Optimising pre-registration booths at the airport

A Slush case study

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Företag kan gå miste om möjliga kunder om företagen misslyckas analysera och agera då personer undviker eller lämnar en kö. Därför kan kö-analys samt optimering ur ett logistik perspektiv möjligen gynna företag. Varje år tar sig ungefär 17500 personer till Helsingfors för att delta i tillväxt- och investeringsmässan Slush. Evenemangets volontärer organiserar registrering och förhandsregistrering före och under själva evenemangets lopp. Slush bidrog med idén till arbetet och syftet med avhandlingen var att bidra med analys av förhandsregistreringsprocessen samt rekommendationer om hur förhandsregistreringen kunde optimeras. Avgränsningen gällde endast förhandsregistreringen på Helsingfors-Vanda flygfält. Långsiktsplanen för Slush är att öka mängden förhandsregistreringar på flygfältet, eftersom det direkt minskar på mängden registreringar som behöver ske på själva evenemangsplatsen. Frågeställningen i avhandlingen var att undersöka kötiderna på flygfältet under år 2015 och 2016, samt vilka tekniska eller strategiska ändringar kunde bidra till en behagligare vänte-erfarenhet. Teoridelen inkluderade litteratur om evenemangsplanering av Getz, Bowdin och Tum samt kö-relaterade studier av Cameron och Gross. Som metoder användes både en kvalitativ och kvantitativ del. En ingående intervju gjordes med den huvudansvariga organisatören för förhandsregistreringen år 2016. Denna intervju gav värdefull insikt i organisationens resurser, förberedelser och processer. I den kvantitativa delen analyserades förhandsregistreringsdata från Slush datasystem (år 2015 gjordes 1060 och år 2016 1455 förhandsregistreringar) och kalkyler utfördes på tidsstämplarna. Dock möjliggjorde inte dessa enkla data en lika djup analys som hade önskats, utan ett antagande gjordes på basis av data och intervju att tidsskillnaden mellan tidsstämpel var en uppskattad processeringstid för deltagarna, processeringstiden låg mellan 60-120 sekunder per deltagare. Rekommendationerna berörde optimering samt sätt att göra vänte-erfarenheten behagligare. Rekommendationerna lydde:

- Ändra registreringsprogrammet så att det samlar in mångsidigare tidsrelaterade data
- Distrahera de köande deltagarna så att de inte fokuserar på själva väntetiden
- Implementera ett virtuellt kösystem (i mobiltelefonen) så att deltagaren kan fritt röra på sig medan hen väntar på sin tur

Denna avhandling kan förhoppningsvis vara till nytta för personer som planerar evenemang med en stor mängd besökare, ett längre sammandrag på svenska kan ses i bilaga 4.

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Abstract:

Businesses that fail to analyse and act on customers that abandon or avoid a queue could mean the loss of potential business income, thus applying queue and waiting experience optimisation out of a logistical perspective could benefit any business. Every year around 17500 people gather in Helsinki to attend the startup and investment event Slush. The event's volunteers organise registration and pre-registration before and during the event. Slush provided the case study, and the aim was to analyse the pre-registration process and provide optimisation recommendations. The case study was limited to pre-registration at the Helsinki-Vantaa airport. The long-term goal for Slush is to increase the number of pre-registrations at the airport, as this directly decreases the number of needed registrations at the event venue. The research questions regarded the queue times at the airport in 2015 and 2016, as well as what technical or strategic changes could improve the wait experience. The theory was sourced from event management literature by Getz, Bowdin and Tum and queuing related studies by Cameron and Gross. Both qualitative and quantitative methods were used, attendee pre-registration ticket data from 2015 (1060) and 2016 (1455 tickets processed) was used for calculating and analysing the timestamps, as well as an extensive interview with the main pre-registration organiser for the year 2016. The interview gave valuable insights into the resources, preparation and processes concerning the pre-registration team. Based on the simple data available detailed analysis was not feasible, an assumption was formed based on the analysis and interview that the results indicated that an attendee could be expected to have been processed within the range of 60 to 120 seconds. The analysis combined with the interview provided the grounds for the main recommendations:

- Registration software modification that gathers more useful and accurate data
- Attendee distractions that can take the focus off queuing
- Virtual queuing that liberates the attendee from physically standing in a waiting line

This case study can hopefully be of use for individuals that plan events with a large number of attendees.

