Development of a structured approach to mobile digital production on a luxury fashion marketplace

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"Sê todo em cada coisa. Põe quanto és No mínimo que fazes."

Ricardo Reis, in "Odes"

Desenvolvimento de uma abordagem estruturada para a produção digital móvel num mercado de moda de luxo

Resumo

Sendo a Farfetch uma empresa em crescimento acentuado, encontra-se agora num momento crítico e necessita de agir. Apesar das melhorias constantes, a sua cultura inovadora resulta numa busca permanente por chegar ainda mais longe. Neste sentido, surgiu a necessidade de criar uma nova modalidade de criação de valor que tem como missão contribuir para o aumento da sua receita e preferência dos clientes, tornando-se na empresa número um em fornecer os produtos mais atuais com os mais altos standards de qualidade e *styling*.

Tais objetivos originaram o desenvolvimento desta dissertação. O seu propósito é criar uma abordagem estruturada para gerir os projetos dentro da nova unidade de negócios. Esta unidade de produção digital móvel envolve reunir uma equipa multidisciplinar que trabalha diretamente com as marcas e remotamente com a unidade de produção do Avepark (unidade de produção principal da Farfetch), com uma unidade de produção digital descentralizada nas instalações da marca de forma a produzir todos os itens de uma só vez, logo após o desfile de moda.

Numa fase inicial deste trabalho, foi essencial compreender a cadeia de valor da empresa analisando minuciosamente a sua estrutura e processos. Depois, perceber como a redução do "*Time to Market"* poderia ser implementada e atingida dentro da Farfetch e criar um método consistente para o desenvolvimento desses projetos.

Tendo em conta estes desafios, o primeiro passo foi compreender as diferenças entre o processo de produção da Farfetch e o de uma unidade de produção digital móvel e definir os novos targets, em conformidade. Além disso, foi criada uma lista de tarefas contendo as tarefas necessárias para a realização deste tipo de projetos organizados em 5 grandes grupos: Conceção do projeto e abordagem à marca; Planeamento; Produção; Controlo do projeto e Encerramento do projeto. Esta lista de tarefas foi também apresentada em formato de matriz RACI, a fim de atribuir os departamentos responsáveis pelas diferentes atividades.

Para planear um projeto de produção digital móvel para uma marca específica, foi desenvolvido um programa em Excel que determina o número de estações de trabalho, o número de recursos e o número de dias necessários para cada projeto e que calcula o custo total. O programa Excel foi testado para uma amostra de 20 marcas, as 20 marcas mais vendidas da Farfetch. Depois de executar o programa para cada uma delas, estas foram priorizadas numa tabela, de acordo com o incremento nas vendas (*Net value*) que a realização de um projeto de unidade de produção digital móvel poderia trazer.

Foi possível concluir que o custo não alterou a ordem em que as marcas foram priorizadas, uma vez que a ordem por beneficio das 20 marcas mais vendidas resulta na mesma ordem por *net value*. Finalmente, espera-se que os métodos propostos ajudem a garantir a gestão correta dos projetos da unidade de produção digital móvel.

Abstract

As a company facing exponential growth, Farfetch finds itself in a critical position and in need of action. Despite constant improvements, the organization's innovative culture results in a permanent search to go further. As such, it deemed necessary to create a new value adding business unit, the "Mobile Creative Operations". This will contribute to an increase in revenue and customer preference and therefore becoming the number one company in delivering the latest products with high standards of quality and styling.

Such goals lead to the development of this dissertation. Its purpose is to create a structured approach to manage the projects within the new business unit. This mobile digital production unit projects involves gathering a multidisciplinary team that works directly with the brands and remotely with the Avepark production unit (main production unit of Farfetch) by having a decentralized digital production unit on the brand's facilities in order to produce all items at once, right after the fashion show.

In this work's initial phase, it was essential to understand the company's value chain by analysing its structure and processes. Then, to perceive how "Time to Market" reduction could be implemented and accomplished inside Farfetch and to create a consistent method for the development of these projects.

Taking into account these challenges, the first step was to understand the differences between Farfetch's production process and that of a mobile digital production unit and to define the new targets, accordingly. Furthermore, a task list was created containing the necessary tasks for the realization of this type of projects organized in 5 major groups: Project conception and brand approach; Planning; Production; Project control and Project closing. This task list was also presented in a RACI matrix format, in order to assign the departments responsible for the different activities.

To plan a mobile digital production project for one specific brand, an Excel program was developed that determines the number of workstations, the number of resources and the number of necessary days for each project and calculates the total cost. The Excel program was tested for a sample of 20 brands, the top 20 best-selling brands at Farfetch. After running the program for each one of them, they were prioritized in a table, according to the increment in sales (Net value) that the realization of a mobile digital production unit project could bring.

It was possible to conclude that the cost did not changed the ranking in which the brands were prioritized, since a ranking by benefit of the top 20 best-selling brands results in the same as a ranking by net value. Finally, it is expected that the proposed methods will help to guarantee the correct management of the mobile digital production unit projects.

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Last but not least, to Farfetch for giving me this amazing opportunity of developing this project and especially for encouraging me to "Be Brilliant, Be Human, TODOS JUNTOS, Think Global, Be Revolutionary and Amaze Customers" (Farfetch's values).

Thank you very much!

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1 Introduction

Although, in the beginning of internet sales, it was believed that it would diminish the idea of uniqueness that customers have about luxury goods (Pruzhansky, 2012), nowadays the luxury industry is established and growing in the digital market. For the worldwide luxury fashion e-commerce platforms, it is essential to be in a constant reinvention of themselves, bringing new and differentiated products as soon as possible, in order to survive and grow in such a competitive market (Aubry et al., 2007).

Bearing this in mind, the present dissertation was developed within Farfetch's new experimental business unit, which main goal is to reduce product's "Time to Market" by conducting mobile digital production unit projects. In an e-commerce business, "Time to Market" is critical in order to accomplish a higher sales volume and to distinguish itself from competitors. As such, Farfetch needs to improve the structure of its operations.

1.1 Farfetch

Farfetch is an online platform for fashion, founded in London in 2008, that is "redefining the meaning of retail therapy". Its unique business model created by José Neves made Farfetch the first Portuguese tech unicorn, currently valued at over 1 billion US Dollars (Farfetch, 2017).

Over the years, Farfetch consolidated its market position and endorsed the exceptional business model, which attracted both boutiques and end-consumers. With over 1000 workers, Farfetch already has offices in eleven cities and four digital production units who shot close to 340.000 items just this year (2017): Los Angeles (United States of America) with 7 studios; São Paulo (Brazil) with 4 studios; Hong Kong with 7 studios; and Guimarães (Portugal) with 40 studios.

This luxury fashion e-commerce platform gathers over 500 boutiques around the world and 150.000 items in only one address and links them with their global customers. Farfetch offers to every boutique that retails luxury fashion a fully developed sales channel enabling them to reach a broader audience and increase their revenue without having to invest.

The company operates as a bridge of trust between customers and boutiques, developing a win-win partnership with them. Therefore, both parties become Farfetch's customers, who in turn, will be responsible for maintaining the platform, shipping the product to the customer and performing all the customer service needed. Besides this, the company is not the owner of the products displayed on its platform and does not store inventory, which on the other hand, are stored by the boutiques. Therefore, the boutiques are responsible for wrapping the products before the transportation company picks up the order. The absence of ownership and inventory is Farfetch's main differentiating factor in comparison with other fashion e-commerce retailers. Thus, the company will never lose money in case the product sells below expectation and its revenues is generated by the commission charged over every sale occurred in the platform.

The present dissertation was developed in Avepark (Guimarães) production unit (Figure 1) which is the main production unit of Farfetch, where over 90% of the items are produced. This production is considered to be digital, in the sense that it defines the process that each item goes through in order to be displayed on the online platform.

Figure 1 - Avepark (Guimarães) production unit in https://www.farfetch.com/pt/careers#10008, referenced in 2018-01-10, 16:48

1.2 Project Motivation and Goals

Farfetch's intensive growth leads to inevitable opportunities of improvement and innovation. Since the company is at a critical point of its journey, a need has emerged in order to create a complete strategy which will help it to grow sustainably. By becoming the number one company in delivering the latest products with high standards of quality and styling, Farfetch will see its revenue increase and its customer preference reinforced. This strategy's aim is the recognition as the highest quality, cost and service digital production centre in the world as well as becoming a content hub, while securing continuous growth. Considering this, many initiatives have emerged to upgrade foundations, expand and innovate, in which the present dissertation is contained.

Currently, Farfetch's competitors are placing products online faster. Since the ambition is to be the first to deliver the latest products, it deems necessary to improve the speed to market and, at the same time, the forecast. With this aim, Farfetch started to analyse the life cycle of its products and detected that, even though they are one season ahead, there is a lack of visibility over certain areas as illustrated in Figure 2.

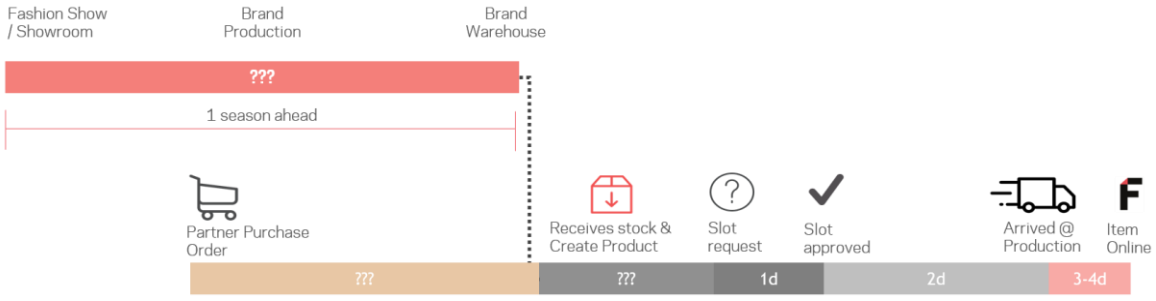


Figure 2 - Product life cycle

These areas include every step of the process before the partner boutique requests Farfetch to send their products. Besides this, every partner has different behaviours when making products available for shooting as it is emphasized on Figure 3.

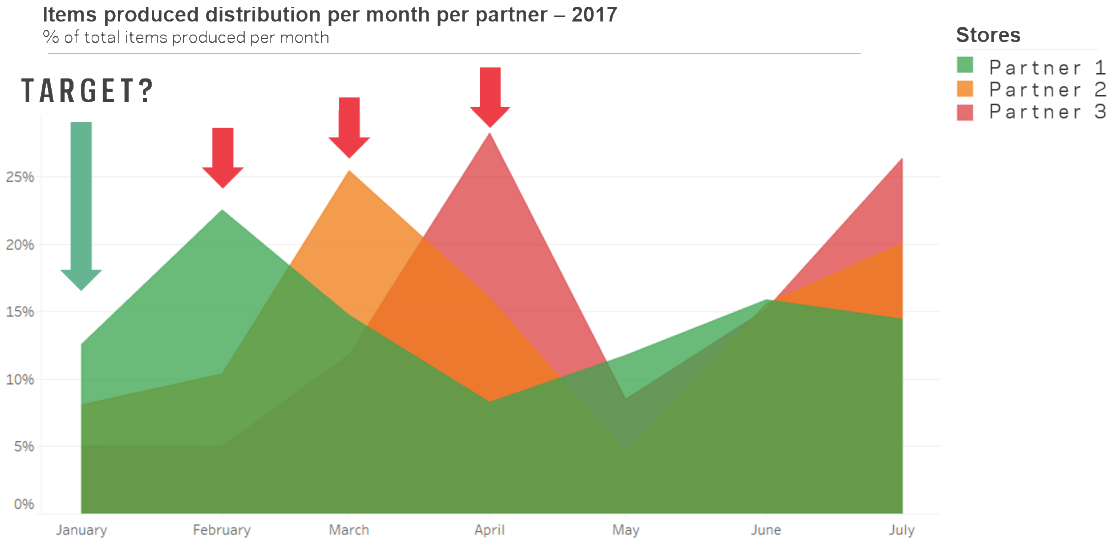


Figure 3 - Example of different partners' behaviour

To mitigate these issues, Farfetch created "Mobile Creative Operations" to fulfil the opportunities of becoming the first to reach the market in all products, increase partners' sales through full price, drive Gross Margin Value (GMV) increase by anticipating product to market and strengthening the relationship with brands.

This new business unit involves the realization of mobile digital production unit projects by gathering a multidisciplinary team that works directly with the brands and remotely with the Avepark production unit to guarantee the best communication for the last steps, Post Production and Quality Control, as illustrated on Figure 4. This way Farfetch has the opportunity of having a decentralized digital production unit working closely with the brands, possibly in their showrooms, to improve their position on the market and benefit both parties. Each mobile digital production unit project consists on assembling a digital production unit, a smaller and adapted version of the one in Avepark, on the brand's facilities in order to produce all the items at once, right after the fashion show. This allows Farfetch to have the products' images of the entire collection three to four months earlier and provide a differentiated service to the brand.

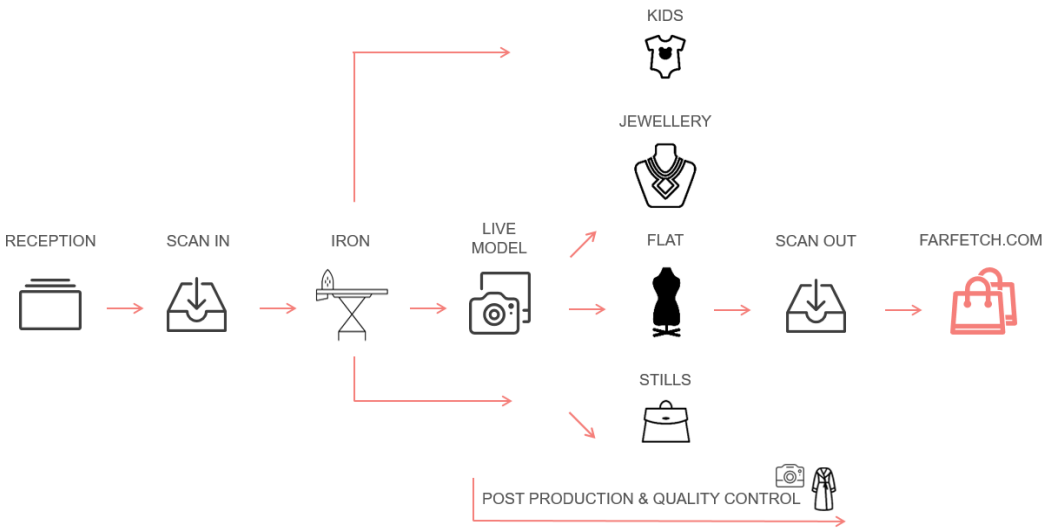


Figure 4 – High level overview of the digital production at Farfetch

Having all the above in mind, a SWOT analysis of a mobile digital production unit project was constructed (Figure 5), with the aim of understanding the powers and limitations of Farfetch to move forward with these projects.

Figure 5 – SWOT analysis

Finally, the main goal of this dissertation is to create a structured approach for managing and planning mobile digital production unit projects meeting all the motivations described above. The base overall model should also allow to estimate its costs and hence support decision makers regarding which brands to approach first.

1.3 Methodology

Considering the main purpose of this dissertation, a methodical approach was implemented.

The present dissertation was elaborated following these main steps.

The first step was to deeply comprehend why reducing "Time to Market" is essential in an e-commerce business, how it can impact Farfetch and how the mobile digital production unit projects can help to accomplish it.

In a second step, it was crucial to understand how the company works: the stakeholders, the supply chain and, specially, how the digital production was structured at Farfetch. Since it is a very complete and complex production, there were a lot of processes to consider. To do so, all the production processes were mapped using descriptions and cross-functional flowcharts. The layouts of the digital production units were also designed with the aim of guarantee a better organization and planning.

The third step was to create a consistent method for the management of the projects. Thus, an Excel program was developed by taking into account multiple factors such as production processes, resources planning and costs calculation. A cost-benefit analysis were also made for top 20 best-selling brands at Farfetch.

Alongside all these steps, there was an opportunity to analyse a proof of concept that was conducted in a real project due to a sudden request from a brand with which Farfetch has a good relationship. This enabled the gathering of real needs and improvements that could be easily detected and tested.

1.4 Dissertation Structure

The remainder of this dissertation is structured into four more sections.

Section 2 includes a literature review over the main subjects referred. The review starts with the clarification of digital production, reviews process mapping, layout design, project management and ends with cost-benefit analysis concepts.

Section 3 contains an analysis of the production processes starting with the current digital production at Farfetch, moving to the mobile digital production and finishing with the description of the structure of this type of projects.

Section 4 presents the proposed overall model to approach mobile digital production unit projects, as well as an analysis phase with a sample of 20 brands.

Finally, Section 5 concludes this dissertation with the main results and suggestions for future developments.

2 Literature Review

This section focus on exploring some questions regarding key topics addressed during the course of this dissertation. This work has two main components. The first consists of mapping the production process and building a program that help planning and managing it. The second has to do with using that program to estimate costs and selecting the best brands to approach for this type of projects.

In order to understand well the production process, this section starts by introducing and exploring the concept of digital production. Then, process modelling techniques are reviewed to give support to process mapping and the layout design that are conducted in this dissertation. In addition, and given that mobile production moves away from the standard flow shop system of the fixed production at Farfetch to a more project-oriented system, project management as well as RACI matrix concepts are also reviewed. Finally, the cost-benefit analysis and multicriteria analysis are covered to help understand which brands Farfetch should focus on.

2.1 Digital Production

Pei et al (2013) stated that, in the past, companies' vehicle for sales was traditionally physical but, as times evolve, those same companies accompanied evolution and realized that the path was through digital production. The combination between the trigger set by technology development, followed by business changes and continuous research changed market practices leading to more costumers buying online.

Kasakow and Aurich (2016) affirmed that every production process has different specifications, therefore is unique, meaning that, depending on the tools you will apply, you will have a perception of digital connectivity other than the one you would have by using another tool.

Digital production undoubtedly is gaining its space through e-commerce companies which are now evolving to an integrated approach, combining IT advantages, leading to services or products made with decreased costs, quicker delivery deadlines and offering distinguished services, an all-digital production cycle (Porra, 2000a).

There are multiple advantages coming from the switch from the traditional to the digital market and the most remarkable is that night or day are not relevant since digital market is unlimited concerning time, communications are much faster and information is more detailed than ever, and this is highly valuable (Porra, 2000b).

Along with this concept of digital, it is possible to find different definitions of e-commerce but, Porra (2000c) approaches the Porter's definition where value is the main word since it reports from value chain to value network with multiple stakeholders (producers, customers, suppliers, etc.). She advocates that digital is an extension of traditional economy, even though the first may lead to a redefinition of this one, both for big and small companies which have through the digital era the same opportunity to reach a global market.

The digital production cycle involves creating, promoting, selling and distributing all-digital models in digital business areas, as can be seen below in Figure 6.

