	0,21%	3,60%	3.50%
		B	0,58%	2,35%	0,18%	3,10%	
	Foreign Banks	A	0,58%	2,80%	2,37%	5,74%	
		B	0,58%	2,90%	1,78%	5,25%	

From the table is evident that total fee is higher in the UK flow (EU & ROW) than in the US flow as well as the total fee is higher in national banks than in foreign for both countries. For US market, the difference for both acquirers is not so relevant but with lower costs for Acquirer

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A-B. This data was collected in the same period of the data of the two acquirers analysis done subsection 4.3.3.

Table 4.17: Transaction Costs in US and UK markets - Region Clustering

Market Bank Country	UK			US			Difference
	Interchange	Scheme	Total	Interchange	Scheme	Total	
UNITED KINGDOM	0,38%	0,11%	0,49%	2,64%	1,59%	4,23%	3,74%
UNITED STATES	2,13%	1,04%	3,17%	2,45%	0,19%	2,64%	-0,53%
AMERICA	3,16%	1,03%	4,20%	2,87%	1,75%	4,62%	0,42%
APAC	2,80%	0,89%	3,69%	2,87%	1,92%	4,79%	1,10%
EUROPE	0,71%	0,14%	0,85%	3,04%	1,86%	4,90%	4,05%
MIDDLE EAST	3,14%	0,72%	3,86%	2,85%	1,99%	4,84%	0,98%

The most relevant issue to assess in this part is the correlation between mainly the interchange fees and the division flow in the payment workflow. For that reason a quick regional division of issuing bank countries was done. United Kingdom and United States by being the studied market countries remained alone. The other countries were grouped by Europe, American countries, countries from the Middle East and APAC. The results are expressed in Table 4.17.

This table shows the relevant differences for these fees in both markets. First of all every single region of the issuing bank has a better result in the UK flow than in the US. The exception is the United States itself because their own banks result in less interchange fees. The most relevant values are the European (including the British). This provides one more reason to the hypothesis of sending the transactions dealing with European banks (or other regions with similar results) through EU & ROW workflow.

Following the analysis done about the top 15 banks in the American market reflected in Table 4.15 it is relevant to understand whether these costs have significant impact. So in Table 4.18 it is represented the comparisons between the percentage of gains with the Acquirer possible change as well as the difference in terms of costs based on the results for each bank. Thus, the final balance indicates the ratio of gains (or losses) with the hypothetical change.

Table 4.18: TOP Banks in the US market - Gains vs Costs analysis

Issuing Bank	New Acquirer	Acquirer A Costs	Acquirer B Costs	% Costs Variation (New - Old) (C)	% Revenue Gains (R)	Final Balance (R-C)
JPMORGAN CHASE BANK N.A.	B	3,38%	2,98%	-0,40%	0,77%	1,17%
BANK OF AMERICA	A	2,27%	1,65%	0,62%	0,02%	-0,60%
CITIBANK N.A.	A	3,57%	3,25%	0,32%	1,08%	0,76%
WELLS FARGO BANK N.A.	A	0,86%	1,61%	-0,75%	4,29%	5,04%
CHINA MERCHANTS BANK	A	5,10%	4,60%	0,51%	1,31%	0,81%
CAPITAL BANK N.A.	A	4,38%	3,90%	0,48%	1,33%	0,85%
BANK OF CHINA LTD.	A	5,31%	4,55%	0,76%	10,15%	9,39%
CHINA CONSTRUCTION BANK CORPORATION	B	5,26%	4,45%	0,81%	0,42%	-0,39%
INDUSTRIAL & COMMERCIAL BANK OF CHINA LIMITED	A	5,13%	5,03%	0,10%	5,20%	5,09%
U.S. BANK N.A.	A	4,12%	2,26%	1,86%	2,91%	1,04%
BARCLAYS BANK DELAWARE	A	4,18%	3,86%	0,32%	1,95%	1,63%
PNC BANK N.A.	A	0,31%	0,34%	-0,02%	2,22%	2,24%
CAPITAL ONE N.A.	B	4,30%	3,91%	0,39%	12,07%	11,68%
TD BANK N.A.	B	0,31%	0,89%	-0,58%	5,71%	6,28%

Data Collection and Analysis

The main conclusion about this data is that in two cases the switch appear as unprofitable but with a balance very close to 0. The referred banks are *Bank of America* and *China Construction Bank Corporation*. Relatively to the others, the percentage of gains remains positive and in some cases the final balance is even higher than the revenues because there is a decreasing of costs.

A final note to the acquirers of the fallback workflows. For them, the costs are slightly higher but, for lack of information, only a rough estimation will be given. So, for A-FEU the variable costs are in average 3,20% of each transaction while for A-FUS the costs are about 3,80%.

Chapter 5

Redefinition of the Workflow

This chapter aims to provide a solutions that assembles every single variable and restriction explored before in order to obtain a better payment workflow with its efficiency improved with a logical and functional structure. This solutions is always based on the data collected and the analyses provided by this dissertation.

This new workflow will be the main focus of the rest of the chapter and will be divided in two phases. The first one exploring a short term solution with a solution able to be implemented currently and with the expected gains already estimated, in performance and revenues. The second, the long term solution, is a more complete one with several variables currently uncontrolled by the company but that in the future are achievable and in the best interest for the company.

The purpose of this dissertation is to provide a new payment workflow for credit card transactions. This new workflow should be based on sustainable and logical principles that allow to have a flexible system, able to match the necessities of the market and able to shape itself to the constant changes occurring within the entities involved, the company and even at the legislation level.