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FOREWORD

This thesis was carried out on behalf of the company Slush. I am very grateful to Nicolas Dolenc who gave me the opportunity to work on this topic as my thesis. I also want to express my gratitude to my supervisor, senior lecturer in Business at Arcada, Siv Relander, for her interest in my work and pushing me to think outside the waiting line.

1 INTRODUCTION

Businesses that fail to analyse and act on customers that abandon or avoid a queue could mean the loss of potential business, thus applying queue and waiting experience optimisation can benefit any business. Queues are formed when the number of requests surpasses the capacity available. Therefore, optimising a common issue such as queue materialisation can be useful in other places and circumstances, such as music festivals, conferences and fairs. Slush has provided the case study for this thesis, and the aim of the study is to suggest how the Slush pre-registration process can be optimised. The case study will take a logistical look at queues and the issues associated with them in the context of event management, more specifically at the non-profit company Slush and their event named Slush.

1.1 Slush

Founded in Helsinki in 2008, Slush is a *"student-driven, non-profit movement originally founded to change attitudes toward entrepreneurship*" (Slush 2017). The two-day investor and startup event is held annually in November-December at the Helsinki Expo and Convention Centre in Pasila. The event has since grown from 300 to 17500 attendees, but the core value remains the same: "*to help the next generation of great, world-conquering companies forward*" (Slush 2017). The atmosphere which could be described as a fair fused with a conference and designed like a festival, is amplified by the can-do attitude of the roughly 2000 Slush volunteers responsible for everything from stage hosting, catering and registration onward.

My exposure to Slush started with the first visit to Slush in 2014 as a student. In 2015, I applied to be a volunteer in the concierge team and in 2016, I was accepted to be the team leader of 140 concierges. It was vital to recruit and train the right people to help manage the team. Without these capable teammates, the whole team would not have been able to function. As part of the experience many situations needed to be solved regarding the arrival of the high-profile guests at the airport and their pre-registration. In 2017, I approached Nicolas Dolenc, the main producer at Slush with the idea of a case study. Dolenc then proposed an analysis of the pre-registration process at the airport.

Sami Ahonen had been the pre-registration team lead in 2016, so I contacted him for more details on the process since he had planned and organised the pre-registration area at the airport. Ahonen was up to date with the pre-registration situation at all times and shared his experiences in the e-mail correspondence that can be found in Appendix 1.

1.2 Research aim

As mentioned above, this thesis focuses on how to optimise and provide recommendations regarding the Slush pre-registration process at the Helsinki-Vantaa airport. During 2015 and 2016 there were respectively 1060 and 1455 registrations made at the pre-registration airport point. This puts considerable strain on the Slush pre-registration booths located at the airport.

By improving the pre-registration process at the airport, the goal for Slush is to attract more attendees that would otherwise use the other pre-registration points or the registration points at the main event venue. Currently, an unknown number of attendees ignore or choose not to use the pre-registration service at the airport. In a broader context, this paper aims to help analyse and optimise the registration processes in regard to events and event management.

1.3 Research questions:

The study will look into the following research aspects: location, technology, wait time and experience.

- What were the waiting times at the pre-registration points in 2015 and 2016?
- What modifications of technical or management strategies could improve the waiting experience at the airport?
- How can the pre-registration process be optimised?

1.3.1 Limitations

The scope of the thesis is limited to the Helsinki Vantaa airport as Slush specifically wants to optimise the pre-registration point at the airport, to improve the overall experience for the attendee.