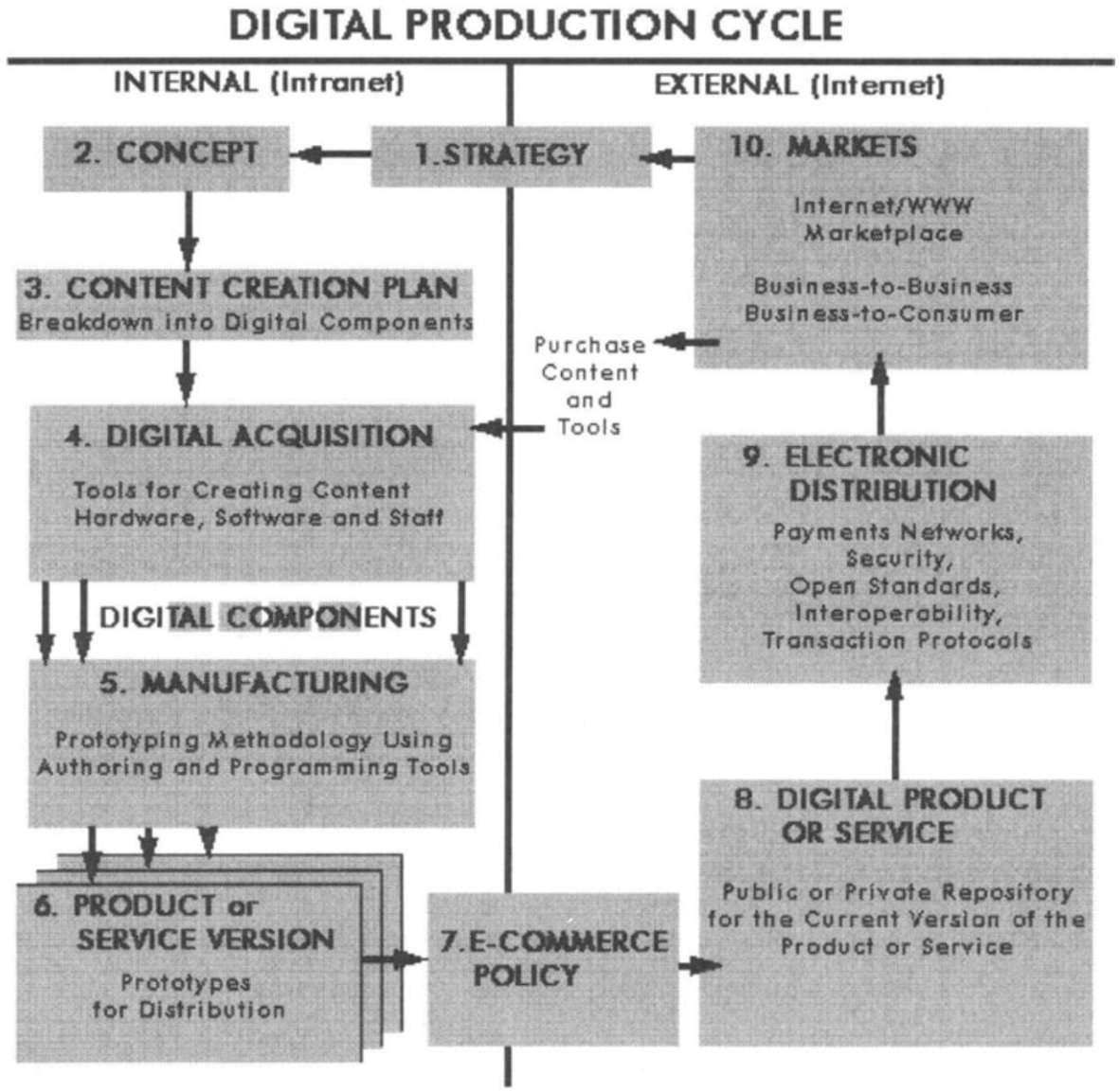


Figure 6 – All-digital production cycle. Source: Porra, 2000

She explains that clearly advocating that in the content creation plan, the digital components are recognized. They are multiple contents from video to audio, text, etc. but, in the end, they are the digital product itself.

2.2 Process Mapping

According to Long (2014) a process is a number of tasks grouped in activities and sequenced into workflows, transforming inputs into outputs to achieve a specific purpose. Taking this into consideration, process mapping creates schematic representations of operational processes. All vital elements of a process are identified and their users are able to see the work steps and their connection. The process maps' diagram is composed by a number of boxes connected through arrows enumerating the steps to be made until the final result. This representation allows to improve processes and to identify inefficiencies (White and Miers, 2008).

Process mapping used as a method to collect data, presents a number of advantages according to Marrelli (2005):

- Awareness of impact caused by the work of anyone in the process since the map shows the effects of that interaction with each other's work;
- A map can be a detailed guide through a process;
- A process mapping can be designed for different purposes from a single employee, to teams or an entire organization;
- Any amount of information can be collected;
- It is not time consuming;
- It is an effective communication tool;
- Interpretation of data is rarely required since they are very objective.

Harmon (2010a) refers to the importance of graphic notations for process modelling and the similarities between Unified Modelling Language (UML) and Business Process Modelling Notation (BPMN). Both are represented by symbols to describe complex processes and there is a standard representation of activities and flow, being an activity represented by a box with arrow pointing to the next box, meaning the next step.

2.2.1 Business Process Modelling Notation

Process mapping and process modelling are used side-by-side to describe how a company operates its business. Business Process Modelling (BPM) can be described as a significant method within the organizations aiming to analyse and improve their ongoing business processes, increasing their awareness and knowledge and becoming less complex (Bandara et al., 2005). The Sarbanes-Oxley Act (Nielsen and Main, 2004), by legislating, reinforced the interest in developing different modelling techniques and the market competition triggered the development of several tools for process modelling (Ami and Sommer, 2007).

BPM usually describe business operations management and includes graphical descriptions. Process models can contain information related to data, IT resources, performance amongst others (van der Aalst et al., 2000). According to Phalp and Keith (1998), BPM techniques can be divided in different categories: methods used for process execution (Van Der Aalst et al., 2006) or used for process analysis (Verbeek et al., 2007).

Process modelling techniques

In the literature we can find several models of process mapping, each one suitable for a certain type of organization, which include (but is not limited to):

- Cross-Functional Flowchart;
- Workflow Diagram;
- Rendered Process Map;
- Document Map;
- Value Stream Map;
- Flowchart.

Focusing on the Cross-Functional Flowchart (Figure 7), the most appropriate for the production process in question, it combines the features of common flowcharts, with the

ability to nominate the person or team responsible for doing them by adding swim lanes horizontally to the flow charts. These divisions can represent the stream of information between participants and the sequence of their tasks (Damelio, 2011).

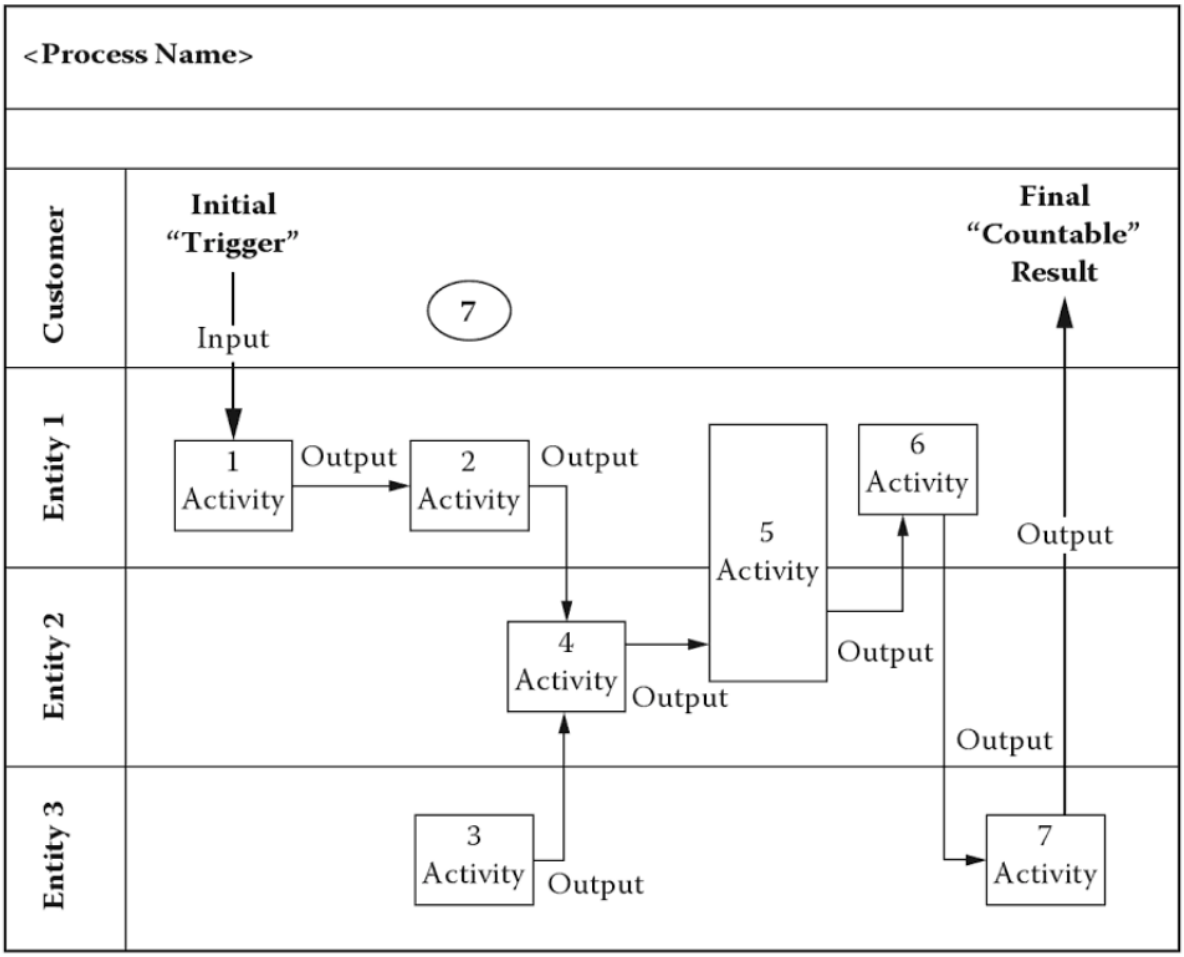


Figure 7 - Cross-Functional Flowchart. Source: Damelio, 2011

When we refer to the current process diagram, that means, the initial status, we call it As-Is. Then, as soon as we start to work in optional diagrams attempting to find a more efficient process, we call this process diagram as Could-Be. When finally, the most efficient diagram for the process is chosen, we call it To-Be process diagram (Harmon, 2010b)

2.3 Layout Design

Find the best organization model able to reduce costs and keep high standards quality may be challenging but, according to Kolb and Göttlich (2015), production systems are organized taking this into consideration. That is why the layouts draw, by organizing the process, enhance the performance (Yang and Hung, 2007). The buffers allocation and the installation of Pull systems along with these layout draws are considered fundamental to reduce costs keeping productivity.

There are several layout methodologies when it comes to organize and make a production process to become more effective. There is an important role that each of them play since they can provide several advantages such as saving space, employees motivation, through an upgrade in their working conditions, flexibility, accessibility among other interesting advantages that one can find by using them in proper context.

Krajewski et al. (2013) demonstrates an approach to layout design, which involves three essential phases. The first is gathering all the necessary information, which includes the requirements for space, capacity and resources. The second phase is the development of a design in blocks, which indicates the location of each step of the production process. To design the layout it is necessary to have information about the measurements of the building, the space that each area will occupy and to take into account which processes should be allocated in consecutive blocks, if they are dependent on one another. The last phase consists of drawing the detailed layout. Once the ideal block design is found, it is necessary a detailed representation showing the exact area and form of each step of the production process, as well as the distribution of all the elements.

2.4 Project Management

Organizations nowadays recognize the strategic importance of project and Project Management to achieve their purposes. Therefore, they now realize that managing a project is not similar to daily work and different approaches are needed (Turner, 2007a).

The project management, by definition, is the combination between restructuring management methods and techniques, aiming to make the best usage of resources (Kerzner 2013a).

When we look for the definitions of Project Management, we need to go back to understand firstly the definition of Project which, according to Kerzner (2013b) can be presented as a group of activities with a purpose achieved by meeting specific requirements, with clear deadlines, resources and multifunctional.

A Project management goes further. A specific team is allocated to a project that will bring a change or benefit while this project is ongoing. Turner (2007b) calls it a temporary organization that can be assigned to develop an engineering project, a new communication technology, a new process or even a new organizational definition. It collides with the traditional methods, heavy by nature, with large amount of paperwork therefore incompatible with quick response needs (Kerzner, 2013c).

Specific skills, knowledge and techniques are needed to successfully run a Project, involving five process steps (Figure 8) from start to end (Project Management Institute, 2013a):

- Initiating is the first process group. When a project is defined and authorization to start is given, all the information and documentation is prepared, the stakeholders are carefully identified, usually chosen with high level of expertise and knowledge, such as consultants, managers, board of directors, sponsors, project managers, etc;
- Planning follows the Initiating process and this one requires a lot of definitions since every step, from the purpose of the project, resources needed, work and documentation involved, timeline to risk assessment fits here, before next one;
- After planning it is necessary to get hands on work and the execution process ensures that project is concluded by leading the team involved, fixing deviations or budgeting changes;
- Along the previous processes and until the successful delivery, Monitoring and Controlling is particularly important since provides review, suggests the necessary adjustments and keep project status constantly updated so that the best performance can be achieved;
- Finally, the Closing, when all activities and previous processes are concluded, paperwork terminated and the Project is officially closed, whether because objectives where achieved and Project is ready to be delivered or because it is earlier terminated under special circumstances.

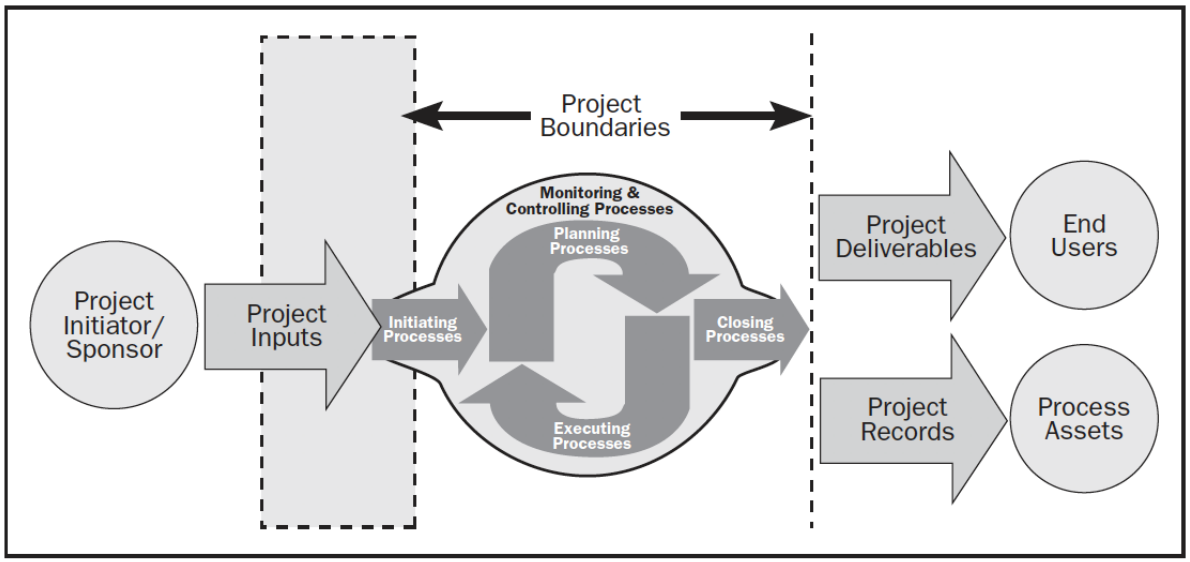


Figure 8 - Project management process groups. Source: Project Management Institute, 2013

Project management aims to anticipate eventual risks and it is considered succeeded when, by terminating the Closing Process, all goals where achieved through customer satisfaction, with effective and efficient resources, the best performance using the best technology available within the agreed initial time and cost (Lock, 2007; Kerzner, 2013d; Project Management Institute, 2013b).

Project Management advantages lay in identifying responsibilities, sets an exact time chronogram, methodology and measures the results obtained versus results planned. During this process, several difficulties will arise that must be overcome in order to be succeeded. The most common relate to complexity of the project, changes occurred when the project is already ongoing, risks, IT changes and prices negotiation (Kerzner, 2013e).

RACI MATRIX

RACI matrices are used to define responsibilities in the project, contributing to the clear division of tasks between people and teams, helping track information easily, avoiding exclusion of key people, improving accountability of tasks, as illustrated in Figure 9. RACI is the acronym to four different responsibilities (Project Management Institute, 2013c).

- Responsible for executing and working in that particular activity;
- Accountable with the responsibility to approve the task;
- Consulted related to opinions given by an expert in the area;
- Informed relates to the person that need to be notified about the results.

RACI Chart	Person				
Activity	Ann	Ben	Carlos	Dina	Ed
Define	A	R	I	I	I
Design	I	A	R	C	C
Develop	I	A	R	C	C
Test	A	I	I	R	I

R = Responsible A = Accountable C = Consult I = Inform

Figure 9 - Responsibly assignment matrix. Source: Project Management Institute, 2013

2.5 Cost-Benefit Analysis

Cost-Benefit Analysis (CBA) is an evaluation technique made to understand the consequences of a project regarding its costs and its benefits. It is the determination of how this project will affect the micro-economy of the company, balancing the influence resulting from existing or not (Dreze and Stern, 1987).

Boardman et al (2006a) states that there are important steps of a Cost-Benefit Analysis such as decide the costs and benefits associated, choose indicators and list the impacts, foresee those impacts during the entire project, and compare the costs and benefits in order to make a proposal. Moreover, the authors state that one can only determine if CBA is the appropriate tool to be used in a decision after fully understand its conceptual foundations and that Pareto efficiency is the most relevant conceptual basis, and crucial if one needs to run a CBA analysis in practice.

Therefore, it is important to point the nine major steps of a Cost-Benefit Analysis:

- Define the group of alternative projects;
- Define the relevant benefits and costs;
- Choose measuring indicators and list the impact categories;
- Anticipate the relevance of those impacts during the entire project;
- Quantify (monetarily) the impacts;
- Compare the costs and benefits to reach real value;
- Calculate the Net Present Value - the difference between present value of benefits and present value of costs - of different projects;
- Make a careful analysis able to evaluate results coming from uncertainty;
- Suggest the better Net Present Value project.

Boardman et al. (2006b) also explains the four common types of CBA:

- Ex ante CBA – conducted before the beginning of the project. Relevant to detail whether resources should be used or not;

- Ex post CBA – conducted after the end of the project. Provides information about the project and the same type of projects, allowing to evaluate future projects of the same class;
- In medias res CBA- conducted during the project. This one has the power to terminate or continue a project since the analysis runs along with it. The information also can give a forecast to further costs;
- Comparative CBA – compares the first type with the second or third within the same project. It has few relevance comparing to the other types.

Regarding decision making of this specific work, the Ex ante analysis is more relevant to decide allocation of resources while ex post is not useful since would be executed to late, but medias res can be useful within this context and to analyse further costs.

Griffin (1998) points eight important principles of the Cost-Benefit Analysis strong enough to incorporate all methods regarding to limitations, achievements and practice:

- Projects can be acceptable if the benefits are by far superior to the estimated costs;
- The existence or absence of the project will impact significantly welfare;
- Cost dimension is originated on social opportunity costs;
- Benefits of Producer shall be considered as additional changes;
- Benefits of Consumer shall be considered as additional changes;
- No benefits or costs arising from analysis shall be ignored;
- Temporal aggregation retains discounting;
- Welfare non-accountable changes shall be divulged.

Pareto multi-objective optimization analysis

There is not a single optimal solution when it comes to project complex systems where options lead to decisions, variables, affecting costs and utilities. Instead, there is a group of efficient solutions, called Pareto front which, through graphic representation, will help the decision-making process (Legriel et al., 2010).

This optimization represents additional difficulties and that is the reason to be considered as a multi criteria decision making process (MCDM) since this multi objective optimization aims to find the most efficient solution among the Pareto represented solutions and elect it (Ngatchou et al., 2005a).

To reach this result, the concepts of Pareto optimality and Pareto dominance are often used since it is only considered Pareto when it is the only solution (dominate) able to better off at least one objective without worst off another (Abbass et al., 2001a).