The proposed models are based essentially in the analyses illustrated in the previous chapter and it seizes all the best opportunities identified in the most recent performances of the current system in the company.

5.1 Short Term Solution

5.1.1 Limitations of the Current System Infrastructure

The motive for having a short term solution is related with the set of constraints that the payment system infrastructure provides. In first place, the constraint of the currency is perhaps the most relevant and restrictive of all.

The first layer decision, no matter what, will have to be the currency and this currency will always be intrinsically attached to the shipping country the customer introduces in the order placement. This means that, regardless of all the other variables, the currency in which the transaction

Redefinition of the Workflow

must be processed is defined in first place. This brings several limitations to the workflow because some current available entities only can process a few range of currencies.

Other unsurmountable current limitation in the short term is the strict dependency on the only main provider. This provider processes all transactions for the three divisions and it has to be the common point on every workflow. For that reason it is not possible to alter the provider accordingly with the performance and to check the results. The current model will have only one provider: P-A

The last constraint is the current Acquirers with whom the company has partnerships. The proposed model in the short term should be built considering all of these restrictions and the current entities available, always with the objective of maximizing the performance and efficiency of the system.

5.1.2 The Workflow

The new model comes to replace the previous rigid model. The old model was conceived due to the necessities of the company at the time and as a response to the new methods introduced. So now it is possible to introduce a new solution that at the same time involves all these key variables.

The main idea is to proceed firstly with some technical changes in the checkout procedure. From now on, after the customer introduces the shipping details and proceed to the payment page it will appear the payment options available based on the shipping country restriction as before. As soon as the customer chooses credit card, a separate flow begins. Here the shipping country criterion disappears and the approach begins to be entirely based on the BIN database. With the help of the complete BIN database in Farfetch's possession, it is possible to trace the card information to its bank, bank country, card type or brand. From this point it gives the company the flexibility to choose which best suits its interests in terms of performance of the workflow.

From here the workflow will be divided in more layers.

5.1.2.1 Issuing Bank Country Layer

The first one is the issuing bank country. With the BIN information of the card number, the bank country becomes accessible. So, the objective is to build clusters of countries and dividing them through the two studied divisions: EU & ROW and US. Due to the large number of countries only the top 10 countries for both markets combined studied in subsection 4.3.1.3 will be used. The main criterion used is the best authorisation rate performance. It is necessary to clearly state two situations: the only currencies dealt with in this new workflow are GBP and USD due to the markets studied. This is relevant because currently no American acquirer is able to process any other currency besides USD. However, at a very short term acquirer A will be able to process GBP. While US division can not process other currencies, all the transactions with other currency than USD (and GBP shortly) must remain as they are in the EU & ROW despite the country bank. We will assume, in the project, that GBP is processed by the American Acquirer A-A.

Redefinition of the Workflow

Hence, bank countries like United Kingdom, Republic of Korea or Australia will be forwarded through the EU & ROW division due to their best performances with differences higher than 2% and in some cases higher than 20%. For bank countries like United States, Hong Kong, Canada or Turkey the process is the reverse being the US division the solution. There are special cases: Russia and China have near 1% of difference between two markets. The solution adopted is to continue the testing and sending them with partial weights: 70% for US division and 30% for EU & ROW. The last case, Saudi Arabia, and since the difference is not significant at all there will be no country criterion and only the currency will decide. The schematic workflow based only in the issuing country criterion is illustrated in Figure 5.1.