The study's scope includes secondary data provided by Slush of the number of attendees that used the pre-registration service at the airport in 2015 and 2016, as well as how many pre-registration booths were open simultaneously. Slush data for 2017 was not available in time to be included. In 2016, Finnair and Slush partnered up for a direct roundtrip flight from San Francisco to Helsinki, it was limited to Slush attendees arriving on the 29.11.2016 at 15:00 and departing at 10:00 on the 02.12.2016. (Slush 2016)

Geographical limitation includes the pre-registration points physically inside the Helsinki Vantaa airport and excludes the pre-registration and registration points located at the event venue and other locations. According to the Helsinki-Vantaa airport company Finavia the airport serves "*about 90% of Finland's international air traffic".* (Slush 2017; Finavia 2017)

Similarly, the overall security aspects regarding registration and ticketing at the fair centre will not be included to maintain focus and clarity. Many attendees do not use the pre-registration service and will register upon arrival at the Expo and Convention Centre in Pasila during the event days. These registration points are not included since the focus is on the airport pre-registration points, however they will be mentioned.

1.3.2 Secondary data

The secondary data provided by Slush contained automated registration logs from its internal database. These logs were exported into Microsoft Excel spreadsheets and used to map and analyse the timestamps, in order to grasp the amount of pre-registration efficiency, which aim was to be measured and compared. In order to collect feedback on the pros and cons of the pre-registration points, an e-mail questionnaire was sent to the 2016 organiser of the pre-registration team. The secondary data contains two sets from

2015 and 2016 in the timelines of 09.11.2015 to 10.11.2015 and 19.11.2016 to 01.12.2016; these data sets also included registration data from every pre-registration point around Helsinki and also all registration points at the event venue.

1.3.3 Research method

Documentary analysis was the primary research method and included a mix of qualitative and quantitative research methods. The qualitative part included the specific e-mail interview and discussions. The quantitative part included primary data produced by Slush which was this thesis' secondary data.

2 LITERATURE REVIEW

The theory section covers events and event management, registration and queues due to their very nature of having a high impact on perceived service quality. In chapter 2.3.1 the difference between ticketing and registration is identified, as well as the need for accreditation through guidelines and scheduling. Furthermore, theory of people flow, queueing and the experience of waiting in line explore the customer service paradigm.

Return customers notice inconsistent service quality, due to previous experience and according to Bowdin (2006) "*quality service occurs when expectations of the event match perceptions of the service experienced*". Thus, the customer can only determine afterwards if their expectations were met or not. Tum (2011) generalises and states that "*most organizations can provide a high level of customer satisfaction for a short period, but the level offered has to be sustainable*". This is especially crucial at events where the attendee might roam around the venue and return to an area, such as the toilets or an information booth. According to Tum (2011) *"the perception of an improved quality service can be achieved at very little cost, and involves cleanliness, consistency, reliability, friendly and helpful frontline staff",* the attendee's previous experience of clean toilets versus the experience of dirty toilets lets the attendee benchmark the organisers performance. Likewise, smiling and helpful staff at the info booth, versus grumpy and unhelpful staff, give the attendee very different experiences to benchmark.

Quality is not defined by the product or service provider, but by the customer experiencing the service or product and Tum (2011) highlights that service quality can be measured in consistency, since "*customers expect service to be at the same level, or better, each time it is experienced*". The overall perceived quality can also be impacted by poor customer service even though the product offered at an event or the event itself could be considered high quality. (Tum 2011 p.35, p.62; Bowdin 2006 p.197)