Ngatchou et al. (2005b) by detailing the meaning of Pareto optimality, explain that the set of all Pareto optimal solutions are named as the Pareto front and, although it is hardly possible to use an analytical expression to represent it, Figure 10 illustrates the potential solutions that optimize a Pareto set for a two-objective maximization problem.

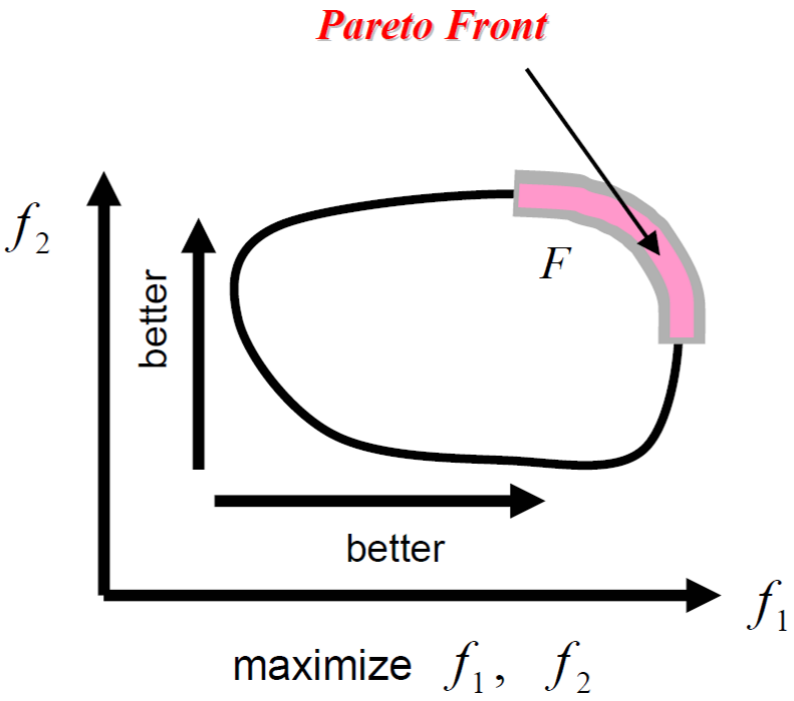


Figure 10 – Pareto front. Source: Ngatchou et al., 2005

Optimizing all purposes at the same time and creating a set of alternative solutions, will permit the decision makers to have more flexibility (Abbass et al., 2001b).

3 Mobile Digital Production Unit

In this section, the processes and situation of Farfetch at the beginning of the present dissertation are clarified, as well as the main differences of these processes for a mobile digital production unit. Moreover, the structure of this type of projects will be described with special focus on the main tasks and the definition of targets.

As referred on the introduction, all the work developed was based on a proof of concept conducted in a real project with a partner brand of Farfetch. With this, it was possible to understand the key constrains and requirements for mobile digital production unit projects.

3.1 Digital Production Process at Farfetch

Farfetch's digital production process is unlike the ones of manufacturing companies since the output is related with updating the products portfolio available on the website. Figure 11 gives an overview of these processes and Figure 12 shows the Avepark digital production unit layout.

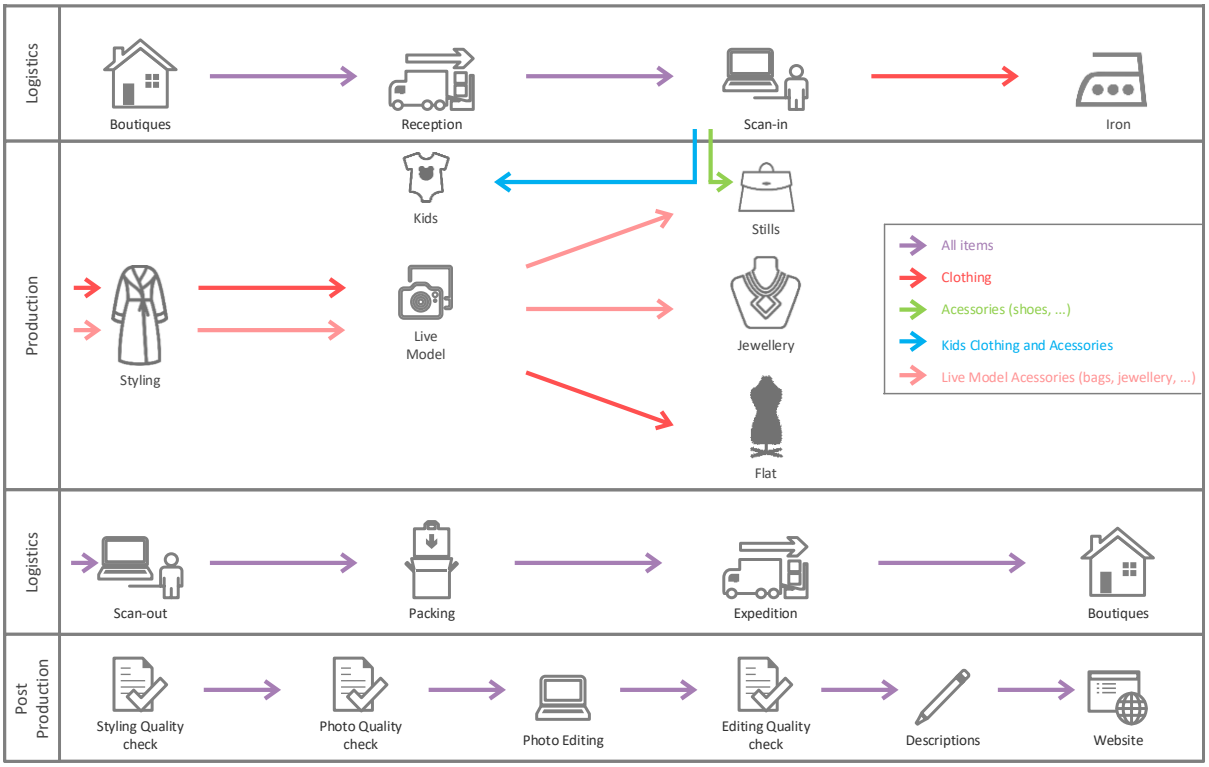


Figure 11 - Digital production at Farfetch

Figure 12 – Current layout at Farfetch

The digital production unit at Farfetch contains the following workstations: Reception, Scan In, Iron, Live Model, Stills, Jewellery, Flat, Kids, Scan Out, Post Production and Quality Control. The processes within each of these workstations are described next.

Reception

The carrier (DHL, TNT, etc.) arrives with the slots for the second shift of the day (from 2pm to 10pm) and for the first shift of next one (from 6am to 2pm). Each slot has a maximum of 50 items and can be divided into several shipping boxes, so that each boutique can send more than one slot at a time. The reception specialist checks the Excel document sent by the Planning Department in order to confirm the number of boxes per slot and validate them. There are a few times where some slots are not planned for the day, so they go to a special area to be processed on the next day (next day priorities' area) or to the stock area if they are in too early.

As soon as the slots for the second shift of the day are completed they go to the corridors marked in yellow to be opened by the mizu[1] (who will verify the conservation status of the box) and will wait for the priority plate, in order to move to the scan-in process according to the priority/order given by the Planning Department. The slots for the first shift of the next day wait on the corridors marked in yellow on the reception area. They will then be opened by the reception specialist, receive a priority plate and wait for the 6am shift to move to the scan-in process.

If the shipping box is identified as visually damaged it is opened on the marked area so that the plate is clearly visible to the camera as well as the damage.

If the slot is incomplete (if they have more than one box) they go to the designated stocking area where they will wait for a maximum of 3 days for the rest of the boxes, otherwise they move into the process anyway.

[1] Mizu – Normally defined as Mizusumashi, logistic train, in Farfetch is a worker who does the transportation of items between the workstations.

Figure 13 - Slot priority plate example[2]

Scan In

The mizu is responsible for distributing the slots into the scan in workstations by priorities. The slot number and the boutique name it belongs to is introduced in the system so that the list of necessary items to pick the rails/boxes is verified. The items are removed from the shipping box and analysed one by one, they are introduced in the system by scanning its product sheet to verify if it is a duplicated item and validate it. If so, it is introduced in the duplicates' system and put on the designated area of the rail with the right identification only to be used in the Live Model workstation if necessary. If not, the tags are removed, if possible, and photographed in case of defects (in order to notify the boutique) and put on the rail/box by category (women or men's clothes, bags, accessories, shoes or jewellery). As soon as the slot is entirely verified and recounted on the rails, it is given a priority plate for each rail/box and put on the done area so the mizu can move it to the next workstation of the process.

If the shipping boxes sent by the boutiques are in good conditions they are stored and moved by the mizu to the Packing area to be reused.

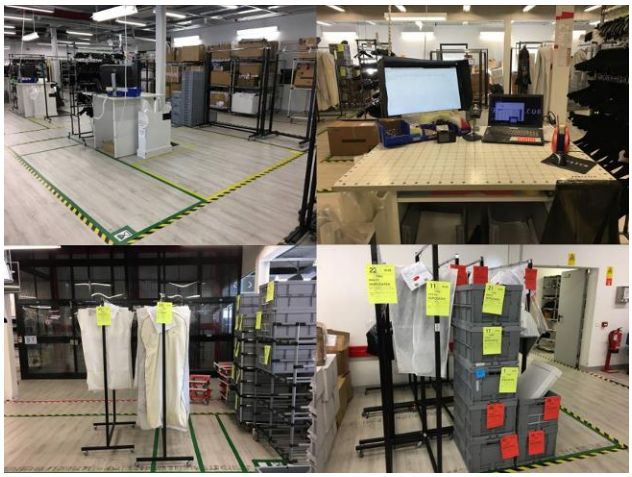


Figure 14 - Scan In workstation area

Figure 15 - Rail/Box priority plate example[3]

[2] Slot priority plate - Each one contains the slot number, the boutique name, the priority, the reception date and the number of slot boxes

[3] Rail/Box priority plate - Each one contains the slot number, the priority, the boutique name, the reception date, the category, the quantity of items in the rail, the number of rails in the slot and the number of duplicates in the slot.

Iron

The first step is to remove the item from the protection bag (if necessary) and to verify if it is fit for ironing (for example leather or items that cannot be processed (damaged, too big, offensive or with alarms) don't need ironing). If it seems fit, it'll be ironed on the board or with steam until there are no more wrinkles. It can happen that there are wrinkles that cannot be removed, if so, they have to be identified with the "Unremovable wrinkles" label, if it happens to be any other reason, the motive should be introduced in the system and the item should be placed back on the rail. Afterwards, all the items are scanned and placed back on the rail on the done area, so the mizu can move it to the next workstation of the process.

In case the item is damaged during the ironing it has to be identified with a special label.

Figure 16 - Example of labels used

Figure 17 - Iron workstation

Live Model

Before the Live Model shooting, a styling process is needed. The stylist is responsible for checking the items in the rail and for writing a small description on the product sheet to make it easier to put it back after shooting. Having in mind the toolkit available (set of basic items from different brands, e.g., clothes, shoes and jewellery) and after making a quick search of the item's brand and its guidelines (if they are available), the stylist starts creating outfits by matching the items with the toolkit's styling cards that they want to use. When possible, they use items of the same rail to ease the Live Model's shooting process, preferably items of the same brand. As soon as the stylist finishes all the rails in that slot, the styling consultant has to check all the outfits and approve it according to Farfetch's standards and brand guidelines.

Afterwards, the stylist goes into the studio with the created outfits to help the model, make some retouches before the shoot and check the quality of each photo taken in terms of styling.

The styling assistant is in charge of bringing all the toolkit items selected by the stylist and to make it ready for the model to quickly change outfits in between. When the slot is ready, the styling assistant has to reorganize all the items on the correspondent rail as well as the toolkit items.

Each outfit is shot 4 times: main view (front view), ¾ view, back view and detail view.

The photographer has to verify the checklist of the materials necessary on the studio, associate himself, the model and the stylist to the shooting, verify the quality of each photo as well as the colour and process it. They are responsible for scanning the bar code of the item's product sheet and of each toolkit's styling cards of that outfit, if they are available in Farfetch.com, to enable the shop the look option. All the photos of that item are then submitted for Quality Control.

As soon as the slot is entirely shot, the styling assistant moves it to the done area so that the mizu can move it to the next workstation of the process and the styling consultant has to approve all the photos.

There are some differences on this process when shooting Lingerie and Beachwear, for example, it is shot in a close studio with only 2 views (front and back) and has exclusive days.

Figure 18 - Live Model workstation

Figure 19 - Toolkit's styling card example

Stills

Contrarily to Live Model workstations, Stills only have one resource assigned, the photographer. The workstations are divided between items in rails and items in boxes to specialize the resources and to help the work of the mizu since the rails come from upstairs from Live Model and the boxes come directly from Scan In. The rails contain only bags and scarfs (since the clothes go directly to Flat) and the boxes contain all the other accessories like shoes, hats, sunglasses, phone cases, etc.

The photographer has to verify the checklist of the materials necessary on the studio in the beginning of the shift, prepare all the items, scan their product sheets and photograph them one by one in different views. Depending on the item, they have to follow the guidelines defined by Farfetch (for example, shoes are shot 4 times: side view, ¾ view from the front, ¾ view from the back and top view; but bags only 3 times: front view, back view and detail view) as well as check the quality and the colour of the photos. As soon as the slot is entirely shot it goes to the done area so the mizu can move it to the next workstation of the process.

Figure 20 - Stills workstation

Jewellery

Jewellery workstations work in a very similar way to Stills. However, some main differences are that the items shot are more delicate so they require a special cleaning and the use of stacking focus technique for some views to allow a total focused image. Each item is shot 3 times: front view, detail view and, if needed, back view.

Flat

Flat is the last workstation of the photographic part of the digital production. The items come mostly directly from the Live Model (clothes, lingerie and beachwear) and some from Stills. Like in Stills, Flat have only one resource assigned, the photographer, who is responsible for the checklist, to prepare and scan all the items and to photograph only one view (front view) in the adequate mannequin (woman or man entire body mannequin, half-body for pants or transparent for furs). However, it is always necessary more photos to focus on details (wire manikin), like the inner side of the collar, so the Post Production can assemble the final photo. As soon as the slot is entirely shot it goes to the done area so the mizu can move it to the Scan Out.

To avoid surpassing the daily repetitions percentage, Flat have their own Quality Control that re-checks all the work before uploading in the system by the photographers.

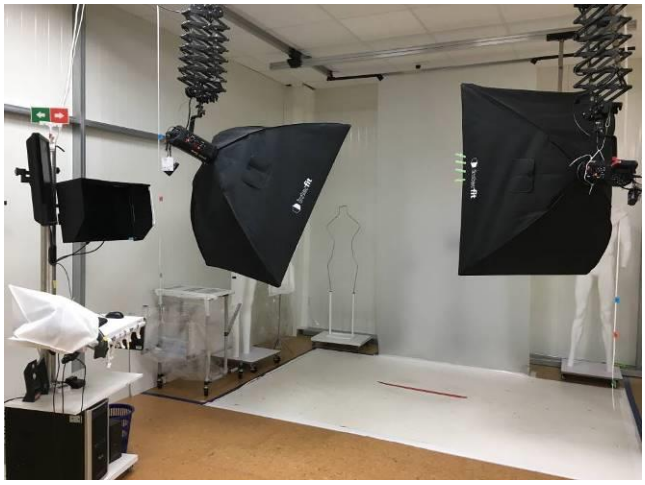


Figure 21 - Flat workstation

Kids

In alignment with the other workstations, Kids only have one resource, the photographer, and are divided in Flat (clothes) and Stills (Underwear, Shoes, Baby grows kits, Blankets, Scarfs and Gloves), which function in a very similar way as the ones referred before. The main difference are the views in Flat (front view, back view and detail view) since this items do not go through Live Model. The items are divided in 3 categories: Baby, Kid and Teen.

Figure 22 - Kids workstation

Scan Out

Scan Out is divided in three parts:

- Data Entry: The items are distributed through the workstations by the mizu. Each item is scanned after a visual verification in order to verify if the product sheet is the correct, measured (if possible) and has its information verified and corrected. Finally, the presence for damages is checked on the item, it is packed and placed in a box. When the box is full with items of the same priority it is sent to the packaging area using the Scan Out ramp. When the item is damaged or dirty there is a special area where the item is thoroughly analysed and the problem is handled, for example, by sewing the tag or sending the item to the laundry.
- Packing: Each item is scanned and placed inside the corresponding shipping box sent by the boutique if it was in good conditions to be reused. If not, the items are placed inside a new one.
- Expedition: Each shipping box is weighed, carefully closed, sealed and moved to a stocking area. When the slot is complete (if they have more than one box), a waybill is assigned and they are moved to the carrier’s stocking area where it will wait for expedition.

Figure 23 - Scan Out workstation

Post Production

Post Production is responsible for all the countries in which Farfetch has digital production units (Portugal, Hong Kong, USA and Brazil) and is entitled for editing and retouching all the photographs shot during the digital production process. All the editors are prepared to process ready-to-wear, but for Jewellery and Kids an expert editor is required. Once the edition is finalized, the editors upload the photos online every 2 hours. However, they are only available for customers after going through the Content team.

Quality Control

The Quality Control workstation is divided in Check In, Check Out and New In that are non-productive processes.

When the slot is, preferably, on the last workstation of digital production, the Check In manually verifies the photos sent by all the workstations (Live Model, Stills, Jewellery, Flat and Kids). The main parameters checked are light, focus, symmetry, the view necessary for Post Production and the style accordingly to Farfetch's guidelines. If any of these parameters are not approved, a repetition is requested and the mizu is notified to pick the item from the Scan Out and deliver it to the right workstation, depending on where the flaw was found. Unless the problem is colour related, this is solved directly by the technical team.

The Check Out is done after the Post Production and consists on the quality control of the edition. The items are, normally, already live on Farfetch.com and on their way back to the boutiques. So, if a photo is not approved by the Check Out, a correction is requested to the Post Production edition. If this is not enough then a re-shoot is required, meaning that the boutique has to send the item again.

New In consists on a final quality control made by the Quality Control specialists. They check the items selected by the Visual Merchandising Department to go to the New In section on Farfetch.com only on the next day.

Each repetition, correction or re-shoot request represents an unnecessary additional cost, so each workstation of digital production works hard to avoid it.

There is also an extra service provided to the boutiques consisting on the possibility to have all their items' photos in a high quality resolution for their own use.

3.2 Digital Production Process at Mobile Digital Production Unit

On a mobile digital production unit, the digital production process is very similar with the one at Farfetch. As such, only the main differences between the two processes, with the help of the cross-functional flowcharts (explained in the Literature Review Section) of each workstation, will be described. Also, an example of a possible layout for a mobile digital production unit is shown in Figure 24.

Figure 24 - Example of a layout at a mobile digital production unit

Reception

The reception process is not necessary in a mobile digital production unit since the items are already organized by slots and available in the brand´s showroom ready for Scan In process.

Scan In

The mizu does not intervene in this process as the space between workstations is much smaller and the Scan In specialist can move the rails/boxes directly. The duplicates and defects detection is not necessary seeing that the brand is present during the process and any problem can be solved in real time.

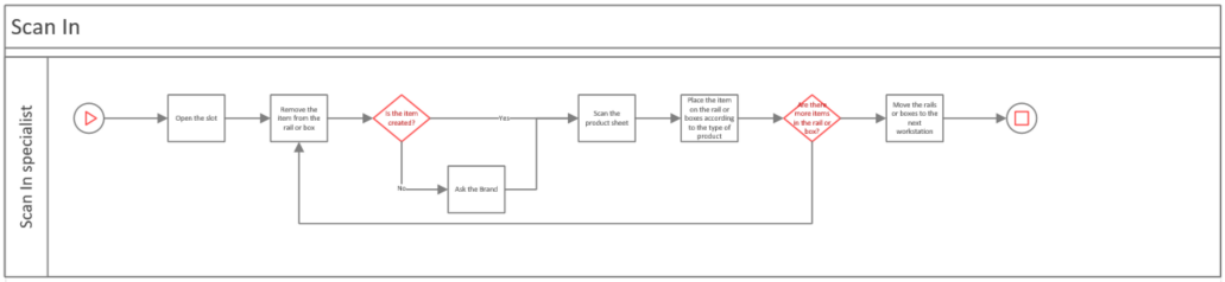


Figure 25 - Scan In cross-functional flowchart

Iron

The only difference in this process is the lack of intervention from the mizu for the same reason described before.