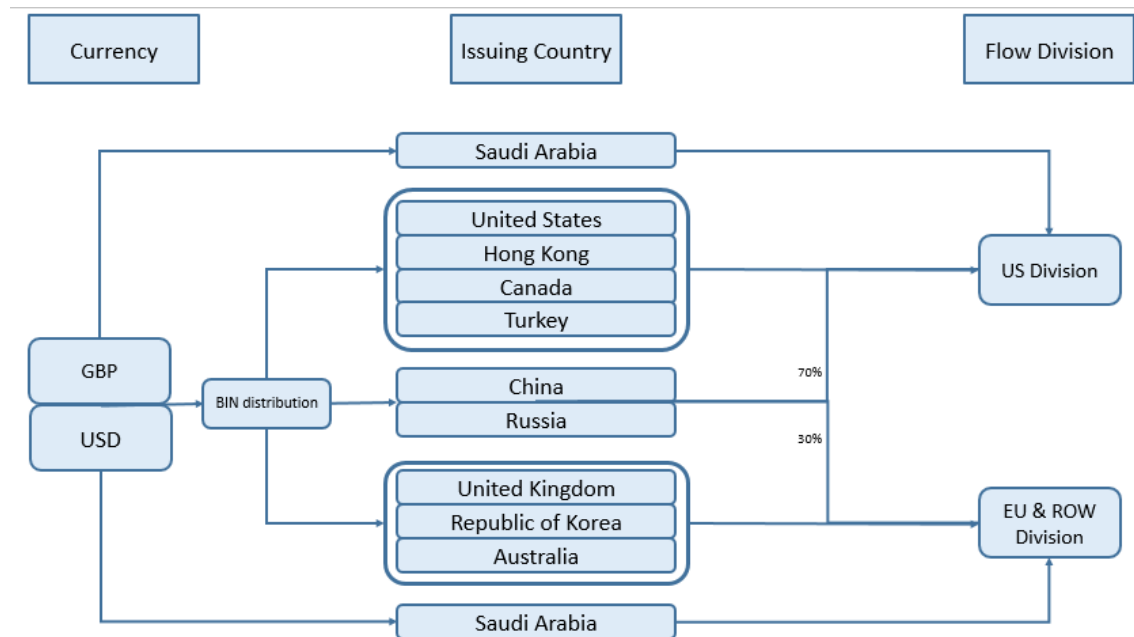


Figure 5.1: New Payment Workflow - Only Issuing Country criterion

5.1.2.2 Issuing Bank Layer

The next layer could be called the issuing bank layer and essentially it details one level more the workflow. There are some banks from the countries referred before that work better with the opposite division defined for the country. So, there are these exceptions that could be handled to improve even more the banks efficiency. First of all a strong conclusion is that the national banks of the studied markets have always best results in the own markets. So they will be excluded from these exceptions. Only the foreign banks could have some relevancy here. The sample countries are the ones studied in subsection ??, being the top banks combined from the two markets.

This new step is illustrated in the reformulated workflow, Figure 5.2. All the top banks are represented in the scheme even for the cases where the decision remained the same.

Redefinition of the Workflow

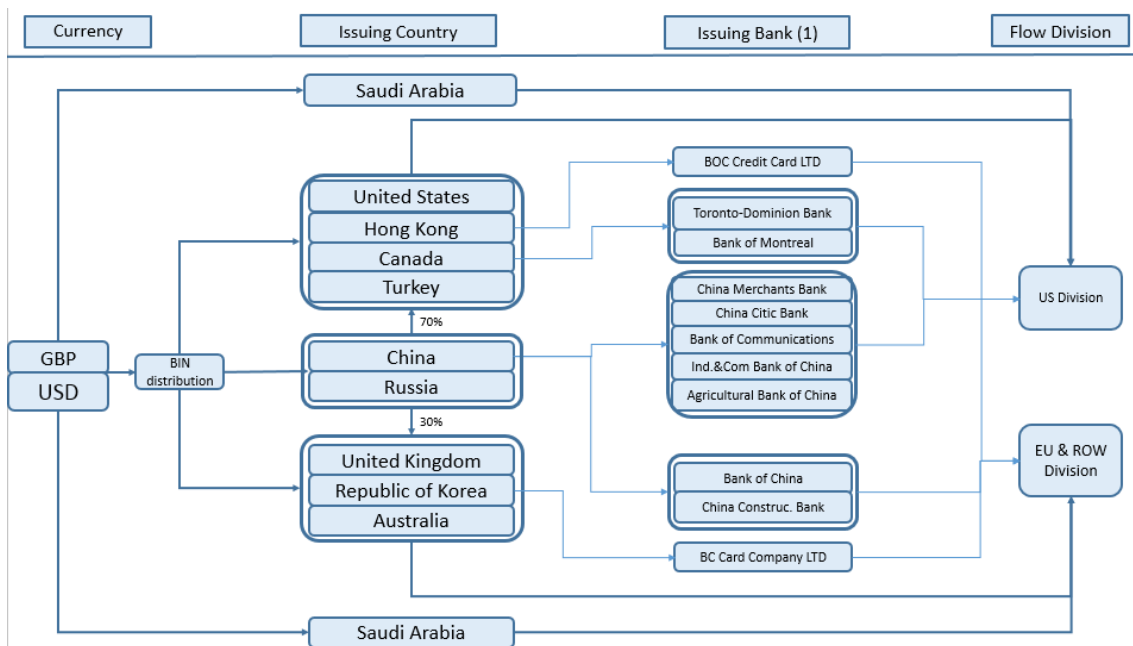


Figure 5.2: New Payment Workflow - Issuing Country and Bank criteria

5.1.2.3 Acquirers Layer

Following this step comes the final one with attention only to the acquirers. On this layer only US division is affected because it is the unique division with more than one acquirer. Here, the top banks used will be the same as for the analyses in subsection 4.3.3 together with the cost analysis section 4.4. The main decision in this final layer is to divide the transactions through the best issuer-acquirer combination based on the data analysis.

There is an important difference between the acquirers that is extremely important to the flow. Acquirer B only processes USD, so every transaction through the US division in GBP must go immediately through acquirer A. The ones in USD must go through the acquirer that suits the issuer better. As for the transactions with only the issuing country criterion from the second layer (in USD) must go with a 50/50 ratio through both acquirers. The proposed final model is depicted in the Figure 5.3.

Some notes about the graphic explanation. The two issuing banks layers are totally different. The first concerns about issuing banks exceptions over the previous issuing bank country criterion and the second, within the already decided division, concerns about choosing the acquirer with the best performance for each bank. There are some cases of countries with completely different weights in the two current divisions studied which can have affected the decision process. These cases must be held in attention in the future (Korean banks is one example).