2.1 Events

An event can be anything that is a "*noteworthy happening*" as defined by Merriam-Webster (2017) and the duration can vary anywhere from minutes, hours to days or weeks and always have a beginning and an end. Tum (2011) further elaborates on the short-lived nature of events "*the moment the event is delivered it is consumed*". Events can be broken down and specified into some of the many forms of events, according to Getz (2011) "*festivals, meetings, conferences, exhibitions, incentives, sports*" are typical examples of the private and public events in the event industry. Figure 1 identifies special events and split them into four different main categories: personal, leisure, organisational and cultural events. Matthews (2008) elaborates further that special events are "*designed to celebrate, honour, sell, teach about, or observe human endeavours*". (Matthews 2008 p.1; Merriam-Webster 2017; Getz 2011 p.12, p275; Tum 2011 p.49; Shone & Parry 2004 p.4)

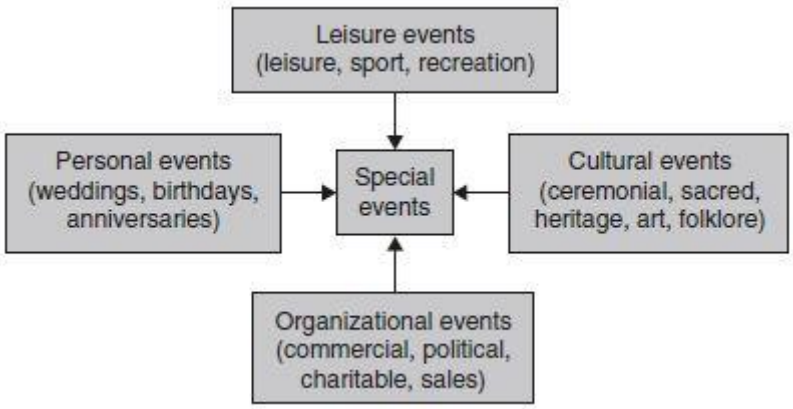

Figure 1. Typology of events (Shone and Parry, 2004)

Getz (2011) notes that special events are "*something that can be experienced*" by the attendee, such as a leisure skiing trip or performance art (Getz 2011, p.11). Included in the personal events category are happenings that more than often have a jovial tone and are limited to a specific group, such as the friends and family celebrating an anniversary. Leisure events such as sports competitions often encompass a broader audience and are more inclusive due to their very aim to attract spectators. (Getz 2011 p.9, p.33)

Organizational events include meetings, conferences, fairs and trade shows that are private in the sense that an invite might be needed. Events might be restricted to certain individuals, groups, social contexts or industries. The nature of these special events is often to promote, sell, market products or services in a commercial setting. Examples are businesses meeting to discuss topics that affect the industry, international horse fairs, business marketing conferences and heavy industry trade shows. According to Bowdin (2012) "*corporate involvement in events had become the norm, so sponsorship was perceived as an integral part of staging major events*", however with the corporate involvement came the focus on the benefit and return on investment (ROI). (Bowdin 2012 p.14)

2.2 Event management

Definitions concerning terminology have changed within the field of event management. In 2000 Getz called for event management to be recognised as a separate field of study (Page 2014). When designing an event, it is crucial to ask whom the event is for, what the purpose and what are the goals are (short term and long term) of organizing the event (Berridge 2011). According to United States industry research company IBIS World (2017), the party and event planning industry in the United States is approximately worth 5 billion US dollars and employs 137,217 people. Bowdin (2006) asserts that "*apart from ticketing, other operational processes have an immediate impact on the experience of event consumers. Visitors evaluate security checks on entry to the event, queuing for food, and the speed of access to services such as automatic teller machines and toilets*" and Getz further (2011) splits the operational part of event management into three focus areas:

1. Customer-oriented (traffic, queuing, ticketing, information, essential services, comfort and safety, crew management).
2. Supplier-oriented (utilities, infrastructure, technical services, security systems).
3. Communications (equipment, procedures, accreditation, hosting the media, scheduling).