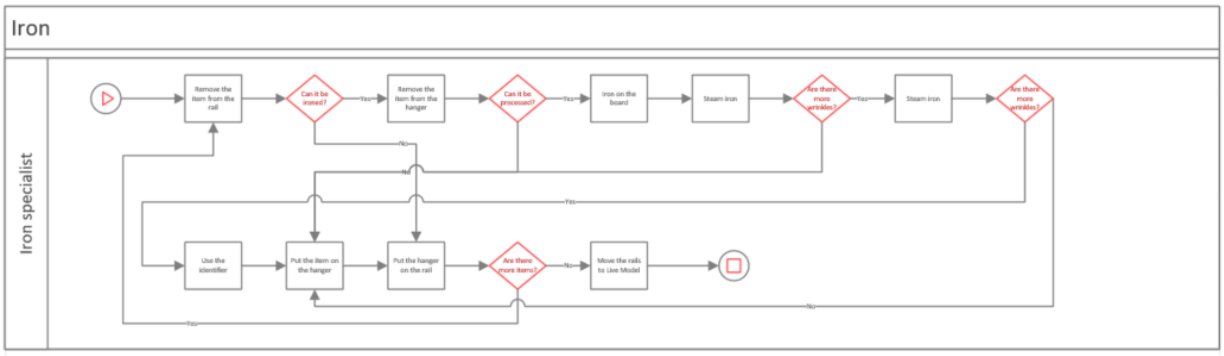


Figure 26 - Iron cross-functional flowchart

Live Model

The main differences on this process are the possibility of shooting extra views requested by the brand, the photographer working live with the Quality Control to avoid the necessity of repeating photos and the toolkit is smaller or inexistent since the outfits will mostly be created based on the brand's fashion show. There is also the addition of a new type of resource named the "Size&Fit specialist".

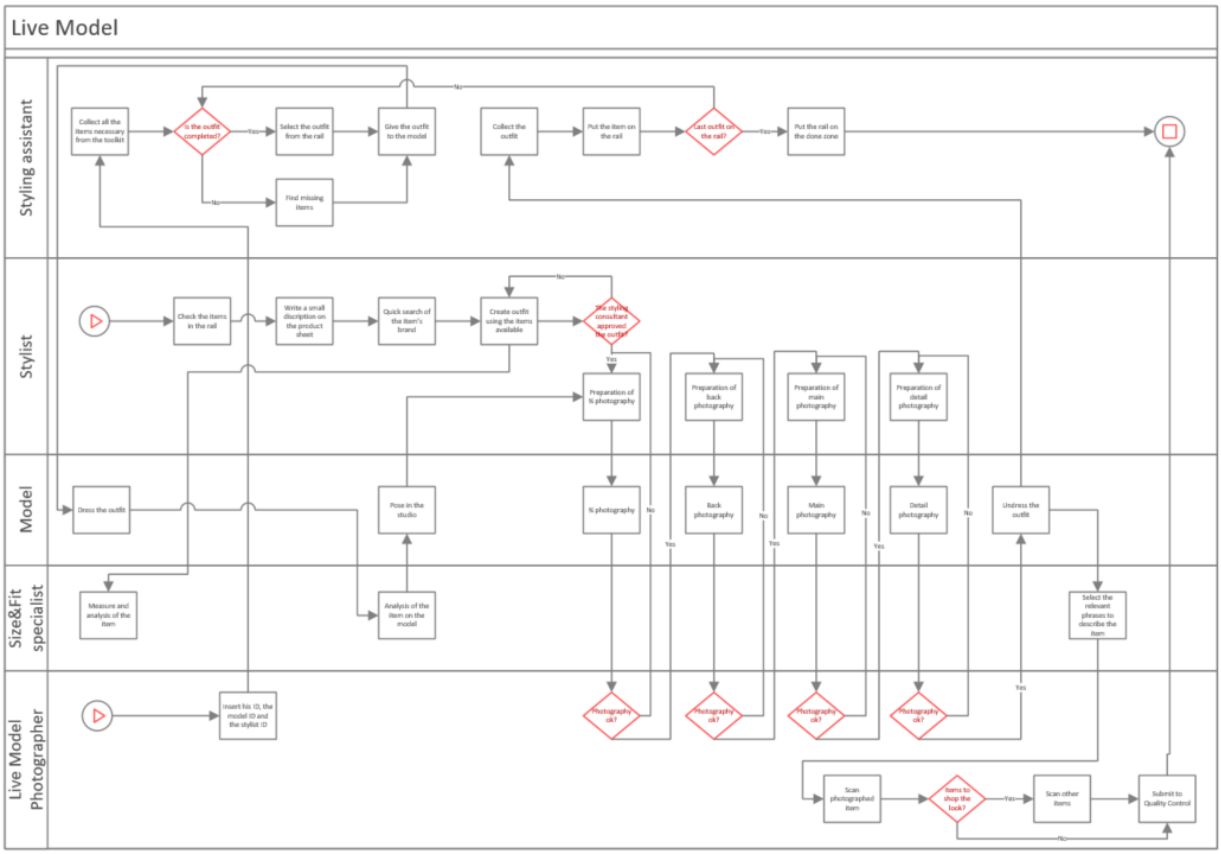


Figure 27 - Live Model cross-functional flowchart

Stills and Jewellery

These 2 types of workstations work in a very similar way with the differences referred on the digital production unit at Farfetch. The mizu also does not intervene in this process and it is not necessary to divide the workstations between item in rails and item in boxes.

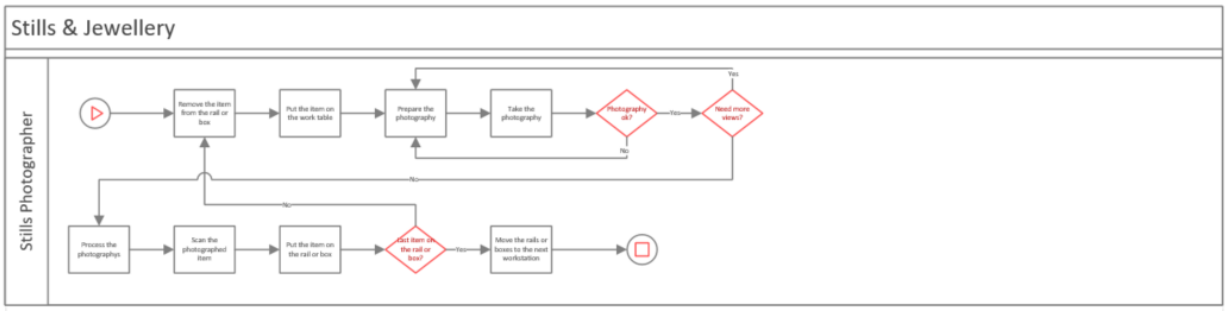


Figure 28 - Stills and Jewellery cross-functional flowchart

Flat

This process works exactly the same as in Farfetch.

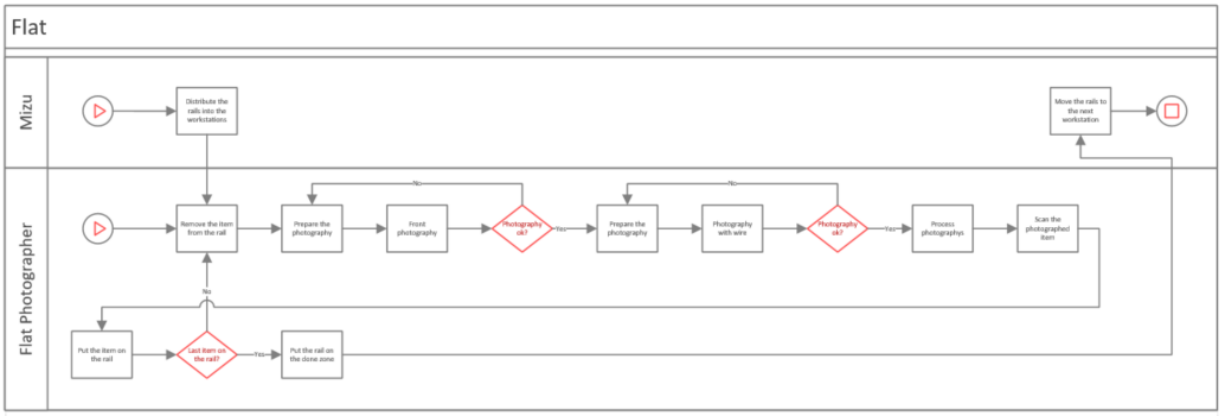


Figure 29 - Flat cross-functional flowchart

Kids

This process also works exactly the same as in Farfetch.

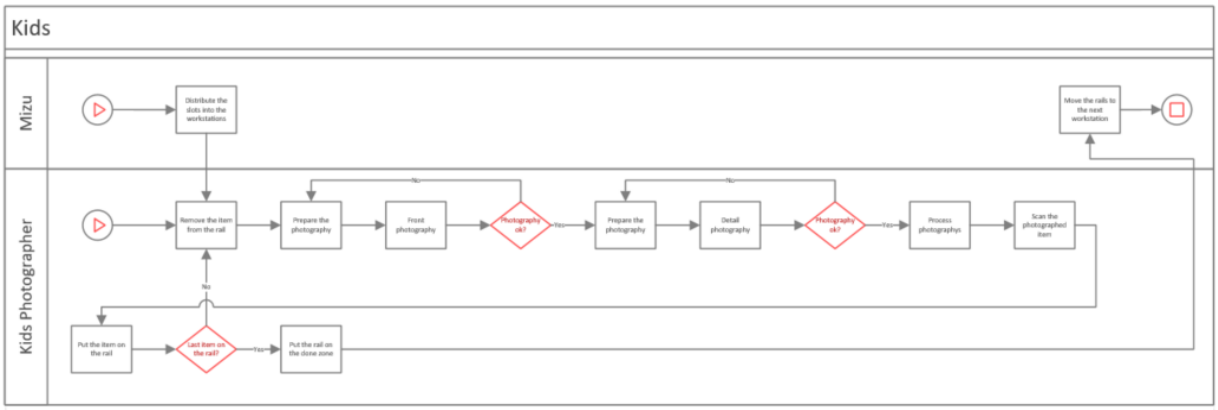


Figure 30 - Kids cross-functional flowchart

Data Entry and Packing

These processes are the equivalent as the ones described in Scan Out at Farfetch with the differences that it is not necessary damage detection neither Expedition. The Packing is done by scanning each item and putting it back on the rail/box instead of the shipping box.

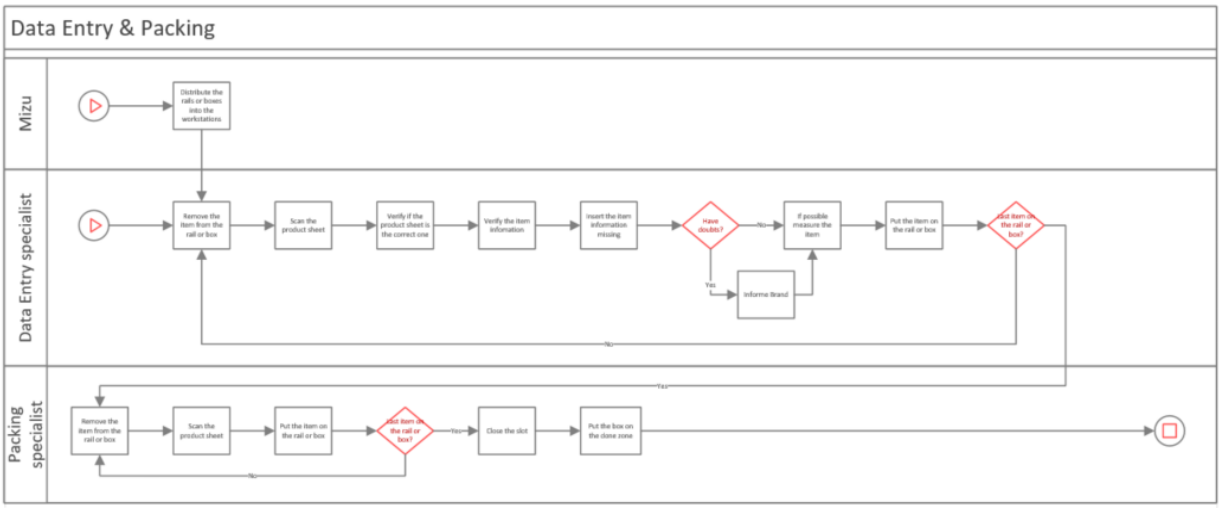


Figure 31 - Data Entry and Packing cross-functional flowchart

Post Production and Quality Control

The Post Production and Content processes are done in Avepark digital production unit as well as the Check Out and New In processes. On the other hand, Check In process is working live in the mobile digital production unit.

3.3 Project Structuring

After finishing the processes mapping and understanding the differences between Farfetch and mobile digital production, it was necessary to define the structure of the mobile digital production unit projects. To do so, it is here identified the main tasks and defined the targets.

3.3.1 Main Tasks Identification

In order to assure that all the phases, since the conception of a project until the final results evaluation, are considered and properly executed, a task list was developed, as shown in Figure 32.

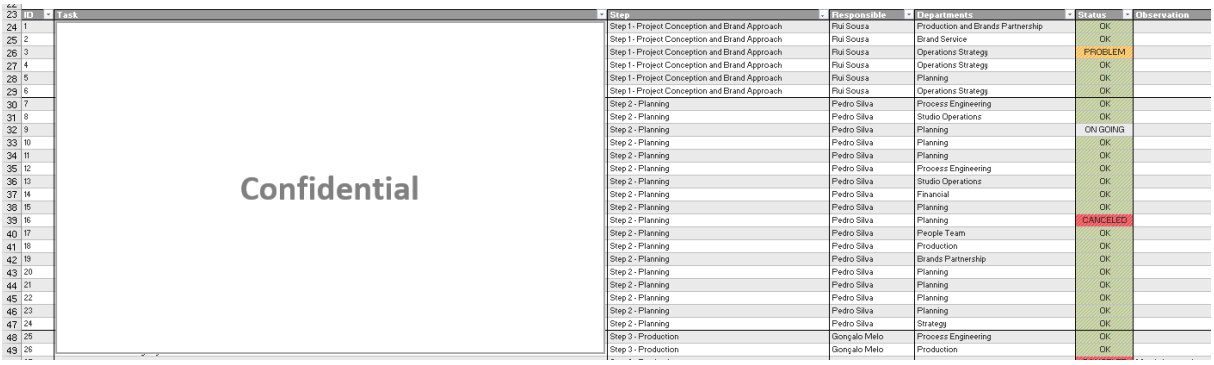


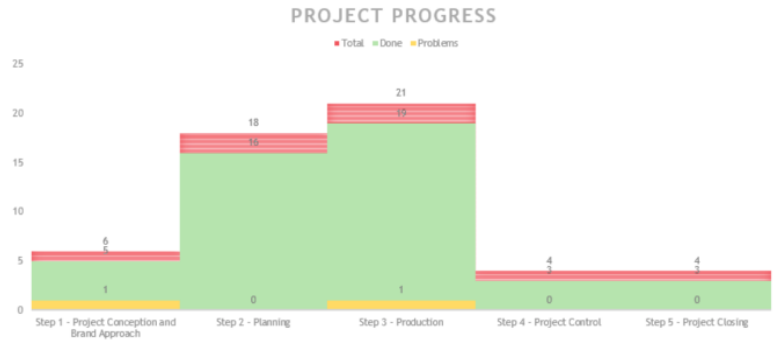
Figure 32 – Task list table

The tasks necessary for this type of projects were organized in major steps according to the 5 groups of processes described in the Literature Review Section, although with a rearrangement for a better fit:

- Project conception and brand approach: focus on evaluating the potential of a project, the cost-benefit analysis and define a budget; approach the brand and close the deal;

- Planning: focus on identifying needs and requirements, with the collaboration of the brand; definition of the detailed planning and resources assignment;
- Production: implementation of the planned processes and close supervision to avoid last minute changes;
- Project control: focus on controlling and monitoring processes, as well as targets to meet the project goals;
- Project closing: focus on formally completing the project, evaluate the results and lessons learned; conduct a cost-benefit analysis and calculate deviations from the estimated values.

These tasks organized by steps were compiled in an Excel document where it was possible to easily monitor the status of each task ("DONE", "ON GOING", "PROBLEM" and "CANCELLED"). As the tasks status are defined, a chart is updated to allow the visualization of the progress within each step. In Figure 33 it is illustrated an example of the chart.



Step	Total	Done	Problems
Step 1 - Project Conception and Brand Approach	6	5	1
Step 2 - Planning	18	16	0
Step 3 - Production	21	19	1
Step 4 - Project Control	4	3	0
Step 5 - Project Closing	4	3	0

Figure 33 - Tasks progression chart

Furthermore, it was created a RACI matrix (Figure 34) for each step, in order to assign the departments responsible for the different activities. For each activity, there are four different key responsibility roles as clarified in the Literature Review Section.

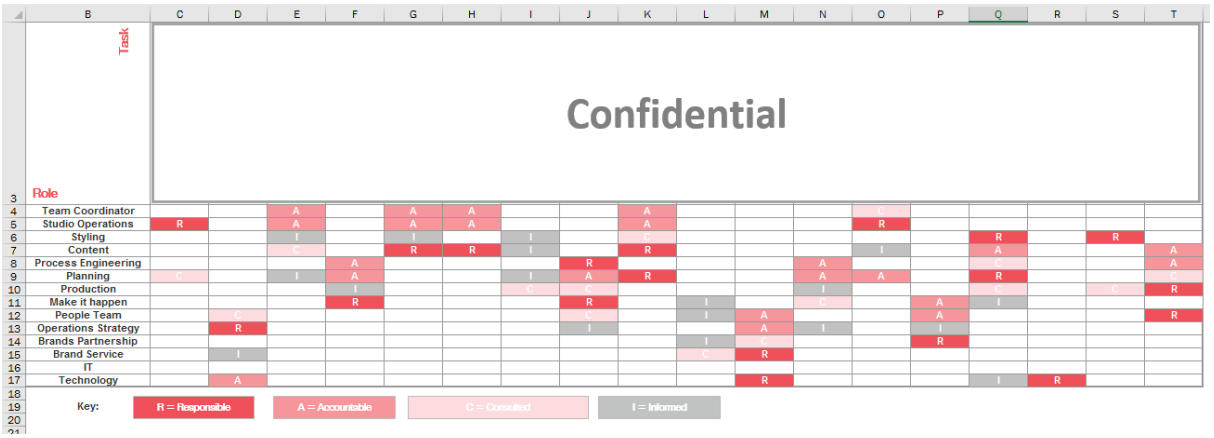


Figure 34 – RACI matrix example

3.3.2 Targets Definition

In Farfetch a target is the expected quantity of items to be produced by each workstation in a shift (8 hours period).

These targets are well defined for the Avepark digital production unit. For the proof of concept, it was necessary to adjust these targets due to, among other reasons, scale reduction in a mobile digital production unit. These referred adjustments are represented on the following Figure 35.