The model consists essentially in fulfilling the main objective of increasing the efficiency the payment workflow. Divided in several layers, some of them restrictive as the currency, it aims in a first phase to allocate the transaction based on the bank country or bank name according to previous performances. After deciding the flow division, the last phase consists in choosing the

Redefinition of the Workflow

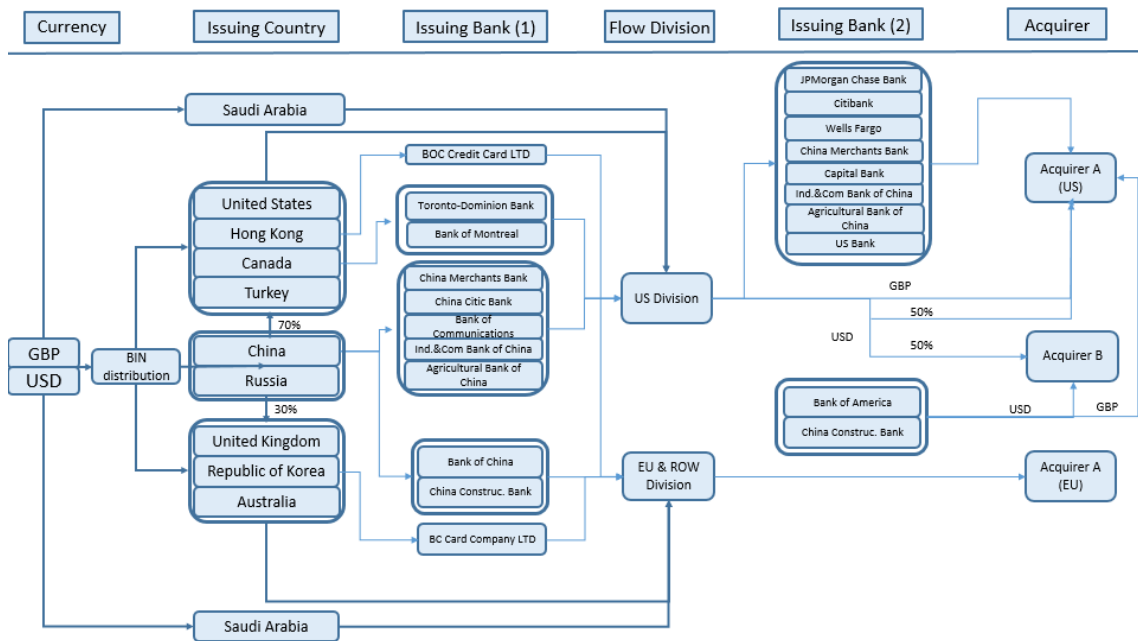


Figure 5.3: New Payment Workflow - Complete Model

best acquirer. Thus it is possible to have a logical and efficient model but, above all, it permits a huge flexibility to change the flow and its decisions based on further analyses and future results.

The model presented in graphic views is not the whole workflow in its extension. Only some of the available banks and countries were mentioned to allow a better comprehension on the model logic. For having the full workflow fulfilled, it is necessary to attend to all countries, banks and their results which for this explanation would not fulfill the purpose. Lastly, it is not a finished work and can be viewed as an working in process product being this the starting point to an optimal workflow. Monitoring this workflow and understanding, live, which parts have the best performance will allow to improve even more the process.

5.2 Medium/Long Term Solution

The already mentioned limitations of the current infrastructure implemented in the company do not allow some important changes at short term that could improve in a larger scale the payment system performance. Therefore this section provide some examples of structural implementations that could result in a more complex and detailed workflow but with a remarkable performance.

5.2.1 Acquirers - wider offer range

As proven by the tests with the two acquirers in the US, there are different performance results for issuers-acquirers combination. One of the main goals is to build the flow in such a way that permits to choose the best acquirer for the issuer of the transaction. For that to happen the group of

Redefinition of the Workflow

acquirers working with the company is not enough. For achieving the desired degree of flexibility and efficiency, the range of available acquirers option must be wide enough.

The wisest option is to understand the most important and influence acquirers in the market and to start working with them. The contractual aspects can be the biggest barrier due to the conditions bargaining from both sides that normally do not coincide. Apart from this, having a large number of acquirers do not require a big structural effort, having a easy implementation process. One of the main advantages is that these acquirers work on a commission (fee) basis which means only the transactions processed by them are charged without the existence of fixed costs.

This matter is substantially relevant in the market because most of the big banking companies provide acquiring services. Examples are cases like *JPMorgan Chase Bank* or *Bank of America* that have a huge impact in the company transactions. The first bank represents around 30% of all American transactions. Thereby having this bank as an acquirer in the company would predictably increase the authorisation rate in a meaningful way which considering the bank weight it would result in major results for the company.

5.2.2 Payment System Providers - Double System

The whole payment system was built while the company was starting and growing and all the entities were suited for the dimension in the early beginnings. With the increasing sales volumes most of the providers (main and fallback) started to seem undersized to the required demand. The exception is the main provider that could cope with the company growth and it knew how to adapt to the circumstances.

However, the payment system situation relies only in one main provider which created a huge dependency. The objective is to start working with another PSP with a bigger and more powerful structure, used to working in a larger scale. This new provider would allow the company to have a more robust system making use of the extra capacities provided, ability of processing more currencies, to have a better integrated system with more detailed information on the transactions and in the end, the main goal, to increase the authorisation performance.

The idea is to create a dual system, with both old main provider and the new in parallel with the transaction insightfully divided through both according to further analyses to be made. This model is completely different from the Main/Fallback model because both would work as main providers and at the same time as fallback of each other to permit a stronger system and the same standards for each transaction. Currently the providers for fallback system can not fulfill this intention due to its small dimension.

5.2.3 APAC Division - an important market solution

The current three division system in the company seems insufficient because two of three divisions only supply two specific country markets. Therefore the remaining division embraces all the other countries. The APAC countries have a considerable weight in Farfetch transactions and they have assisted to a sustainable growth in the last years.