All three categories affect the event attendee, queuing for registration and ticketing. (Bowdin 2006 p.215-216; Getz 2011 p.33; IBIS World 2017, Page 2014 p.475)

2.3 Event registration

Event registration has many forms and depending on the event; registration can be managed in different ways. If the event is open to all, without any form of registration or limits, then the organisers have little control over the flow of participants and prior knowledge on how many people will attend. Examples are events that are intended to attract as many people as possible, such as governmental parades. Having no registration process and understanding of who has visited the event and the flow of people in and out of the event areas makes analysing the impact of the event difficult. (Getz 2011 p.276)

The amount of information about attendees that event organisers require varies. Industry-specific events often want to know the attendee's name, job title and company, and this information could be visible on the attendee's event badge during the event. The attendee information is usually logged in a database in order to keep track of how many attendees have redeemed their tickets to keep track of financial and security aspects and to limit the possibility of the same reservation being used several times. Event registration is a variety of ticketing, the attendee has already pre-purchased/booked a ticket and arrives at a point where the event ticket can be redeemed, often by showing valid personal identification or booking number or invitation or membership card. On a side note, it will be interesting to see how event management firms that work with attendee data will be impacted by new data privacy regulations coming into effect in many parts of the world, for example the General Data Privacy Regulation coming into force in the EU on the 25th of May 2018. (Conway 2014 p.69; Getz 2011 p.276; EU GDPR Portal 2018, Van der Wagen 2010)

Several reasons might require event registration, such as the size of the event venue or local fire safety laws, which often limit the number of participants. Furthermore, from a planning perspective, it might be important to know the need for facilities and services, such as toilets, food and beverage. The number of event attendees gives an indication and helps the event organisers plan the number of staff and what their tasks should be. A smaller seminar could function with less staff and the work tasks could be more versatile and demanding whereas, at a large festival, work tasks could generally be more streamlined and efficient because of the need of repetition. (Van der Wagen 2010; Tum 2011)

Accreditation further limits the attendee, staff and volunteers to access only predetermined areas or services as part of the level of the ticket. Bowdin (2012) further elaborates that once the ticketing aspect has been dealt with the event attendees, staff and volunteers are given crowd control bands to wear, that are "*colour coded to indicate the level of the ticket – a day ticket, a weekend ticket or a special performer's ticket*" for example at a music festival. (Bowdin 2012 p.355)

Getz (2011) also points out the needs of clear guidelines on "*who gets in, or under what schedule*". Extra privileges and services often incur higher ticket prices and can be marketed as a premium service. Media might have access to many highly-restricted areas to be able to conduct interviews or film/photograph from angles that would normally be unavailable to the festival attendee. (Bowdin 2012 p.361; Goldblatt 2002 p.308; Getz 2011 p.219)

2.3.1 Ticketing

Ticketing is often called registration, however the two differ in the aspect of pre-purchase or pre-registration, referring to events Getz (2011) states that "*registration and ticketing are key elements, as these often cause bottlenecks*". Getz suggestion is that event organisers process "*it in advance, electronically*" and according to Bowdin (2012) registration and ticketing" form *an effective means of controlling numbers*". The attendee provides their accreditation to access the event as part of the ticketing process. Name, company types, gender and age are typically required upon registration,

according to Bowdin (2012). However, if the event organisers have no previous knowledge of the event attendees and the expected participation amount, then the admission process is called registration. (Getz 2011 p.276; Bowdin 2012 p.355-357, p.418)

2.4 Concept of queues and queue theory

Queue formation occurs when there is more need for service or products than there is capacity to deliver that service or product. Gross (2008) states that "*a queueing system can be described as customers arriving for service, waiting for service if it is not immediate, and if having waited for service, leaving the system after being served*". Queuing is a daily occurrence, either in the physical or digital world and Breckenridge (2012) comments that "*queueing theory deals with one of the most unpleasant experiences of life, waiting*". (Gross 2008 p.2; Breckenridge 2012 p.11)