Types of workstation	Percentage Variation
Scan In	79%
Data Entry and Packing	6%
Iron	-20%
LMM	-51%
LMM L	-51%
LMW	-47%
LMW L	-47%
JW	-38%
Stills	-27%
Flat	-21%
QC in	-13%

Figure 35 – Percentage variation of the targets

By analysing the table in Figure 35, is possible to identify that the majority of targets are negative, which mean that they were reduced. This reduction is a reflex of the improved careful taken in order to provide more exclusivity to the brand. On the other hand, there are two workstations with increased targets (Scan In and Data Entry and Packing) due to simplification on the processes within them, as explained on Section 3.2.

To validate these adjustments, the productivity in each workstation was calculated by collecting the data from the company's database and compiling it in an Excel document, as shown in Appendix A.

Although the productivity values (Figure 36) were not very positive for all the workstations, it was concluded that they are justified by some internal reasons that are not expected to occur again in future projects of this type. So, it was decided to maintain the targets defined for the proof of concept.

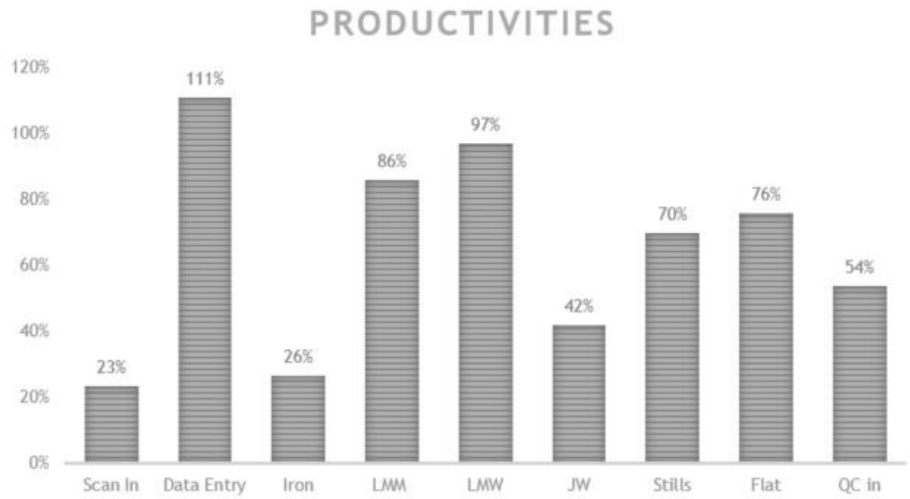


Figure 36 - Productivities from the proof of concept

4 Structured Approach to Mobile Digital Production Unit Projects

In this section, an Excel program is described, which was created to support the necessary decisions for the steps "Project conception" and "Planning", previously referred to in Section 3.3.1, as well as to calculate the total cost of a mobile digital production unit project. The program is divided in two major modules: Project Planning and Cost Analysis. The results of a cost-benefit analysis for brand prioritization are also presented, using the Excel program, for a sample of 20 brands.

4.1 Project Planning

In this first module, the main goal is to calculate the number of workstations and resources needed for the project as well as their allocation and planning, depending on the quantity of items per category of the brand to be produced. To do so, the first step was to understand how the planning is done at Farfetch and to collect some data that revealed itself as relevant for a mobile digital production unit.

4.1.1 Key Factors

The terms used in the present module, of the Excel program, for the Planning Model are:

- Total items: total quantity of items to be produced for the project;
- Project days: number of days available for the project;
- Shifts per day: number of shifts in one day. For this type of projects, 2 shifts per day are always considered;
- Hours per shift: number of hours in one shift;
- Total resources: total number of resources needed for the project;
- Resources per workstation: number of resources assigned to each type of workstation;
- Targets: expected quantity of items to be produced by each type of workstation in an 8 hour shift;
- Targets adjusted: new targets calculated for a shift with a different time-frame than the usual 8 hours;
- Items split: quantity of items to be produced by each type of workstation, depending on the quantity of items per category;
- Rework: estimated quantity of items that will need to be reshot;
- Shifts needed: calculated number of shifts needed by each type of workstation for the project;

- Days needed: calculated number of days needed by each type of workstation for the project;
- Workstations needed: calculated number of workstations required of each type for the project;
- Total resources per workstation type: calculated number of resources needed for the number of workstations required of each type for the project;
- Count per category: quantity of items per category to be produced for the project.

The terms used in the present module, of the Excel program, for the Detailed Planning are:

- Set-up shift suggestion: Suggestion for the shift when the set-up of each type of workstation starts, considering the dependencies between workstations;
- Set-up time: number of shifts needed to complete the set-up of each type of workstation;
- Disassembly time: number of shifts needed to complete the disassembly of each type of workstation;
- Start shift: shift when the production in each type of workstation starts;
- End shift: shift when the production in each type of workstation ends;
- Disassembly shift: shift when the disassembly of each type of workstation starts.

The terms used in the present module, of the Excel program, for the Resources Assignment are:

- Working days: number of working days needed by each type of resource for the project;
- Days off: number of non-working days of each type of resource for the project;
- Total days: total number of days of each type of resource for the project;
- Arrive day: day and shift when the flight of each type of resource should arrive for the project;
- Departure day: day and shift when the flight of each type of resource should departure for the project.

4.1.2 Planning Model

Before using the Excel program, it is necessary to gather some information with the brand selected for the project. The most important information in order to ensure the program's accuracy are the "Total items" and the "Count per category". The "Total items" field is the sum of the "Count per category" column, which is the quantity of items for the shooting, organized per category, presented in the column coloured in pink in Figure 37.

Gender	%	Count	Principal Category	Count	Category	%	Count per category	Workstation1	Workstation2
Men	37,76%	1123	Acc Men	84	Scarves	0,61%	18	LMM	Stills
					Bags	2,22%	66	LMM	Stills
			ClothMen	736	Clothing	22,53%	670	LMM	Flat
					Underwear	1,08%	32	LMM L	Flat
					Socks	0,37%	11		Stills
					Beachwear	0,77%	23	LMM L	Flat
					Activewear	0,00%	0	LMM	Flat
			Stills	298	Accessories	5,85%	174		Stills
					Lifestyle	0,64%	19		Stills
					Shoes	3,53%	105		Stills
					Beauty & Grooming	0,00%	0		Stills
			JewelleryMen	5	Jewellery	0,17%	5	LMM	JW
Women	48,32%	1437	Acc Women	370	Scarves	2,22%	66	LMW	Stills
					Bags	10,22%	304	LMW	Stills
			ClothWomen	664	Clothing	20,71%	616	LMW	Flat
					Lingerie & Hosiery	0,44%	13	LMW L	Flat
					Beachwear	1,18%	35	LMW L	Flat
					Activewear	0,00%	0	LMW	Flat
			Stills	371	Accessories	4,84%	144		Stills
					Lifestyle	1,24%	37		Stills
					Shoes	6,39%	190		Stills
					Beauty & Grooming	0,00%	0		Stills
			JewelleryWomen	32	Jewellery	1,08%	32	LMW	JW
Unisex	0,74%	22	AccUnisex	6	Scarves	0,10%	3	LMM	Stills
					Bags	0,10%	3	LMM	Stills
			ClothUnisex	2	Clothing	0,00%	0	LMM	Flat
					Lingerie & Underwear	0,00%	0	LMM L	Flat
					Beachwear	0,07%	2	LMM L	Flat
					Activewear	0,00%	0	LMM	Flat
			Stills	12	Accessories	0,27%	8		Stills
					Lifestyle	0,13%	4		Stills
					Shoes	0,00%	0		Stills
					Beauty & Grooming	0,00%	0		Stills
			JewelleryUnisex	2	Jewellery	0,07%	2	LMM	JW
Kids	13,18%	392	AccKids	108	Accessories	3,63%	108		StillsKids
			ClothKids	284	Clothing	9,55%	284		FlatKids

Figure 37 - “Count per category” table (example of Brand A’s project)

For each mobile digital production unit project, the brand should fill-in this pink-coloured column in Figure 37 in order to be automatically recognized by the program. Depending on the brand’s “Count per category”, the remaining columns are automatically fixed and calculated. This eases the organization and comprehension for the brand.

The last two columns, “Workstation1” and “Workstation2”, indicate which type(s) of workstation(s) each category of items should go through on the production process.

The types of workstations considered for the Excel program are the ones referred on Section 3.2 with some changes, namely the addition of the Mizu and Support, as shown in the following table (Table 1):

Table 1 - Types of workstation considered for the Excel program

Types of workstation	Description
Scan In	Scan In workstation
Data Entry and Packing	Data Entry and Packing workstation
Mizu	Not a real workstation but it is considered here for simplifying the representation of the mizu resources
Iron	Iron workstation
LMM	Live Model workstation for men
LMM L	Live Model workstation for men lingerie and beachwear
LMW	Live Model workstation for women
LMW L	Live Model workstation for women lingerie and beachwear
JW	Jewellery workstation
Stills	Stills workstation

Flat	Flat workstation
FlatKids	Kids workstation for Flat
StillsKids	Kids workstation for Stills
QC in	Check In workstation
Photo Editing	Post Production workstation working from Avepark digital production unit
Photo Editing JW + Lingerie	Post Production workstation for jewellery, lingerie and beachwear working from Avepark digital production unit
QC out	Check Out and New In workstation working from Avepark digital production unit
Content	Content workstation working from Avepark digital production unit
Support	Not a real workstation but it is considered here for simplifying the representation of the Logistic Support, the Team Coordinator and the Office Supervisor resources

There are two other topics that need to be discussed with the brand. The first is the "Hours per shift" field, which normally is 8 hours. However, if requested by the brand, it can be adjusted. The second is the "Project days" field, which can take values from 2 until 30.

In Figure 38 it is possible to have an overview of the Planning Model of the Excel program (example of Brand A's project), that will help to understand how all the key factors are related.

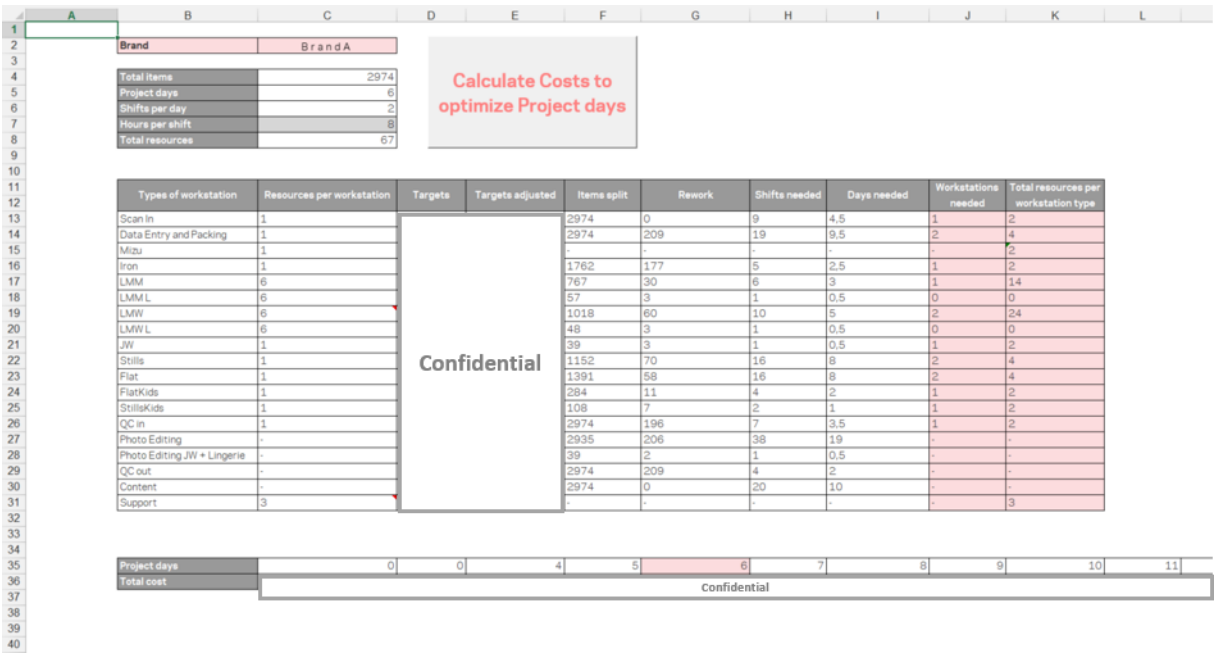


Figure 38 – Planning Model overview (example of Brand A's project)

As it is possible to verify in Figure 38, the Planning Model has a table with several columns that represent auxiliary information and calculations required to calculate its main outputs, which are the number of workstations and resources needed for the project.

The "Resources per workstation" column shows the number of resources assigned for each type of workstation, which is fixed and defined according to the production process explained in Section 3.2. The following table (Table 2) illustrates the type of resources assigned for each type of workstation:

Table 2 - Types of resources for each type of workstation

Types of workstation	Resources per workstation	Types of resources
Scan In	1	Scan In specialist
Data Entry and Packing	1	Data Entry and Packing specialist
Mizu	1	Mizu
Iron	1	Iron specialist
LMM	6	Live Model supervisor Live Model photographer Men 2 x Stylist Men Styling assistant Men Size&Fit specialist Men Model Men
LMM L	6	Same resources as LMM
LMW	6	Live Model supervisor Live Model photographer Women 2 x Stylist Women Styling assistant Women Size&Fit specialist Women Model Women
LMW L	6	Same resources as LMW
JW	1	Stills/Jewellery photographer
Stills	1	Stills/Jewellery photographer
Flat	1	Flat photographer
FlatKids	1	FlatKids photographer
StillsKids	1	StillsKids photographer
QC in	1	QC in specialist
Photo Editing	-	Not applicable
Photo Editing JW + Lingerie	-	Not applicable
QC out	-	Not applicable
Content	-	Not applicable
Support	3	Logistic Support Team Support Office Support

The “Targets” column refers to the targets defined for each type of workstation in an 8-hour shift as explained on Section 3.3.2. The “Targets adjusted” column is used when the “Hours per shift” field is different from 8 hours and recalculates the targets using the following equation:

$$\text{"Targets adjusted"} = \frac{\text{"Targets"} \times \text{"Hours per shift"}}{8} \quad (4.1)$$

The “Items split” column adds the quantity of items, in the “Count per category” column from the table in Figure 37, that need to go through each type of workstation, following the restrictions shown in Table 3.

Table 3 – Restriction of the “Items split” calculation for each type of workstation

Types of workstation	Restrictions
Scan In	All items
Data Entry and Packing	All items
Mizu	Not applicable
Iron	Scarves and categories of items which have “Flat” and “Flat Kids” on the “Workstation2” column from Figure 37
LMM	Categories of items which have “LMM” on the “Workstation1” column from Figure 37
LMM L	Categories of items which have “LMM L” on the “Workstation1” column from Figure 37
LMW	Categories of items which have “LMW” on the “Workstation1” column from Figure 37
LMW L	Categories of items which have “LMW L” on the “Workstation1” column from Figure 37
JW	Categories of items which have “JW” on the “Workstation2” column from Figure 37
Stills	Categories of items which have “Stills” on the “Workstation2” column from Figure 37
Flat	Categories of items which have “Flat” on the “Workstation2” column from Figure 37
FlatKids	Categories of items which have “FlatKids” on the “Workstation2” column from Figure 37
StillsKids	Categories of items which have “StillsKids” on the “Workstation2” column from Figure 37
QC in	All items
Photo Editing	Categories of items which do not have “LMM L” or “LMW L” on the “Workstation1” column or “JW” on the “Workstation2” column from Figure 37
Photo Editing JW + Lingerie	Categories of items which have “LMM L” or “LMW L” on the “Workstation1” column or “JW” on the “Workstation2” column from Figure 37
QC out	All items
Content	All items
Support	Not applicable

The “Rework” column refers to the quantity of items that need to be reshot in each type of workstation. This factor is calculated by multiplying the average reshoot percentages estimated in Farfetch by the “Items split” column.

The “Shifts needed” column calculates the number of shifts necessary to shoot the quantity of items in each type of workstation. As such, it is necessary to divide the “Items split” column plus the “Rework” column by the “Targets adjusted” column.

The “Days needed” column calculates the number of days necessary to shoot the quantity of items in each type of workstation. Since the “Shifts per day” field is always 2 for this type of projects, it is necessary to divide the “Shifts needed” by 2 in order to obtain the number in days, as shown in the following equation:

$$\text{"Days needed"} = \left\lceil \frac{\frac{\text{"Items split"} + \text{"Rework"}}{\text{"Targets adjusted"}}}{\text{"Shifts per day"}} \right\rceil \tag{4.2}$$

The “Workstations needed” column is one of the main outputs of the present model. To calculate this factor it is necessary to divide the “Days needed” by the number of productive days. The number of productive days is given by the “Project days” field minus the shift when the set-up starts which is represented on the “Set-up shift suggestion” column (that will be explained on Section 4.1.3) divided by the “Shifts per day” field. The following equation represents this factor:

$$\text{"Workstations needed"} = \left\lceil \frac{\text{"Days needed"}}{\text{"Project days"} - \left(\frac{\text{"Set} - \text{up shift suggestion"}}{\text{"Shifts per day"}}\right)} \right\rceil \tag{4.3}$$

In the case of LMM and LMM L workstations, the Excel program takes into account that when the number of “Days needed” for LMM is different than zero, the numerator (“Days needed”) in the previous equation is the sum of the “Days needed” for LMM and for LMM L. It also disregards any “Workstations needed” for LMM L because this type of shoot can be made in the same workstation of the LMM. If the number of “Days needed” for LMM is equal to zero, then the “Workstations needed” for LMM L is calculated as explained above, using the Equation 4.3. The same case is applicable to LMW and LMW L.

The “Total resources per workstation type” column is the other main output of the present model. This factor is calculated by multiplying the number of “Workstations needed”, the “Resources per workstation” and the “Shifts per day” field.

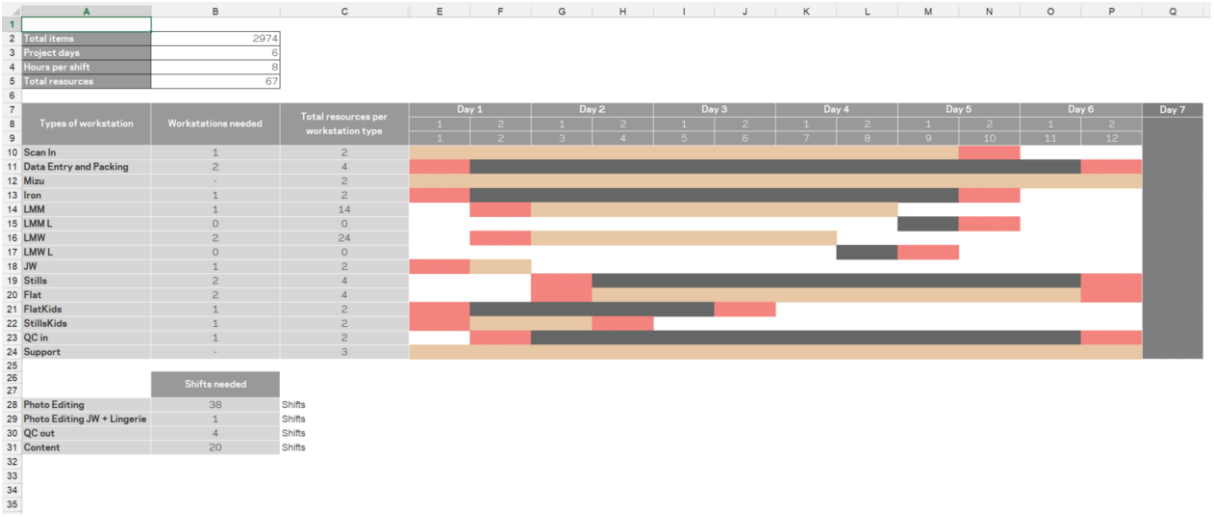
In the case of Live Model workstations (LMM, LMM L, LMW and LMW L), the presence of a “Live Model supervisor” is required for all of them, in every shift. The Excel program only considers his presence in one of the workstations, which is the first that has “Total resources per workstation type” different than zero.