Redefinition of the Workflow

So the hypothesis of having a new division based on this market seemed plausible. The idea is to have an acquirer original from this market region that could be able to easily communicate with the issuer of the main APAC countries (China, Hong Kong, Republic of Korea and Japan are some examples) and at the same time to process all the different currencies existing in these countries. This is a raw proposal but with prospects to have success. Obviously, it would require further analyses and market research but in long term it would allow a better implementation in the referring markets and a better knowledge about how could the performance be enhanced here.

5.2.4 Currencies - Flexible checkout

Lastly the more difficult proposal to implement: the multi currency option to the customer. Currently, the currency is determined by the shipping details due to the way the background portal processes were built. This could not be modified at short term because it would affect the whole portal structure and for the company it is unaffordable.

The main objective is to allow the customer to choose the currency which the customer would mostly like to pay, regardless the country where the package will be delivered. Being able to allow a multi currency system, it will make the payment system more flexible because most of the transactions would turn to be in the currency of the issuing bank. This would make the transaction routing simpler and more efficient because most of the entities would be aligned and currencies restrictions would be reduced. Moreover, and apart of the payment system perspective, this measure would improve in a larger scale the customer experience because not being able to pay in the desired currency is an unpleasant situation for the customer.

Despite the relevancy of this measure it could not be easily implemented and for that reason the workflow optimization should be based on this restrictive currency model assumption.

Finally, all these four structural proposals, in the long term, support the larger workflow optimization model which will be the higher goal of the company in the future and will enhance the short term model presented before.

Redefinition of the Workflow

Chapter 6

Conclusions and Future Work

The aim of the project was to redefine the credit card payment workflow of Farfetch in order to eliminate some structural inefficiencies. These inefficiencies result for a long time in loss of revenues due to payment refusals by the system. The project was able to provide the system with a robust new workflow that was possible because of the strong analytic components now implemented such as the new BIN database and refusal reasons mapping. The new payment workflow has a major characteristic its flexibility because the company is able to constantly change it based on new analyses in order to continuously pursue the optimal structure.

One of the first main problems was the unprepared data available. Some of the transactions were characterized by the absence of the credit card number. Hence, data recovery methods were essential to the existence of quality data available. The BIN database treatment and the consequent association with card numbers permitted the knowledge of the origin of every single credit card, becoming possible to extend the detail level. The last step of this data treatment consisted in mapping all the transactions refusal reasons to main groups in order to select precisely the relevant motives to the analyses. This global step was crucial to structure the data in order to do the required analyses in a more complete and correct way.

With the help of BIN database association, it was possible to assess two major levels of detail: the issuing bank name and its country from every credit card used in the transactions. This way it was possible to check if the combination between the entities referred in the card number and the shipping country had significant impact in the transactions success.

Here, the two markets studied, United States and United Kingdom, representing two flow divisions had significantly different results. While the US market represents 30% of all transactions and with a settled amount of £75 million, United Kingdom is considerably smaller with only 7% and £25 million of settled amount. However the relevant aspects here consisted in the authorisation rate performance where United States showed value around 90% and UK 82%. This shows the efficiency in the US market is very good and superior to the UK. The improvement margins are still considerable but the most relevant factor here relates to the impact of the nationality of the issuer as well as the issuer itself could have in this performance.

Starting by the Issuers nationality, for each market the separation between national and foreign

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bank countries was done and the results assessed. The first conclusion is the extremely higher weight of the national banks in the countries as expected. In terms of authorisation performance in both markets foreign countries had worse performances 90,18% vs 87,98% in the US market and 82,81% vs 81,14% which reveals that the customer bank nationality matter in the process, being highly related with the division acquirer nationality and questions of compatibility.

In fact the issuing country revealed having relevant weight in the authorisation rate performance, with different results in both markets for the same country. Taking China, Canada and Australia as demonstration examples, Chinese banks had almost 1,5% higher performance in the US markets while Canadian had more than 25% better performances in the US. Australia on the other hand had 32% lower performance in the US. Applying a simulation where the transactions would go though the division with best performance for each bank country the estimation savings reached to £500 thousand in a period of an year and a half.

The issuing bank granularity is also quite relevant and checking the performance of the top 15 banks in the American market with the introduction of a second acquirer provided some interesting results. It showed that actually some issuing banks worked better with one acquirer than the other. From here a new redefinition idea started, where it is possible to forward the transaction though the acquirer which suits better the issuer. Doing a simulation similar to the issuing country the results were savings around £40 thousand in a three weeks periods which is relevant to the company.

Regarding transaction costs in the credit card payment process and treating the variable costs as a united parcel they are relatively higher in the UK market than in the US which means in average a transaction going though the US division is more costly than in the EU & ROW division. However, most of the times these transaction costs are not so relevant and the authorisation rate becomes the main criterion to define the best flow. Still, a little simulation was done with the analyses about the relation issuer-acquirer in the top 15 US market banks and they changed the previous results because, in some cases, the % of costs was higher than the gains which turned the switch unprofitable and nonsense in this logical procedure.

After these analyses been scrutinized the new workflow was defined with the same structural limitations. The multilayer decision system remained the basis but the layers changed for a BIN basis multi criteria decision. The first layer is the currency. Each transaction can now be routed though the best divisions for each bank country. Creating clusters of countries and forwarding the transactions through the respective divisions became the process. Having the division chosen the last layer consists in choosing best acquirer-issuer based on historic performance. However for this final decision the currency is fundamental. It was observed that for some currencies acquirers didn't process the transaction, so in this cases, the flow continues to the currency processing acquirer.