The main way to decrease the waiting times in both the digital and physical realm is to improve infrastructure, such as increasing or improving server capacity for a digital solution or increasing the number of service booths and staff to increase the service-to-customer ratio. If the aim is to reduce waiting time or queue lengths by optimising, then according to Adan (2015) "*it is important to know the effect of the investment on the waiting time*". However, having over-capacity in the form of company resources standing idle is an unwanted cost for the company. Slack (2007) states that "*there seems to be a direct trade-off between staff utilization (and therefore cost) and customer waiting time (speed of service)*". (Getz 2011 p.277; Gross 2008 p.2, Slack 2007 p.79, 346-347; Adan 2015 p.7)

Gross (2008) divides the queuing system into six parts:

"(1) arrival pattern of customers, (2) service pattern of servers, (3) queue discipline, (4) system capacity, (5) number of service channels, and (6) number of service stages".

Regarding Gross' point number two on (service patterns of servers), there are several options available, and Jaffeux (2013) highlights three:

FIFO or FCFS, first-come, first-served.
LIFO, last-in first out.
SIRO, Service in random order.

In FIFO or FCFS the service pattern is according to the order that customers arrive on a first-in, first-out or also called first-come, first-served basis. According to Tum (2011) this is a logical and to the customer an acceptable form of queuing since the waiting experience is perceived as everyone is of equal importance due to the first-come, first-served policy. LIFO on the other hand is a form of stack policy, where the most recent customer to arrive is served first, this however contradicts Tum's statement that LIFO "*will affect the waiting time for customers and, consequently, their feeling of being equitably served*". Gross (2008) states that LIFO is used in inventory systems. Using the SIRO pattern, the server randomly picks the next customer to receive service, compared to LIFO the SIRO pattern treats customers equally randomly, noted that some customers would receive service quicker regardless of when they entered the system. (Gross 2008 p.3-5; Jaffeux 2013 p.377; Tum 2011 p.210)

Tum (2011) points out a priority process as a fourth serving pattern, which favours certain customers based on modifiers, such as higher tier tickets for airline or concert seats. In the eyes of the customer, SIRO and LIFO are both less equal compared to the FIFO pattern, and the priority process can further increase the customers' feelings of not "*being equitably served*" (Tum 2011, p.210). On Gross' point one, two and four (arrival pattern of customers, service pattern of servers and queue discipline), Slack (2007) defines three strategies that use to manage the service supply and customer demand:

- Ignore the fluctuations and keep activity levels constant (Level Capacity Plan)
- Adjust capacity to reflect the fluctuations in demand (Chase Demand Plan)
- Attempt to change demand to fit capacity availability (Demand Management)

In the approach of "*Level Capacity Plan*" there are a fixed number of servers per time frame, neglecting the actual forecast or real-time demand for service. This can, for example be a government-run facility, which employs eight customer service representatives, all eight customer service booths would be open even though there was less demand for service. When the Level Capacity Plan is in use, Slack (2007) states that "*service cannot be stored as inventory*" and Tum (2011) concurs that it "*is possibly a waste of resources*". In the Level Capacity figure 2 the Y axis represents the capacity of the servers, with the darker straight line indicating the number of servers available and on the X axis the time frame is displayed (in hours). The wavy line indicates the

need for service in the within the time frame. (Tum 2011 p.203-205, 210; Slack 2007 p. 333-339)

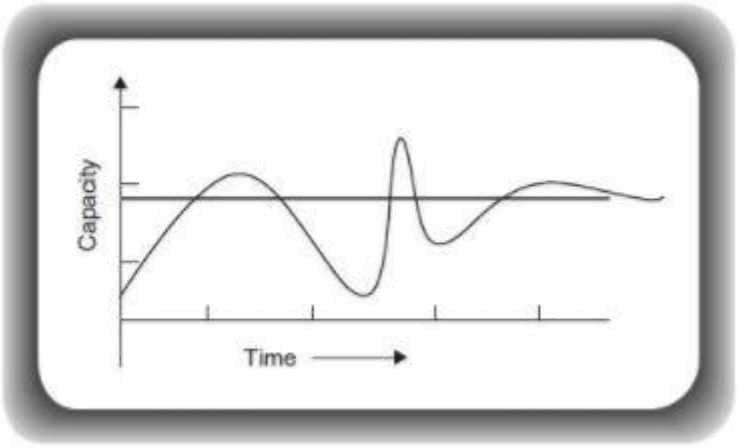

Figure 2. Level capacity (Tum, 2011)