The “Total resources” field is the sum of the “Total resources per workstation type” of all the types of workstations.

4.1.3 Detailed Planning

The Detailed Planning of the Excel program (Figure 39) presents a summary of some data and outputs from the Planning Model as the “Total items” field, the “Project days” field, the “Hours per shift” field, the “Total resources” field, the “Workstations needed” column and the “Total resources per workstation type” column. It is also possible to observe four types of workstations that are not considered in the Gantt diagram. This is due to the fact that, even

though the “Shifts needed” are required to be considered for a future cost calculation, it is not necessary to calculate the “Workstations needed”, the “Total resources per workstation type” neither the Detailed Planning because these workstations work from the Avepark digital production unit.



Total items	2974
Project days	6
Hours per shift	8
Total resources	67

Types of workstation	Workstations needed	Total resources per workstation type
Scan In	1	2
Data Entry and Packing	2	4
Mizu	-	2
Iron	1	2
LMM	1	14
LMM L	0	0
LMW	2	24
LMW L	0	0
JW	1	2
Stills	2	4
Flat	2	4
FlatKids	1	2
StillsKids	1	2
QC in	1	2
Support	-	3

	Shifts needed	
Photo Editing	38	Shifts
Photo Editing JW + Lingerie	1	Shifts
QC out	4	Shifts
Content	20	Shifts

Figure 39 - Detailed Planning overview (example of Brand A’s project)

The main goal of the creation of the Gantt diagram was to create a straightforward and intuitive comprehension of how the production is planned for a mobile digital production unit project. In order to construct this Gantt diagram, the Excel tool, Conditional Formatting (Appendix C) was used, and therefore an auxiliary table was required, as presented on Figure 40.

Types of workstation	Set-up shift suggestion	Set-up time	Disassembly time	Start shift	End shift	Disassembly shift
Scan In	1	0	1	1	9	10
Data Entry and Packing	1	1	1	2	11	12
Mizu	0	1	0	1	12	12
Iron	1	1	1	2	9	10
LMM	2	1	0	3	8	8
LMM L	9	0	1	9	9	10
LMW	2	1	0	3	7	7
LMW L	8	0	1	8	8	9
JW	1	1	0	2	2	2
Stills	3	1	1	4	11	12
Flat	3	1	1	4	11	12
FlatKids	1	1	1	2	5	6
StillsKids	1	1	1	2	3	4
QC in	2	1	1	3	11	12
Support	0	1	0	1	12	12

Figure 40 - Auxiliary table for the Gantt diagram (example of Brand A’s project)

The “Set-up shift suggestion” column indicates when the set-up of each type of workstation starts, considering the dependencies between workstations (Table 4). The program uses a sequential numeration to represent the day and the shift. As such, if the “Set-up shift suggestion” is equal to 1 it means the first shift of the first day, if it is equal to 2 it means the second shift of the first day, if it is equal to 3 it means the first shift of the second day, and so on.

Table 4 – Dependencies of the “Set-up shift suggestion” calculation between workstations

Types of workstation	Dependencies
Scan In	No dependencies
Data Entry and Packing	No dependencies
Mizu	From the beginning of the project
Iron	No dependencies
LMM	One shift after the start of Iron
LMM L	One shift after the end of LMM because use same workstations and resources
LMW	One shift after the start of Iron
LMW L	One shift after the end of LMW because use same workstations and resources
JW	No dependencies
Stills	One after the end of JW because use same resources
Flat	One shift after the start of LM workstations
FlatKids	No dependencies
StillsKids	No dependencies
QC in	One shift after the start of JW
Support	From the beginning of the project

The columns, “Set-up time” and “Disassembly time”, represent the number of shifts required to complete the set-up and the disassembly, respectively.

The “Start shift” column indicates the day and the shift, following the same sequential numeration explained above, when the production starts for each type of workstation. The following equation represents this factor:

$$\text{“Start shift”} = \text{”Set-up shift suggestion”} + \text{”Set-up time”} \tag{4.4}$$

The “End shift” column indicates the day and the shift, following the same sequential numeration explained above, when the production ends for each type of workstation. To calculate this factor, it is necessary to sum the “Start shift” and the shifts necessary to shoot the quantity of items considering the number of workstations of each type, which is represented by dividing the “Shifts needed” column and the “Workstations needed” column. It is also necessary to subtracted one unit (1 shift), since the “Start shift” is also considered in the “Shifts needed”. The following equation represents this factor:

$$\text{"End shift"} = \left\lceil \left(\text{"Start shift"} + \frac{\text{"Shifts needed"}}{\text{"Workstations needed"}} \right) - 1 \right\rceil \tag{4.5}$$

This equation is used for all the types of workstations, except for the ones explained in the following table (Table 5):

Table 5 – Exceptions of the "End shift" calculation

Types of workstation	Dependencies
Data Entry	Last workstation
Mizu	Until the end of the project
Iron	After the end of LM workstations
QC in	Last workstation
Support	Until the end of the project

In the case of LMM and LMM L workstations, the Excel program takes into account that when the number of "Workstations needed" for LMM L is zero, the program considers the number of "Workstations needed" of LMM in the Equation 4.5. If the number of "Workstations needed" for LMM L is different than zero, the "End shift" for LMM L is calculated as explained above, using the Equation 4.5. The same case is applicable to LMW and LMW L.

The "Disassembly shift" column indicates the day and the shift, following the same sequential numeration explained above, when the disassembly of each type of workstation occurs. The following equation represents this factor:

$$\text{"Disassembly shift"} = \text{"End shift"} + \text{"Disassembly time"} \tag{4.6}$$

4.1.4 Resources Assignment

With the purpose of assigning resources and understanding their utility, a table, as illustrated on Figure 41 was constructed, using an Excel macro in Visual Basic for Applications language (Appendix D) that adds or removes lines according to the number of "Total resources per workstation type" of each type of resources.

	B	D	E	F	G	H	I
1							
2	Name	Types of resources	Working days	Days off	Total days	Arrive day	Departure day
3		Scan In specialist	5	2	7	0,5	6,0
4		Scan In specialist	5	2	7	0,5	6,0
5		Data Entry and Packing specialist	6	2	8	0,5	7,0
6		Data Entry and Packing specialist	6	2	8	0,5	7,0
7		Data Entry and Packing specialist	6	2	8	0,5	7,0
8		Data Entry and Packing specialist	6	2	8	0,5	7,0
9		Mizu	6	2	8	0,5	7,0
10		Mizu	6	2	8	0,5	7,0
11		Iron specialist	5	2	7	0,5	6,0
12		Iron specialist	5	2	7	0,5	6,0
13		Live Model supervisor	5	2	7	1,0	6,0
14		Live Model supervisor	5	2	7	1,0	6,0
15		Live Model photographer Men	5	2	7	1,0	6,0
16		Live Model photographer Men	5	2	7	1,0	6,0
17		Live Model photographer Women	4	2	6	1,0	5,5
18		Live Model photographer Women	4	2	6	1,0	5,5
19		Live Model photographer Women	4	2	6	1,0	5,5
20		Live Model photographer Women	4	2	6	1,0	5,5
21		Stylist Men	4	2	6	1,5	5,5
22		Stylist Men	4	2	6	1,5	5,5
23		Stylist Men	4	2	6	1,5	5,5
24		Stylist Men	4	2	6	1,5	5,5
25		Stylist Women	3	2	5	1,5	5,0
26		Stylist Women	3	2	5	1,5	5,0

Figure 41 – Resources Assignment overview (exemple of Brand A's Project)

The first column indicates the name of the workers who will be assigned to each type of resource function. The second column indicates the type of resource, presented on Table 2.

The "Working days" column represents the number of working days needed for each type of resource. To calculate this factor, the program looks upon the number of days passed between the "Disassembly shift" and the "Set-up shift suggestion". It is also necessary to add one unit

(1 shift), since the “Set-up shift suggestion” is not considered. The following equation represents this factor:

$$\text{"Working days"} = \left\lceil \frac{\text{"Disassembly shift"} - \text{"Set-up shift suggestion"} + 1}{\text{"Shifts per day"}} \right\rceil \quad (4.7)$$

This equation is used for all the types of resources, except for the ones explained in the following table (Table 6):

Table 6 – Exceptions of the “Working days” calculation

Types of resources	Dependencies
Mizu	From the beginning until the end of the project
Live Model Supervisor and Photographers	From the start of the set-up until the end of the disassembly of LM workstations
All the others resources related to LM workstations	From the start shift until the end shift of LM workstations because they do not need to be present for set-up or disassembly as opposed to all the rest of the resources
Stills/Jewellery Photographer	From the start of the set-up of JW until the end of the disassembly of Stills
Support	From the beginning until the end of the project

The “Days off” column illustrates the number of days that each type of resource does not work in the project. To calculate the number of non-working days, the program uses the “Departure day”. This calculation assumes that for each 6 working days there is one day off and a maximum duration of a project of 30 days, as implied on the “Project days” field. If the “Departure day” is in less than 6 days, then the “Days off” are 2 (the two-ways flights days), if it is between 6 and 12 days, the “Days off” are 3 (the two-ways flights days and one Sunday), if it is more than 12 days, then the “Days off” are 4 (the two-ways flights days and two Sundays), and so on.

The “Total days” column is the sum of the “Working days” and the “Days off” for each resource.

The “Arrive day” and the “Departure day” columns represent the two-ways flights days. The program represents the day and the shift in the form “A,B”, where the A stands for the day and can take any value from 0 to 30, and the B stands for the first shift of the day (morning) if it is zero, and for the second shift of the day (afternoon) if it is five. For example, if the “Arrive day” is equal to “0,5” it means that the resource’s flight should take place on the day before the shooting starts in the afternoon.

The following table (Table 7) explains how these two factors are calculated for each type of resource:

Table 7 – Calculation of the "Arrive day" and the "Departure day" for each type of resource

Types of resource	Arrive day	Departure day
Scan In specialist	"Set-up shift suggestion"÷"Shifts per day"	"Disassembly shift"÷"Shifts per day"
Data Entry and Packing specialist		
Mizu	"Start shift"÷"Shifts per day"	"End shift"÷"Shifts per day"
Iron specialist	"Set-up shift suggestion"÷"Shifts per day"	"Disassembly shift"÷"Shifts per day"
Live Model supervisor		
Live Model photographer Men		
Live Model photographer Women		
Stylist Men	"Start shift"÷"Shifts per day"	"End shift" ÷"Shifts per day"
Stylist Women		
Styling assistant Men		
Styling assistant Women		
Size&Fit specialist Men		
Size&Fit specialist Women		
Model Men		
Model Women		
Stills/Jewellery photographer	"Set-up shift suggestion"÷"Shifts per day"	"Disassembly shift"÷"Shifts per day"
Flat photographer		
FlatKids photographer		
StillsKids photographer		
QC in specialist		
Support	"Start shift"÷"Shifts per day"	"End shift"÷"Shifts per day"

4.2 Cost Analysis

In this second module, one of the main goals is to estimate the total cost for a mobile digital production unit project, depending on the brand selected. To do so, the first step was to understand which outputs from the first module are necessary and afterwards calculate the value of each component of the total cost. The other main goal is to calculate the optimized number of days necessary for the project, to which the total cost is smaller.

4.2.1 Key Factors

The terms used in the present module, of the Excel program, for the Cost Calculation Model are:

- Cost per day – Models: cost of one model (type of resource) per day;
- Cost per day – Others: cost of one resource (other types of resources) per day;
- Headcount: total cost of all the resources;
- Overheads: total indirect costs (e.g. water, electricity, etc);
- Pre-operation resources: number of resources needed for the pre-operation;
- Pre-operation days: number of days needed for the pre-operation;
- Pre-operation: total cost of the pre-operation;
- Cost per night: cost per resource for one night in the hotel;
- Hotel: total cost of the hotel;
- Cost per flight: cost per resource for the two-ways flight;
- Flights: total cost for the flights;
- Cost per day - Included meals: cost per resource per day for the daily included meal;
- Included meals: total cost for the daily included meals;
- Cost per day - Daily budget: cost per resource per day for the daily budget;
- Daily budget: total cost for the daily budgets;
- Extra costs: total extra costs (e.g. rent steamer);
- Cost per resource - Shuttles: cost per resource for the airport shuttles;
- Shuttles: total cost for the airport shuttles;
- Cost per day - Subway: cost per resource per day for the subway ticket;
- Subway: total cost for the subway tickets;
- Shipping: cost for the materials and workstations shipping;
- Total cost: total cost of the mobile digital production unit project;
- Weight: weight of each component of the total cost.

4.2.2 Cost Calculation Model

For the cost calculation, it is necessary to collect data from the Project Planning module.

The present module uses the “Total items” and the “Total resources” from the Planning Model, as well as the “Working days” and the “Total days” from the Resources Assignment. It is also necessary to introduce, as an input, the “Pre-operation resources” and the “Pre-operation days” that refer to the visit to the brand’s showroom before the project starts. This occurs in order to gather previous information like the showroom layout, measurements and limitations.

An auxiliary table was constructed (right table on Figure 42) containing the components of the total cost that do not depend on the brand selected (“Cost per day – Models” and “Cost per day – Others”) and the ones that depend on the brand selected as the “Cost per night”, the

"Cost per flight", the "Cost per day - Included meals", the "Cost per day - Daily budget", the "Cost per resource – Shuttles" and the "Cost per day – Subway". These components are inputs as well as the "Extra costs" and the "Shipping".

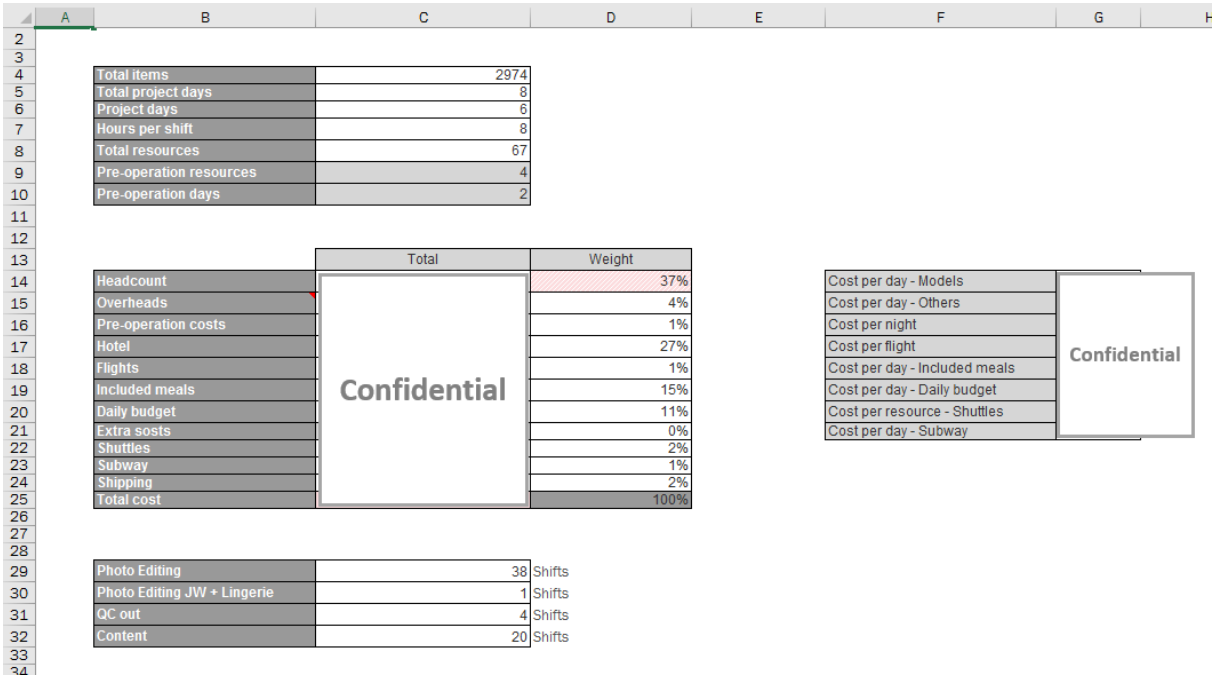


Figure 42 – Cost Calculation Model Overview (example of Brand A's project)

With all the data gathered up to this point, it is possible to calculate the "Total cost" of the mobile digital production unit project, being the sum of the following components detailed in the following equations.

Headcount

$$\begin{aligned}&\text{"Cost per day-Models"}\times(\text{"Total days"}_{\text{Model Men}}+\text{"Total days"}_{\text{Model Women}})+\\&\text{"Cost per day-Others"}\times(\text{"Total days"}-(\text{"Total days"}_{\text{Model Men}}+\text{"Total days"}_{\text{Model Women}}))+\\&\text{"Cost per day-Others"}\times(\text{Shifts}_{\text{Photo Editing}}+\text{Shifts}_{\text{Photo Editing JW+Lingirie}}+\text{Shifts}_{\text{QC out}}+\text{Shifts}_{\text{Content}})\end{aligned} \quad (4.8)$$

Overheads

$$a\times\text{"Total items"} \quad (4.9)$$

Where:

a, is a confidential value, in euros, provided by Farfetch

Pre-operation costs

$$\begin{aligned}&[\text{"Cost per flight"}+\text{"Cost per night"}\times(\text{"Pre-operation days"}-1)\\&+\text{"Cost per day-Daily budget"}\times2\times\text{"Pre-operation days"}]\times\text{"Pre-operation resources"}\end{aligned} \quad (4.10)$$

To calculated this factor is necessary to consider the flight cost, the hotel cost for the total number of nights (subtract one unit to the number of days) and the daily budget for two meals for each day. To know the total cost is necessary to multiply for the number of resources needed for the pre-operation.

Hotel

$$\text{"Cost per night"}\times(\text{"Total days"}-\text{"Total resources"}) \quad (4.11)$$

Flights

"Cost per flight"×"Total resources" (4.12)

Included meals

"Cost per day-Included meals"×"Working days" (4.13)

Daily budget

"Cost per day-Daily budget"×"Working days"+
"Cost per day-Daily budget"×2×"Days off" (4.14)

Shuttles

"Cost per resource-Shuttles"×"Total resources" (4.15)

Subway

"Cost per day-Subway"×"Total days" (4.16)

4.2.3 Optimization of the number of days

After the development of the Excel program, explained until this point, it became evident the necessity to optimize the "Project days" instead of being just an input from the brand.

The objective function of this optimization problem is clearly discontinuous, because at some point one more workstation is needed. On the other hand, as the solution space is small (only one decision variable, ranging from 2 until 30), an exhaustive search is justified. Thus, an Excel macro in Visual Basic for Applications language (Appendix B) was developed, that runs the Excel program for "Project days" from 2 until 30, by clicking on the "Calculate Costs to optimize Project days" button, illustrated on Figure 38. It calculates and presents the cost for each number of days (using the Cost Calculation Model) and suggests the "Project days" to which the cost is smallest. If the brand requests to complete the project in fewer days than those suggested by the macro, then it is only necessary to run the macro for "Project days" from 2 until the number of days requested by the brand and find which represents the smallest cost.

4.3 Results: Cost-benefit Analysis for Brand Prioritization

Here, the main goal is to test and illustrate the use of the Excel program developed for this dissertation, explained on Sections 4.1 and 4.2. To do so, a sample of 20 brands was selected and studied, the top 20 best-selling brands at Farfetch. After running the program for each one of these brands, the results are presented in a prioritization form for mobile digital production unit projects, depending on the benefit that each brand can bring.