This workflow is a short term solution and for a long term solution it was decided to make some structural proposals in order to achieve a better performance. Synthetically, having a larger variety of acquirers to permit a flexible and optimized flow definition, partnering with another provider to scale up the payment system and to turn it more robust and capable of responding to the market requirements, creating a new division based in one of the most characteristics and

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strategically region (APAC) and lastly to redefine the restrictive currency-shipping relationship model to permit multi currency to the final customer are the main suggestions and foreseeably will have an huge impact in the system efficiency. These implementations are part of the future work to be done in the workflow because the small implementations to be made in short term help to improve the efficiency but don't solve all the system problems.

The purposed objectives of the project were accomplished. The main workflow problems were identified, several analyses could demonstrate the value of some entities interconnections and thus it was possible to build a new workflow which is logical and hopefully will have major results for the company.

However there were some less positive points and analyses limitations that should be mentioned to future work. First of all, the markets studied have a huge impact but the study should be done to a larger group of markets. Secondly, a overview of the performance of bank countries with the two American acquirers it could have been interesting. The most relevant limitation is the short period of time for assessing the performance of the two acquirers due to the late introduction of the acquirer A-A in the US market which limits the validity of the analysis done in this field. Lastly, the effect of the currencies in the authorisation performance was not considered and it would be interesting to introduce this variable in further analyses because the banks are sensible to this issue and it would complete even more the studies done.

The presented model is not static, requires a narrow monitoring. There are certainly errors in the assumptions made during the dissertation which could have implicated some wrong decisions. With the first results of the model implemented will be possible to change it for the new best proposed model. It is the main objective of the project, a constant model with every time new and better solutions. The advantage of the structured model is the defined basis that allows the required flexibility to the company to adapt to the circumstances and being able to test new options in live.

The future work is already well defined in the project. In the short term, the most important task is to implement the proposed model and to assess the results. With these results, the model should be adjusted to improve its efficiency and to fix the errors inherent to this pilot experience. In the long term, the objective is to reinforce the model and to expand it to a more robust and complex one. Using the advantages of the BIN database in future more complex analyses in higher detail levels, allied to more entities in the system (mostly Acquirers), the payment workflow will be continuously enhanced to provide the company with better operations results. It is expected that in the long term this system development could place the company in the vanguard in the payment systems scientific field.

Conclusions and Future Work

Appendix A

Local Payments

China - Alipay

Alipay is a third-party online payment solution very popular in China. The method has success because the business model is based on the customer feedback on the purchased goods before releasing the funds, thus protecting the Client. Currently, Alipay represents more than 50% of all transactions in China. In Farfetch, globally the numbers are 2,17%. Alipay is only available for China, Macao, Hong Kong and Taiwan and in these countries its weight is almost 24%.

Germany - Sofort

Sofort is a popular payment method created in Germany that has an integrated system with several banks. The customer only introduces the details of their account and before proceeding with the transaction in the Sofort platform he already knows if it is feasible or not. Therefore all Sofort transactions entering in the system are already successful. Sofort method is available in Germany, Austria, Belgium and Switzerland and, in these countries, have an impact of almost 6% in Farfetch.

Netherlands - iDeal

iDeal is by far the most popular payment method in Netherlands and is based on online banking in the same model as Sofort. It is only available in Netherlands but it was the most prominent case of the necessity to adapt to the vicissitudes of the market. In this country, this payment method usage normally ascends to 56%. However attending to Farfetch results, currently it only represents 25% of all transactions in Netherlands.

Brazil - Boleto

Boleto is an example of one of the main adaptations to the unique model system present in Brazil. This method consists in the customer receiving a ticket with a payment reference and then making the payment in a specialized facility like an ATM, internet banking or even a certified supermarket or a post office. Currently, the weight of Farfetch partnership with Boleto is close to 12%.

Local Payments

Appendix B

Authorisation Rate - Evolution

B.1 United States

Always considering authorisation rate with rejections by issuer there is, in the figure B.1, an aggregated representation of the AR for an even more restricted group of countries. The selection was downsized for 8 countries in order to permit an appropriate visual assessment.

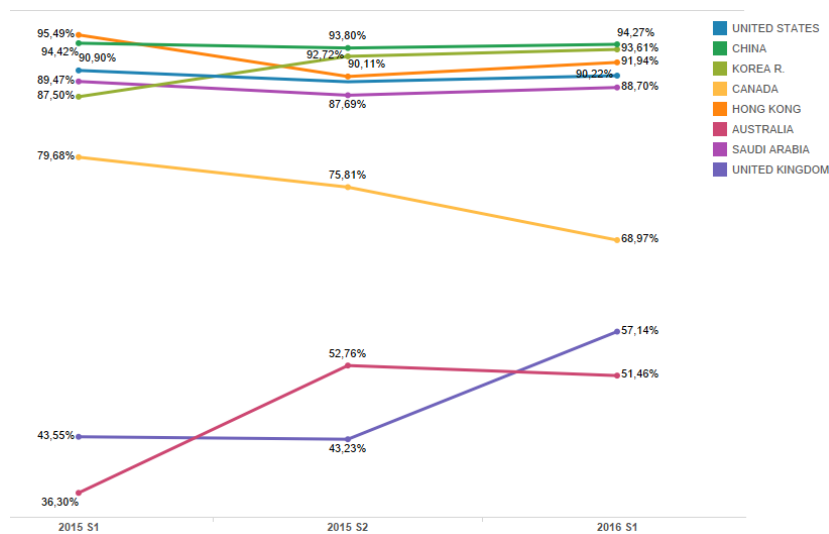


Figure B.1: Authorisation Rate IR issues evolution - Other Countries - US Market

The first natural conclusion is that the five countries with best authorisation rate performance (China, Republic of Korea, Hong Kong, United States and Saudi Arabia) have a general stable evolution, not being detected huge variations and the range is between 88% and 95% which is considered very good. Another relevant aspect is the perception that bank countries from APAC (China, Republic of Korea and Hong Kong) have actually a better performance than the national country, United States. As for the remaining countries they have all unsatisfactory authorisation rates. Canada is with an average of 75% while Australia and United Kingdom have numbers near the 50% which is way above what should be acceptable. However among all there are trending