In figure 2, service over-capacity compared to the need for service in the first hour cannot be stored and used later. The allotted average service time per customer can often be planned ahead of time, based on previous historical data, according to Tum (2011). The second alternative is the more difficult to accomplish (from an organisational perspective) Chase Demand Plan. Both Slack (2007) and Tum (2011) emphasise the difficulty in forecasting service demand, the need for the right amount of staff, scheduling of the staff shifts and that there is the right amount of resources at the right place at the right time. According to Coyle (2008) with any large organization the emphasis of logistics should be "*the right product, to the right customer, in the right quantity, in the right condition, at the right place, at the right time, and at the right cost*". Logistics is not only limited to the physical sphere but also encompasses resources such as capital and information, this thesis will take into account all three of the aspects as well as customer experience in the pursuit of pre-registration optimisation. (Coyle 2008 p.404; Slack 2007 p.336; Tum 2011 p.188-189)

Tum (2011) writes that the Demand Management Plan is "*only appropriate in those circumstances where the resources can be provided flexibly, or where prediction of the demand can be made accurately and the resources can be varied*". Referring again to Slack (2007), that the service cannot be stored for future use but, if possible the service can be relocated as according to Tum's example. During the three peaks in figure 2, the

capacity is less than the demand, and thus the customer will have to be willing to queue for service. In the third alternative Demand Management Plan, according to Slack is to "*change demand through price*". Tum's examples of this are with discounted ski trips at the beginning and the end of the season, early bird tickets to a conference or discounted hotel rooms, during the working week when there are fewer hotel guests. The opposite to discounts, or even in conjunction with discounts in situations according to Tum "*where demand exceeds capacity, prices can be raised to discourage customers coming at busy times*". (Jaffeux 2013 p.377; Tum 2011 p.203-206, 210, 216; Slack 2007 p.333-339)

2.4.1 Distractions and waiting experience

An important aspect that accompanies queue theory is the customers' "*perceived waiting time*" (Bowdin 2011) or time spent in a queue. Cameron et al. (2003) conclude that measuring time in the number of minutes "*is unlikely to totally capture the effects of waiting on consumers*", because each person experiences time subjectively, in other words, the amount of time that the person feels that he or she has waited. Furthermore, the perceived waiting time is experienced as longer due to the person focusing on the length of the wait (Hornik 1984). One way to try to positively influence the mood of the person in the queue is to inform them that the average queue time is for example ten minutes and actually they would receive service after five minutes. Under-promising and over-delivering (Norman 2008) affects their perception of waiting time, if they are focusing on the passing of time they might renege (leave the queue upon having entered it). Norman (2008) states that "*the memory of an event is more important than the experience itself*" therefore remembering the queuing as long and ineffective is stronger than the excellent service that was provided at the end of that queue. (Bowdin 2011 p.357; Cameron et al. 2003 p.421; Hornik 1984 p.615; Norman 2008 p.3)

Slack & Chambers (2007) define seven "*customer perceptions of queuing*":

1. Time spent idle is perceived as longer than time spent occupied.
2. The wait before a service starts is perceived as more tedious than a wait within the service process.
3. Anxiety and/or uncertainty heightens the perception that time spent waiting is long.
4. A wait of unknown duration is perceived as more tedious than a wait whose duration is known.
5. An unexplained wait is perceived as more tedious than a wait that is explained.

6. The higher the value of the service for the customer, the longer the wait that will be tolerated.
7. Waiting on one's own is more tedious than waiting in a group (unless you really don't like the others in the group).