4.3.1 Key Factors

The terms used to present the results for the Brand Prioritization are:

- Top 20 brands: top 20 best-selling brands at Farfetch selected for the study;
- Number of partners: number of boutiques that sell each brand;
- Country: country where the mobile digital production unit project of each brand will take place;
- Average items: average quantity of items to be produced for each brand;
- Benefit estimation: Farfetch's revenue from each brand in one of the last year's season;

- Cost estimation: total cost estimation of the mobile digital production unit project of each brand;
- Net value: Farfetch's profit from the mobile digital production unit project of each brand.

4.3.2 Brand Prioritization

To test the Excel program for the selected sample of brands it was necessary to use historical data instead of real and updated data provided from the brand. To introduce this historical data on the program automatically, some changes were required.

The first necessary change was on the Planning Model. Instead of having the brand fill the pink-coloured column ("Count per category") in Figure 37, a combo box was introduced, where it is possible to select one of the 20 brands under study. Using this, the historical data of the selected brand is collected using SQL language, as shown in Figure 51 of Appendix E, and automatically introduced in the referred column of the table. With these the Project Planning module runs like explained in Section 4.1.

The second required change was on the Cost Calculation Model. Instead of using inputted costs, an auxiliary table (Figure 43) was constructed, based on web research and information collected at Farfetch. This table contains an estimation of the components of the total cost that depend on the country where the shooting will take place, such as the "Cost per night", the "Cost per flight", the "Cost per day - Included meals", the "Cost per day - Daily budget", the "Cost per resource – Shuttles", the "Cost per day – Subway" and the "Shipping".

In the table in Figure 42, the components of the total cost that do not depend on the country ("Cost per day – Models" and "Cost per day – Others") and the ones referred on the last paragraph related to the country of the selected brand were compiled. To gather all these components, the program needed to know in which countries each brand will do its project, using the column "Country" in Figure 44.

	Night	Flight	Included meals	Daily budget	Shuttles	Subway	Shipping
Italy	Confidential						
France							
UK							
USA							

Figure 43 – Auxiliary table for cost estimation

After running the Excel program, with the referred changes, for each one of the selected brands, the table shown in Figure 44 was constructed with the results and some additional information.

Top 20 brands	Country	Number of partners	Average items	Benefit estimation	Cost estimation	Net value
Brand A	Italy	122	2974	Confidential		100%
Brand B	France	133	1592			92%
Brand C	Italy	77	1171			92%
Brand D	Italy	95	2008			68%
Brand E	France	116	1267			64%
Brand F	Italy	118	2470			44%
Brand G	UK	83	316			25%
Brand H	UK	85	1765			23%
Brand I	Italy	86	1299			23%
Brand J	Italy	138	1546			21%
Brand K	France	106	1219			18%
Brand L	France	119	1480			17%
Brand M	France	131	1591			16%
Brand N	France	91	627			15%
Brand O	Italy	103	617			7%
Brand P	Italy	131	1366			3%
Brand Q	Italy	65	1290			1%
Brand R	USA	94	1210			0%
Brand S	Italy	66	1266			1%
Brand T	UK	62	1046			0%

Figure 44 – Brand Prioritization table overview

The first column, “Top 20 brands”, indicates the name of the top 20 best-selling brands at Farfetch.

The second column, “Country”, referrers to the country where the mobile digital production unit project for each brand referred in the previous column will be.

The “Number of partners” column represents the number of boutiques that sell the brand. This factor is important because the more number of partners that sells the brand the better. This information was collected using SQL language, as shown in Figure 53 of Appendix E.

The “Average items” column shows the quantity of items to be produced for each brand, which is the equivalent to the “Total items” used before.

The “Benefit estimation” column should contain the increase in a sales forecast that a mobile digital production unit project could bring. Due to the lack of information to elaborate the forecast, it was necessary to use Farfetch’s revenue from one of the last year’s season of each brand. When the possibility to calculate the sales prediction occurs, the Brand Prioritization table (Figure 44) will be more accurate.

The “Cost estimation” column indicates the “Total cost”, estimated using the Cost Calculation Model as explained in the beginning of this Section 4.3.2.

The last column, “Net value”, calculates the difference between the “Benefit estimation” and the “Cost estimation”. The brand prioritization for mobile digital production unit projects of the selected sample of brands is done based on this factor, by ordering the brands from the largest “Net value” to the smallest.

This column is presented using percentages due to confidentiality.

Multi-objective analysis

In order to recognize which brands Farfetch should focus first, it was done a Pareto multi-objective optimization analysis. For such, a Pareto frontier (Figure 45) was constructed linking the non-dominated solutions with respect to the “Number of partners” and the “Net value” of each top 20 best-selling brands.

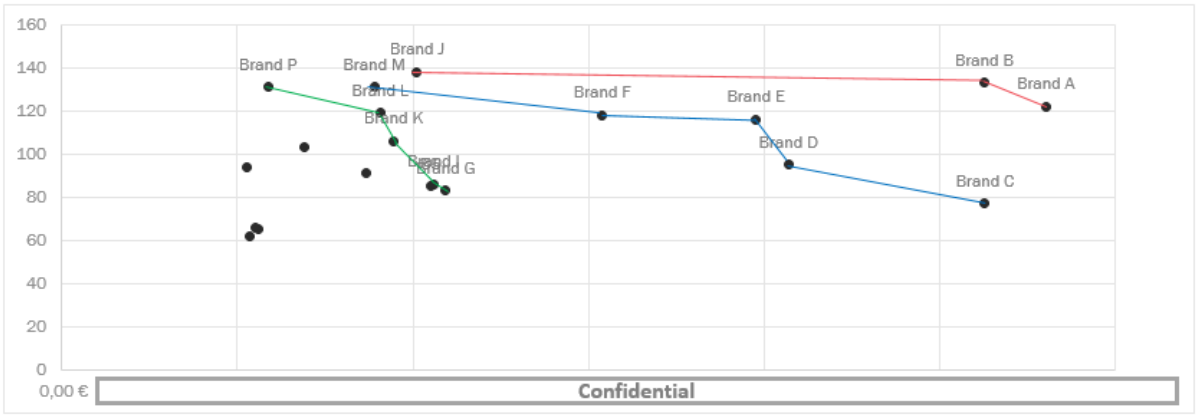


Figure 45 – Pareto frontier of the top 20 best-selling brands

The Pareto frontier shows, in red, the brands that should be the focus of Farfetch in a first stage. If these three brands were not interested in a mobile digital production unit project or if they already have done it, in a second stage the focus should be the ones on the blue curve. Repeating the same logic, the next focus should be the brands on the green curve.

It is also important to analyse the trade-off within the Pareto frontier. For example, although Brand J is also part of the Pareto frontier in red, it is likely that the company will choose Brand B since the net value is 159% superior and the number of partners is only 4% inferior.

In the case that Brand A and Brand B were not considered in this analysis for some reason, the new Pareto frontier would include the Brands J, F, E, D and C. By applying the same reasoning used before, when comparing Brand J with Brand E, it is likely that the choice would be Brand E, since the net value is 95% superior and the number of partners is only 16% inferior. These differences are not so expressive as in the case of Brand B, but still very significant. Nevertheless, the decision will have to be carried out by the decision maker. This analysis only shows to him where he should focus and what type of trade-offs need to be considered.

5 Conclusions and Future Work

The present dissertation addressed the development of a structured approach to mobile digital production unit projects. This new business unit tries to fulfil the opportunity to become the number one company reaching the market in all the luxury e-commerce products. The idea is to shoot all the items of the brands' new season, immediately after their fashion shows, and to be able to make it available online before the competition.

Since this is a total new direction for the company, the lack of structuring was notorious. Therefore, this work helps and guides the company in these new types of projects.

The first step necessary was to go on the field and to closely follow the production process in order to be able to map it and afterwards, to map the already expected differences between Farfetch's and mobile digital production.

After gathering and analysing all this information, it was concluded that these differences were inevitable not only due to its smaller scale but also due to differences, such as working with the brand's workers mingled amongst the production, in the brand's showroom layout limitations, in the availability of material and resources and finally by working in a foreign environment.

By realizing this, the necessity of defining new targets became clear. As such, the new defined targets are different, for each type of workstations, than those for Avepark digital production unit and were duly validated by the proof of concept, as explained on Section 3.3.2.

The next conclusion acknowledged was the need to create a tool in order to accrue the mobile digital production unit projects' costing. In order to calculate these costs, it was essential to determine the number of workstations, the number of resources and the number of days necessary for each project. With the Excel program developed during this dissertation, it is now possible to manage, in a better way, these mobile digital production unit projects and to make more accurate decisions regarding the "Project conception" and "Planning" steps.

The program explained in Sections 4.1 and 4.2 contains a vast number of factors. The choice of which factors to consider and calculate in the program was critical and could be achieved due to the experience provided by the Planning team and the analysis of the proof of concept. Alongside the exploration of the production process, in order to understand which other factors should be considered, which were not obvious at first.

The determination of which inputs to include was also critical, as it defined the level of detail of the whole program and its usability. The first one, and most important one, is the one provided by the brand selected, which is, the table where they fill the quantity of items they wish to be produced from the collection for the new season. This data is essential for planning and programming the project, since it allows to predict how many workstations, resources and days will be required and, therefore, to calculate the total cost.

To test the Excel program, the sample of 20 brands were prioritized according to the increment in sales that the realization of a mobile digital production unit project of each one of them could bring.

This test also drew some conclusions, related to the sample of brands studied. It was possible to observe that the cost did not changed the ranking in which the brands were prioritized. On the other hand, it was identified the groups of brands in which Farfetch should focus, using a Pareto multi-objective optimization analysis that looks at both net value and the number of partners.

Even though the proposed objectives for this dissertation were accomplished, there is always room for further improvements that could be done to manage this new value adding business unit. First, the targets' validation was based on only one proof of concept that had some internal problems, which influenced the productivities calculation. Although the targets were considered appropriate, a more accurate study must be done in order to adjust them in a more truthful way. Secondly, the Excel program developed presents many expansion opportunities. There is the possibility of adding new models that focus on helping the decision-making on the others groups of processes referred on Section 3.3.1 and not only on the "Project conception" and "Planning" steps. There is also the need to enable the program to work for "Shifts per day" different than 2. Additionally, the program could be able to optimize, not only the "Project days" based on the smaller cost for the project, but also the "Hours per shift". Lastly, the most urgent task, in the short term, is to correctly predict the increment in sales that the realization of this type of projects could bring. This forecast was not possible to elaborate due to the lack of information. To mitigate this problem it is necessary to gather and deeply analyse historical data from inside the company and from the market in which it is inserted.

The contribution of this dissertation for Farfetch was the implementation of this initial approach as an enabler to reach the ultimate goal: reduce "Time to Market". The Excel program developed uses data provided from the brand or extracts from the database (using SQL language), calculates the necessities of the project, optimizes the number of days to which the cost is lower and provides deliverables such as the Gantt diagram and the resources' assignment table.

At the end of this work, the approach and the program are ready to be used and implemented on new upcoming projects for any luxury fashion marketplace, with the proper adaptation to its business model.

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Appendix A: Data collection for the Targets Definition

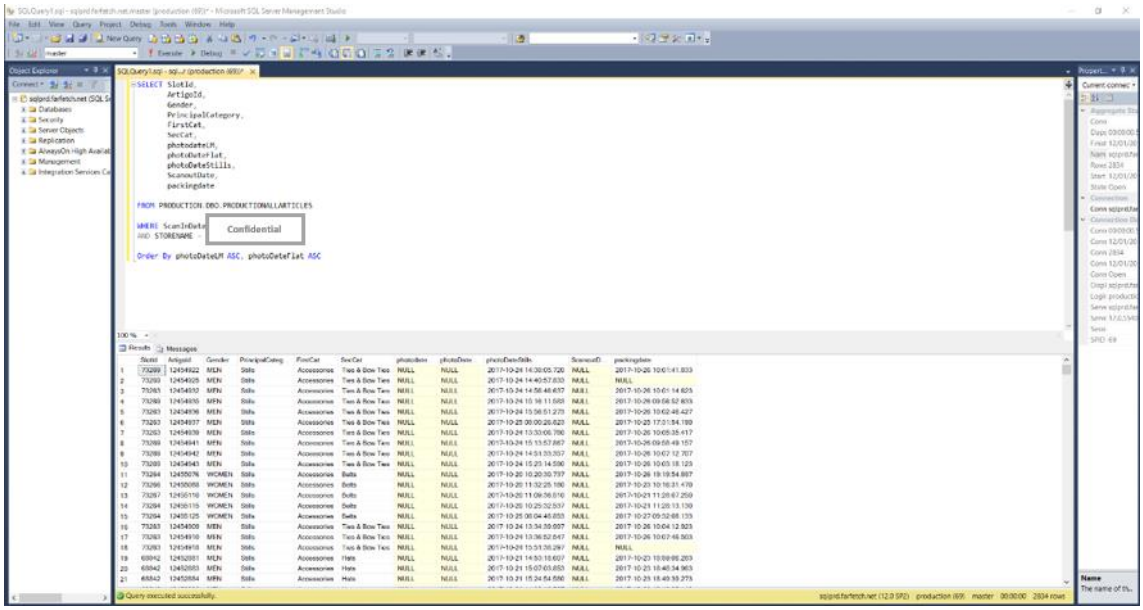


Figure 46 – SQL language to collect historical data for productivity calculation

Figure 47 – Compilation of the SQL results for productivity calculation in an Excel document

Appendix B: Macro development for the Planning Model

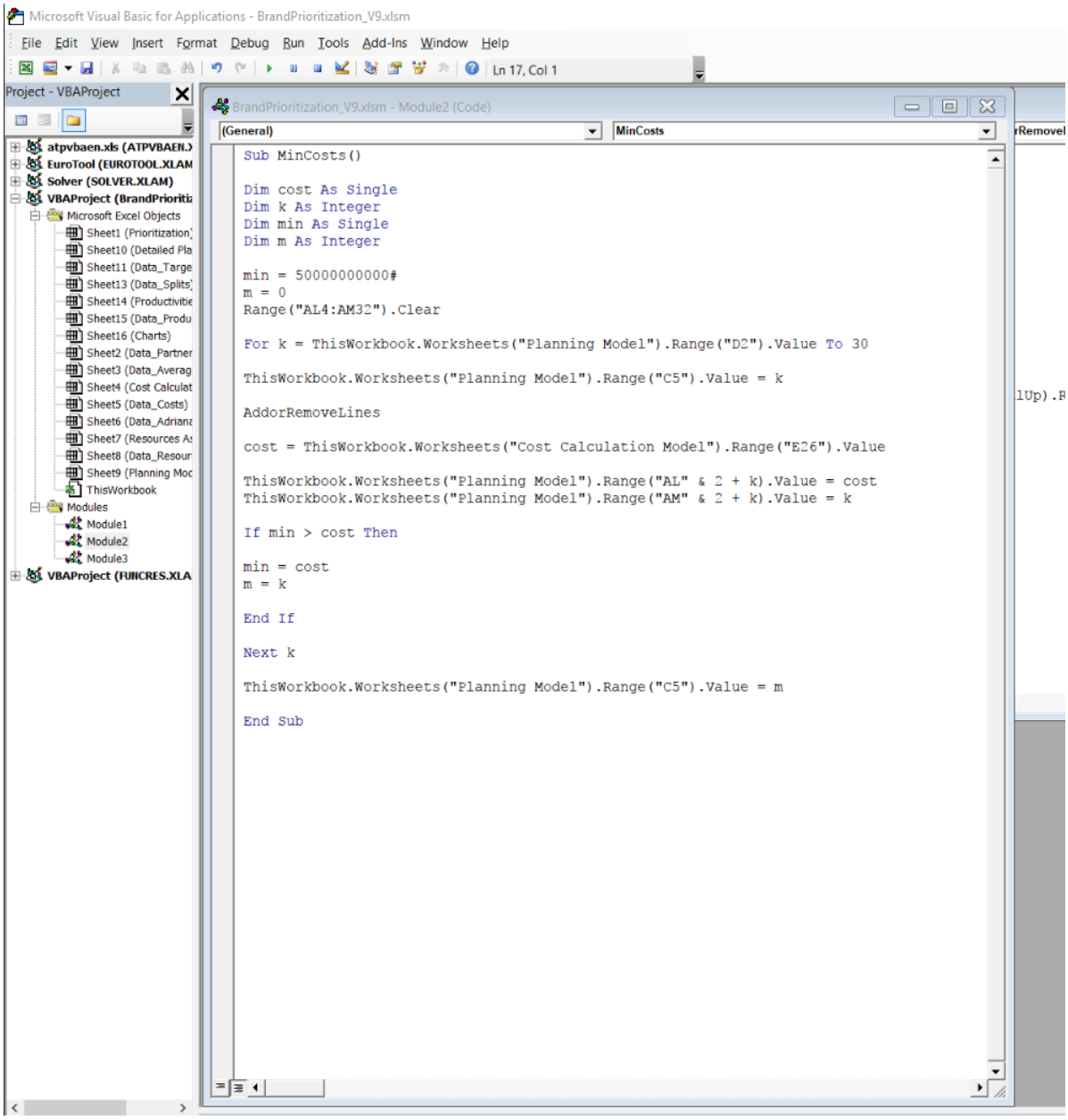


Figure 48 - Excel macro developed in Visual Basic for Applications language to calculate the costs to optimize the “Project days”