Authorisation Rate - Evolution

differences: Canada authorisation rate has decreased almost 10% in the period considered whereas United Kingdom and Australia are in a rising trend.

B.2 United Kingdom

The first conclusion is that generally for these countries the authorisation rate are not so high but still in a very good level.

Starting by the best cases, Russia is clearly the winner, having numbers in average close to 94% but with some oscillations. China and Azerbaijan come next with number close to 90% but with a relevant aspect: China is in a decreasing trend having 1.5% less than in the first semester of 2015. Saudi Arabia and Hong Kong have a good and very similar performance, close to 88%, but with considerable space for improvements even for their weight in the bank foreign countries in this market. Going now to the worst cases, Switzerland and Australia had similar values, around 80% but followed different paths last semester. Switzerland increased its performance to almost 84% while Australia decreased to 75%. About United States it could be said that it is the most critical country. With terrible performances and with a decreasing trend in the last semester. The AR values are close to 36% which allied to its relevancy in the market sound the alarm to modifications in order to recover its yield.

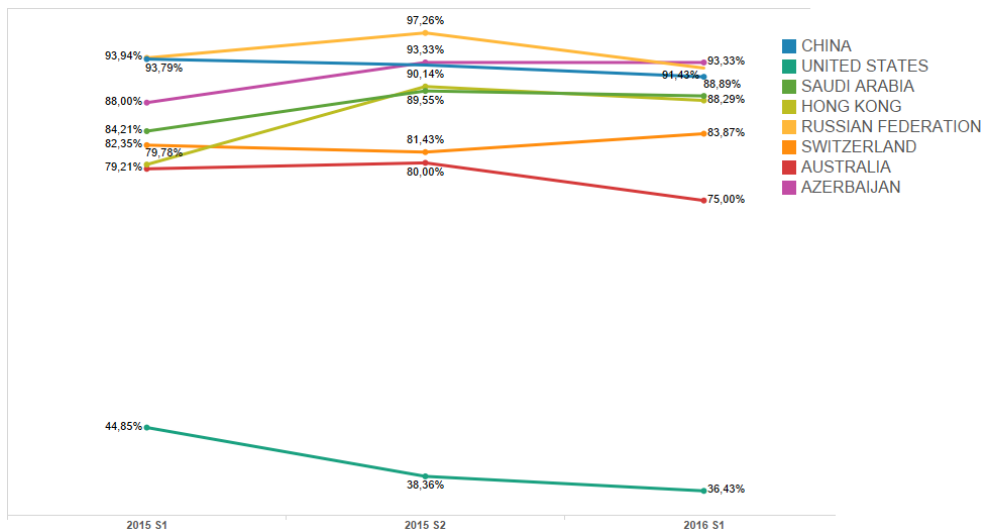


Figure B.2: Authorisation Rate IR issues evolution - Other Countries - UK Market

Appendix C

United Kingdom - Number of Orders vs Amount Value

There is a clear difference between the countries appearing with one and another criterion. Besides some countries not appearing in the number of orders criterion and appearing in the second like Qatar, UAE, Egypt, there are some countries that have a much more relevancy in one table than the other as expressed in Saudi Arabia case. These cases acquire an extra dimension in explaining the particularities of this market. The conclusion that can be taken from these two tables is that, generally, countries from the Middle East place orders of an increased value relatively to other countries. Therefore a special attention must be given to this kind of countries because with a number of orders rise it could mean a sharper growth in revenues.

Table C.1: Top 15 foreign bank countries weight - UK market - Different criteria

Bank Country Top 15	Nr of Orders	Bank Country Top 15	Total Amount
CHINA	3,03%	CHINA	2,87%
UNITED STATES	2,15%	UNITED STATES	2,49%
AUSTRALIA	0,39%	SAUDI ARABIA	0,44%
HONG KONG	0,34%	HONG KONG	0,39%
RUSSIAN FEDERATION	0,31%	RUSSIAN FEDERATION	0,38%
TURKEY	0,25%	SWITZERLAND	0,37%
SWITZERLAND	0,25%	AUSTRALIA	0,32%
ANGOLA	0,23%	AZERBAIJAN	0,29%
FRANCE	0,22%	UNITED ARAB EMIRATES	0,28%
LEBANON	0,22%	QATAR	0,26%
NIGERIA	0,21%	EGYPT	0,25%
SAUDI ARABIA	0,20%	FRANCE	0,25%
CANADA	0,20%	LEBANON	0,24%
KOREA REPUBLIC	0,20%	THAILAND	0,22%
THAILAND	0,20%	CANADA	0,22%

United Kingdom - Number of Orders vs Amount Value

Appendix D

Fallback

To close this chapter a brief overview about the fallback performance will be given. The fallback process is an important piece of the whole implemented system. It is the mechanism that allows the company to reduce the dependency on the main provider by sending them the refused transactions from the main flow. As in the previous analyses, only transactions made to the British and American markets will be accounted. For both of these countries and consequently workflow divisions there are two different systems of fallback. For the EU & ROW division the provider is P-FEU and the acquirer A-FEU while for the US division the provider is P-FUS and acquirer A-FUS.

It is relevant to know the importance of this mechanisms in the total sales of the company even relatively to the main flows. For the UK market the fallback represents 1,81% of all settled transactions with an autorisation rate (with issuer responses) of 5,63%. In the US case the weight is about 0,40% with an authorisation rate of 5,41%. These results suggest the impact of the fallback in both markets is not significant and that exists a lack of authorisation rate performance. However, this process only occurs after the transaction had already been cancelled by the main flow which results in less transactions and with less probability of being accepted.

Nonetheless, an interesting hypothesis came up. Some of the issuing banks or other parts of the system with low authorisation rates could have better results in the fallback system and it would be a good chance to send them directly by this channel. In order to assess this, a study was done, picking all the rejected transaction in the main provider and see what was the value of authorisation rate in the fallback process.

The results for the top 5 banks and bank countries in the two markets studied are presented in Table (D.1). Following the previous criteria there were chosen the most relevant in terms of sales value.

The results show in the first instance the absence of any relevant value that could allow to take some structural actions. The best performance results are China in the UK with 20% but with a very low volume of transactions (due to it high rate in the main flow) and the banks *Lloyds Bank PLC* and *Barclays Bank PLC* with rates above 10% which despite being low are considerable. There are extreme cases as the canadian banks in the UK market with all transactions rejected in

Fallback

Table D.1: Fallback performance for US and UK Markets - Issuing bank and country granularity

	Issuing Country	AR	Issuing Bank	AR
UK	UNITED STATES	5,39%	LLOYDS BANK PLC	10,26%
	UNITED KINGDOM	5,86%	NATIONAL WESTMINSTER BANK PLC	6,57%
	CHINA	20,00%	SANTANDER UK PLC	1,46%
	CANADA	0,00%	BARCLAYS BANK PLC.	10,97%
	AUSTRALIA	4,44%	HSBC BANK PLC	1,38%
US	UNITED STATES	5,58%	CAPITAL BANK N.A	6,40%
	UNITED KINGDOM	0,00%	CITIBANK N.A.	5,53%
	CHINA	0,44%	WELLS FARGO BANK N.A.	8,76%
	CANADA	0,99%	BANK OF AMERICA	3,44%
	AUSTRALIA	3,19%	JPMORGAN CHASE BANK N.A.	5,29%

Fallback and the british banks in the US fallback process with the same result.

At first sight nothing of relevant could be taken for this analysis. Therefore it is rejected, in the short term, the use of any of the fallback entities as main channels. For turning this a real possibility, a different practical stimulation in live should be done testing these channels. The main problem with the fallback entities is the higher prices, decrease of processing capacity and integration with the Merchant.

Appendix E

Authorisation Rate by Value - Issuing Country analysis

Table E.1: ARV calculated for the current results (real)

Bank Country	US Old Settled	US Total	US -ARVo	UK Settled	UK Total	UK -ARVo
UNITED STATES	£ 68.485.256	£ 79.613.704	86,02%	£ 310.681	£ 792.826	39,19%
UNITED KINGDOM	£ 83.337	£ 185.781	44,86%	£ 21.224.891	£ 27.463.768	77,28%
CHINA	£ 8.255.959	£ 8.908.757	92,67%	£ 817.679	£ 915.538	89,31%
KOREA REPUBLIC OF	£ 708.638	£ 797.114	88,90%	£ 47.562	£ 51.395	92,54%
CANADA	£ 489.277	£ 656.940	74,48%	£ 29.397	£ 70.072	41,95%
HONG KONG	£ 253.932	£ 288.553	88,00%	£ 97.056	£ 125.018	77,63%
SAUDI ARABIA	£ 171.558	£ 198.653	86,36%	£ 124.088	£ 139.061	89,23%
AUSTRALIA	£ 63.306	£ 151.917	41,67%	£ 80.101	£ 101.369	79,02%
RUSSIAN FEDERATION	£ 102.228	£ 106.199	96,26%	£ 115.254	£ 120.754	95,45%
TURKEY	£ 130.776	£ 146.005	89,57%	£ 53.779	£ 60.682	88,63%

Table E.2: New ARV for the simulated altered market

Bank Country	Best Division	Best AR	Altered market?	ARVn	New Settled
UNITED STATES	US	90,18%	UK	87,85%	£ 696.513,08
UNITED KINGDOM	UK	82,81%	US	76,78%	£ 142.644,82
CHINA	US	94,15%	UK	90,61%	£ 829.589,83
KOREA REPUBLIC OF	UK	93,55%	US	91,31%	£ 727.862,86
CANADA	US	75,34%	UK	64,93%	£ 45.494,76
HONG KONG	US	92,59%	UK	83,60%	£ 104.517,62
SAUDI ARABIA	US	88,40%	UK	89,69%	£ 124.725,60
AUSTRALIA	UK	78,38%	US	70,54%	£ 107.164,40
RUSSIAN FEDERATION	US	95,57%	UK	96,48%	£ 116.498,64
TURKEY	US	88,00%	UK	91,36%	£ 55.438,65

Authorisation Rate by Value - Issuing Country analysis

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