Appendix C: Gantt diagram construction for the Detailed Planning

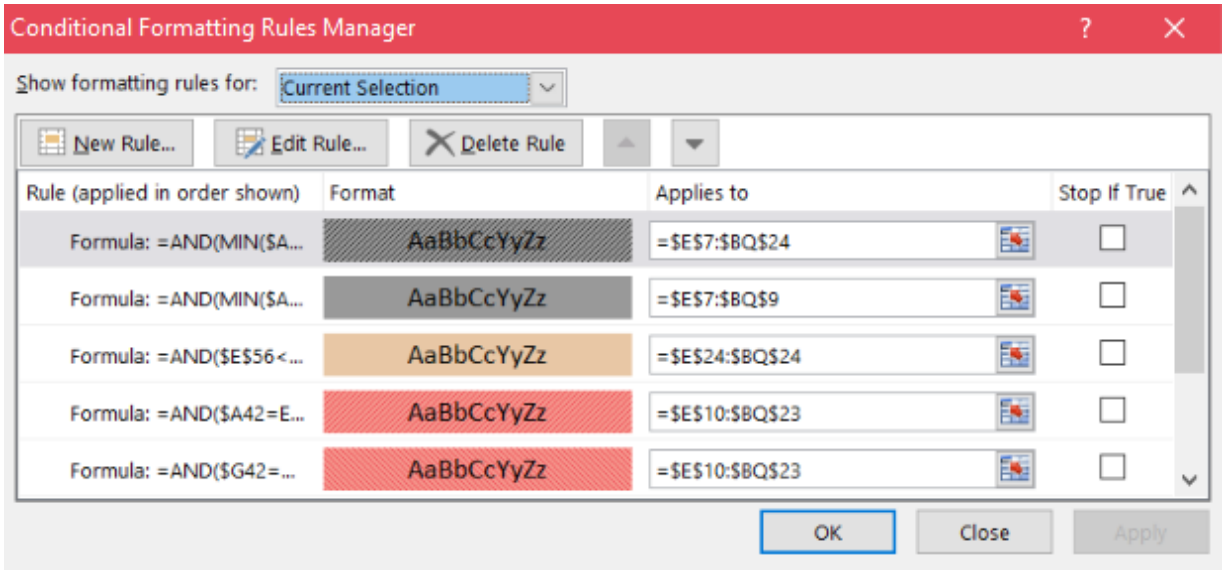


Figure 49 - Excel tool, Conditional Formatting to construct the Gantt diagram

Appendix D: Macro development for the Resources Assignment

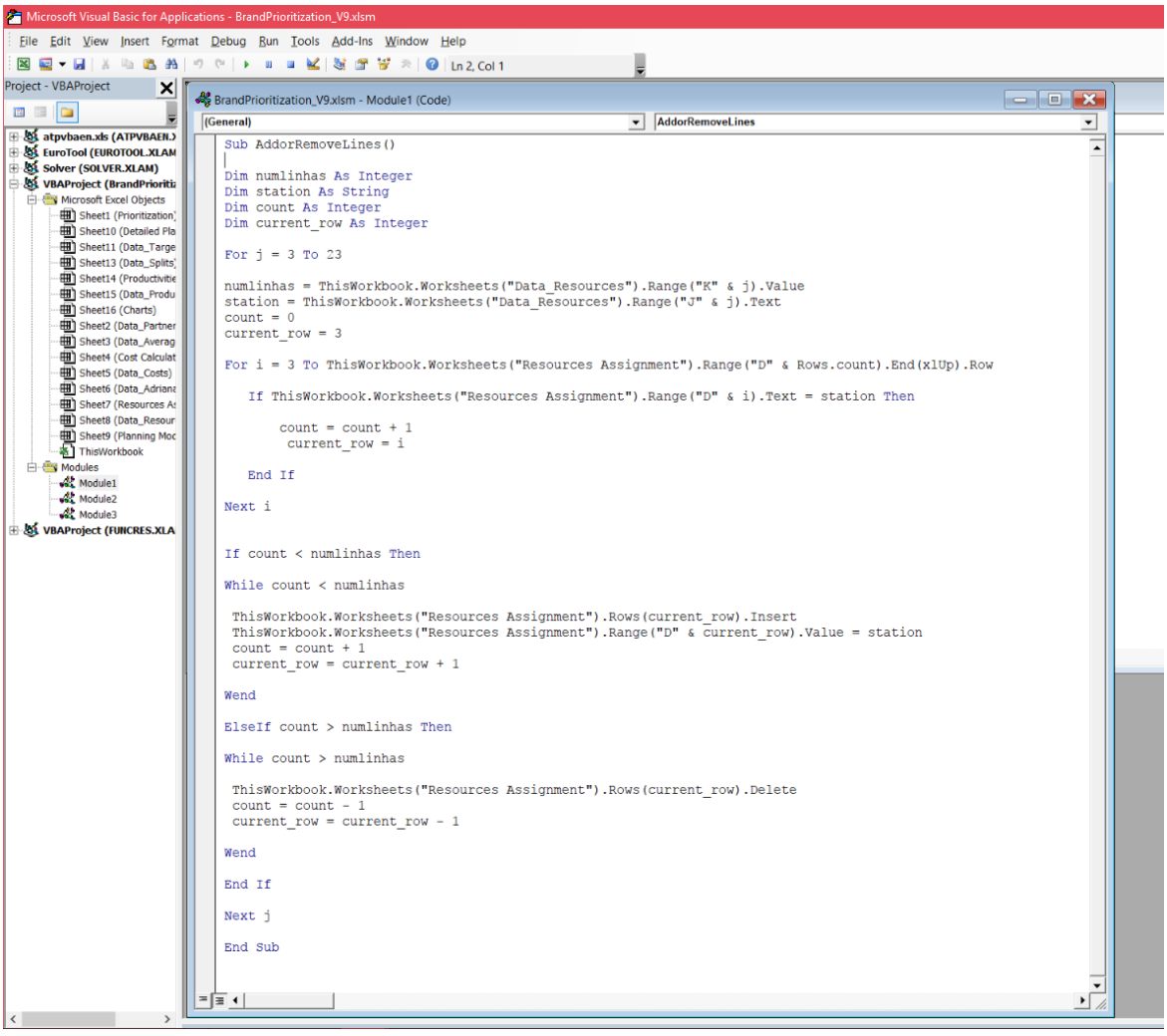


Figure 50 - Excel macro developed in Visual Basic for Applications language to add or remove lines on the Resources Assignment table

Appendix E: Data collection for the Brand Prioritization

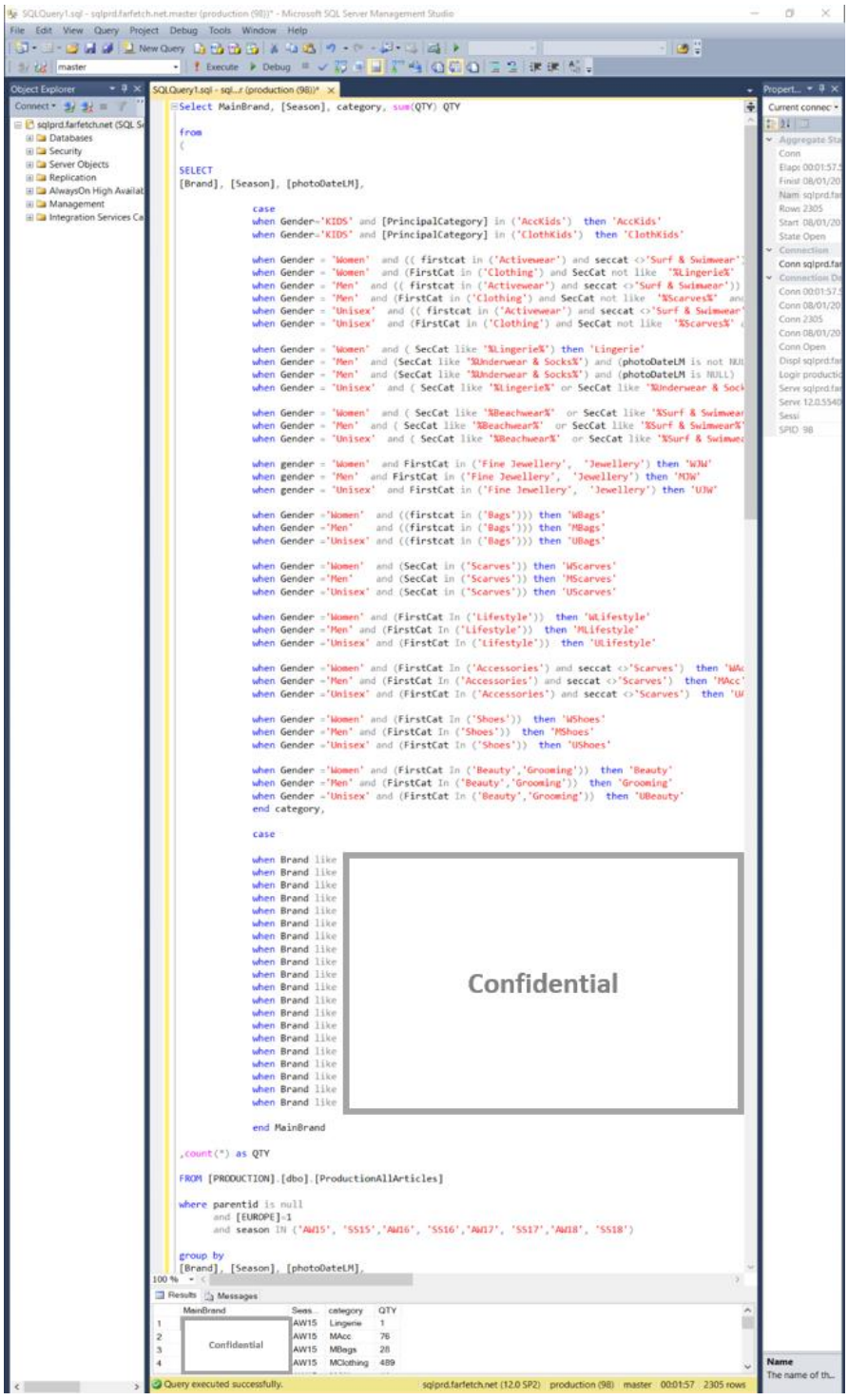
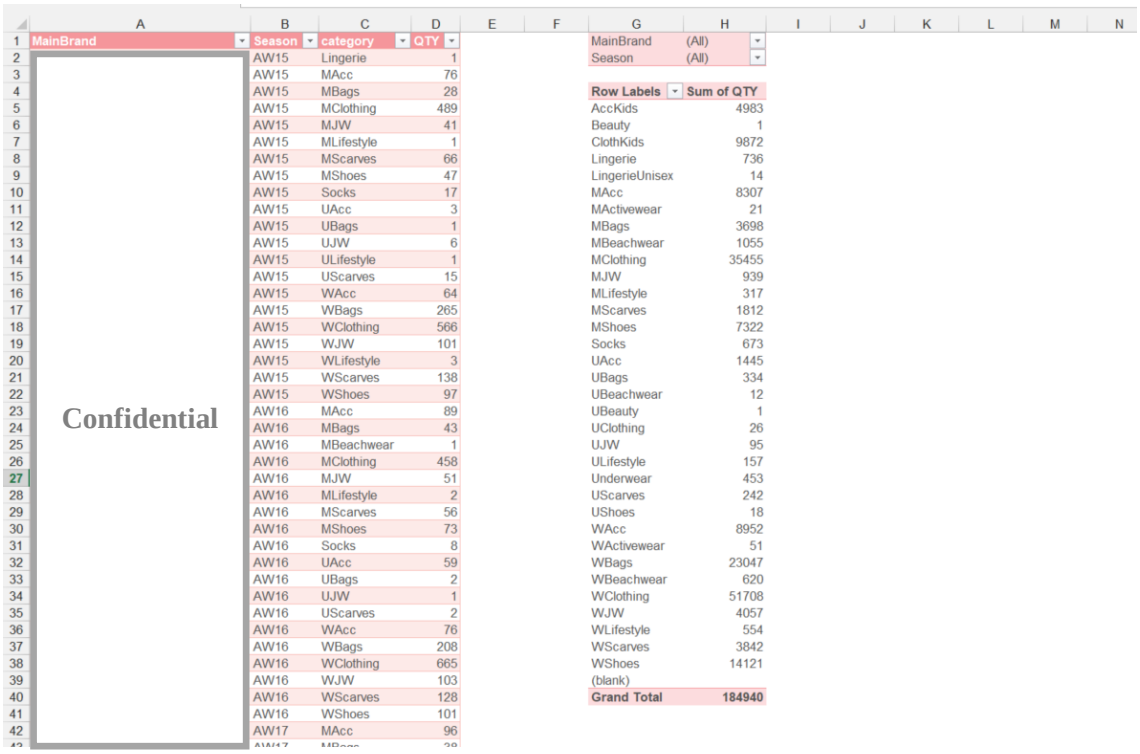


Figure 51 – SQL language to collect historical data of the selected brand

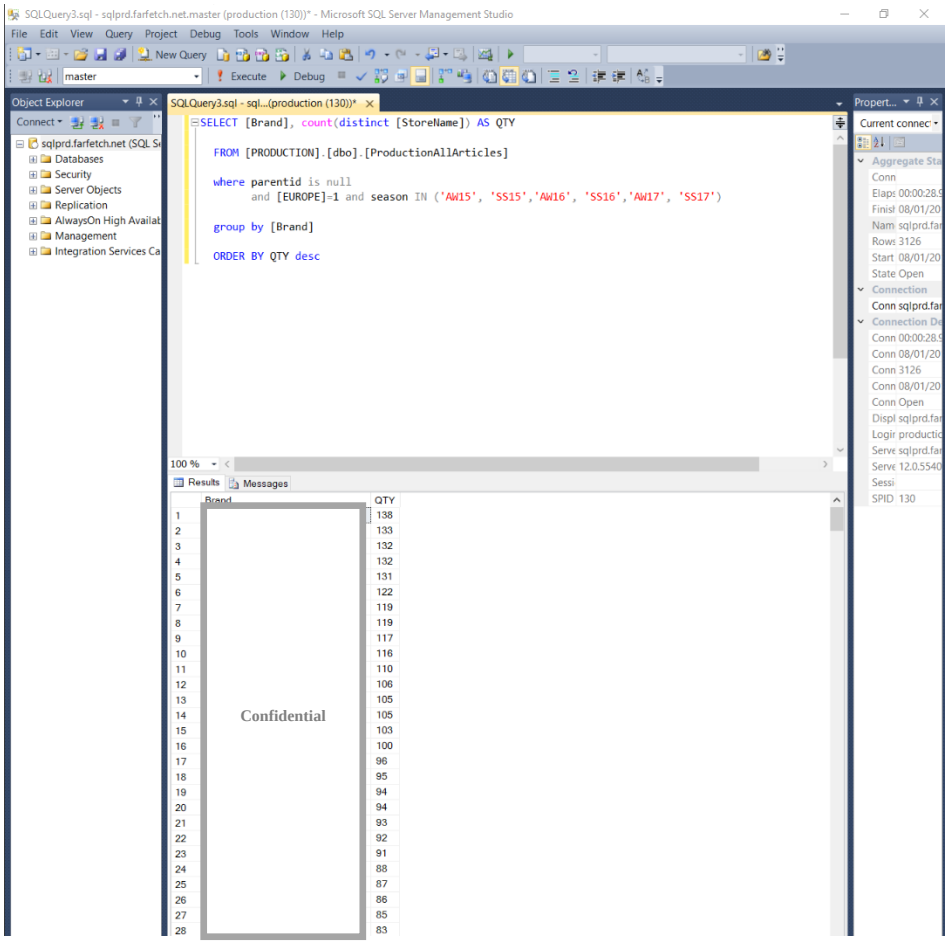


MainBrand	Season	category	QTY
Confidential	AW15	Lingerie	1
	AW15	MAcc	76
	AW15	MBags	28
	AW15	MClothing	489
	AW15	MJW	41
	AW15	MLifestyle	1
	AW15	MScarves	66
	AW15	MShoes	47
	AW15	Socks	17
	AW15	UAcc	3
	AW15	UBags	1
	AW15	UJW	6
	AW15	ULifestyle	1
	AW15	UScarves	15
	AW15	WAcc	64
	AW15	WBags	265
	AW15	WClothing	566
	AW15	WJW	101
	AW15	WLifestyle	3
	AW15	WScarves	138
	AW15	WShoes	97
	AW16	MAcc	89
	AW16	MBags	43
	AW16	MBeachwear	1
	AW16	MClothing	458
	AW16	MJW	51
	AW16	MLifestyle	2
	AW16	MScarves	56
	AW16	MShoes	73
	AW16	Socks	8
	AW16	UAcc	59
	AW16	UBags	2
	AW16	UJW	1
	AW16	UScarves	2
	AW16	WAcc	76
	AW16	WBags	208
	AW16	WClothing	665
	AW16	WJW	103
	AW16	WScarves	128
	AW16	WShoes	101
	AW17	MAcc	96

MainBrand	(All)
Season	(All)

Row Labels	Sum of QTY
AccKids	4983
Beauty	1
ClothKids	9872
Lingerie	736
LingerieUnisex	14
MAcc	8307
MActivewear	21
MBags	3698
MBeachwear	1055
MClothing	35455
MJW	939
MLifestyle	317
MScarves	1812
MShoes	7322
Socks	673
UAcc	1445
UBags	334
UBeachwear	12
UBeauty	1
UClothing	26
UJW	95
ULifestyle	157
Underwear	453
UScarves	242
UShoes	18
WAcc	8952
WActivewear	51
WBags	23047
WBeachwear	620
WClothing	51708
WJW	4057
WLifestyle	554
WScarves	3842
WShoes	14121
(blank)	
Grand Total	184940

Figure 52 - Compilation of the SQL results of the selected brand in an Excel document



```
SELECT [Brand], count(distinct [StoreName]) AS QTY

  FROM [PRODUCTION].[dbo].[ProductionAllArticles]

  where parentid is null
        and [EUROPE]=1 and season IN ('AW15', 'SS15','AW16', 'SS16','AW17', 'SS17')

  group by [Brand]

  ORDER BY QTY desc
```

	Brand	QTY
1	Confidential	138
2		133
3		132
4		132
5		131
6		122
7		119
8		119
9		117
10		116
11		110
12		106
13		105
14		105
15		103
16		100
17		96
18		95
19		94
20		94
21		93
22		92
23		91
24		88
25		87
26		86
27		85
28		83

Figure 53 - SQL language to collect data for the “Number of partners” calculation

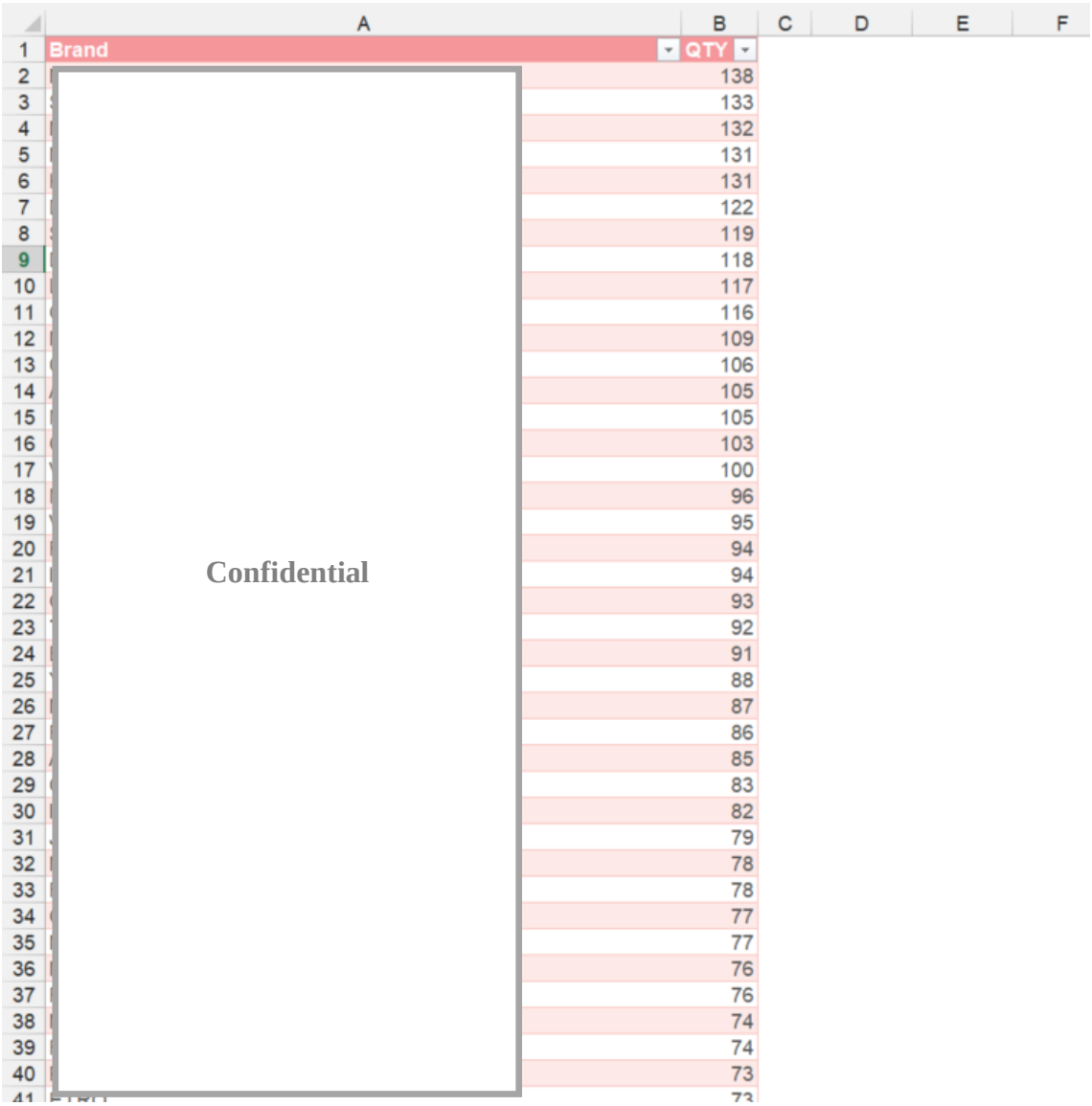


Figure 54 - Compilation of the SQL results for the “Number of partners” calculation in an Excel document