Cameron et al. (2003) further define two concepts, "*high cost and low-cost wait situations*", the low-cost wait situation can be summarised as irritating "*but does not have financial, opportunity or social/emotional cost of a high-cost wait*". The high-cost wait situation has substantially more negative effects on the waiting person. A high-cost wait situation is an airline passenger that is forced to wait and thus misses a connecting flight. By comparison, the low-cost waiting situation has less impact on the airline passenger, the situation could be as trivial as having to spend time in transit waiting for the next process to commence. Since the passenger is (most often) not able accelerate the process, then the effect has a low impact on the passenger. (Cameron 2003 p.421-423; Slack 2007 p.349)

The study by Cameron et al. (2003) studied the use of music as a way to alleviate the negative effects of queuing. By distracting the person in the queue with music, their perception of the low-cost wait experience could be altered towards a more positive experience. However, according to Cameron (2003) the positive effects of background music seem to affect the mood and not the perception of the wait time. During the unavoidable wait situations, distractions can provide a way to improve the tedious but necessary wait, by distracting or occupying the time that regardless will be spent waiting it might be possible to influence the wait experience and the time perceived waiting. Queues can also be an optimal time to advertise or to sell products, both in the sense of aiming to distract the waiting person and to increase revenue. (Cameron 2003 p. 422; Tum 2011 p.141, Norman 2008 p.8).

Cameron (2003) expands on the concept, in a low-cost wait the customer in the queue to the duty-free cashier might be more easily distracted and therefore occupied with listening to the music that is played in the store, and Norman (2008) states that "*filled time passes more quickly than unfilled time*". However, in the high-cost wait scenario of the airline passenger, the use of music would have little or no effect due to the passengers focus on the ineffective queuing and the wait itself. (Cameron 2003 p.422; Tum 2011 p.141, 216; Norman 2008 p.3-7; Slack 2007, p.346-349)

2.5 Summary of theory

The literature review included in the thesis was chosen based on the relativity to the topics discussed within the thesis, since events, customer service, logistics and queuing are some of the concepts that are covered and analysed. Literature on events and management were included due to the attendee not simply visiting an event but also experiencing it, as according to Getz (2011). This applied to all the customer touch points that the attendee had before, during and after the event. Registration and ticketing applied to the research aspect of the queuing area and possible technological solutions and resources. In event management, Getz pointed out that the emphasis of customer-orientation and communication in order to provide a successful event experience. Theory on decreasing wait time using logistical models and how to improve people flow, apply to the pre-registration points at the airport. These aspects were included since the main purpose of this thesis was to give recommendations on how to optimise the queuing process and reduce the wait time for attendees. Wait time experience and distraction theory provided an important part of the optimisation part of the thesis. (Getz 2011 p.11, 278-280).

3 METHODOLOGY

Bryman (2011) states that qualitative research "*usually emphasises words rather than quantification in the collection and analysis of data*" whereas quantitative research "*emphasises quantification in the collection and analysis of data*". Quantitative studies either collect primary data or analyse secondary data, that consists of quantifiable information and uses statistical methods to compare and arrive at conclusions. Qualitative research differs from quantitative research by for example observing a process and gathering information about it, such as customer experiences of a service. This thesis uses both the qualitative and quantitative aspects of research called a mixed-method. According to Creswell (2015) it is "*an approach to research in the social, behavioural, and health sciences in which the investigator gathers both quantitative (close-ended) and qualitative (open-ended) data, integrates the two, and then draws interpretations based on the combined strengths of both sets of data to understand research problems*". (Bryman 2011 p. 717; Creswell 2015 p.2)

3.1 Qualitative process

Information and data regarding Slush, its organisation and processes arrive from the author's exposure. Figure 3 shows the work process, such as the email interview with the Slush organiser that was involved in organising the pre-registration process in 2016. The e-mail questions were formed in step 5 of the writing process, based on the thesis case discussion with relevant Slush stakeholders as well as theory.

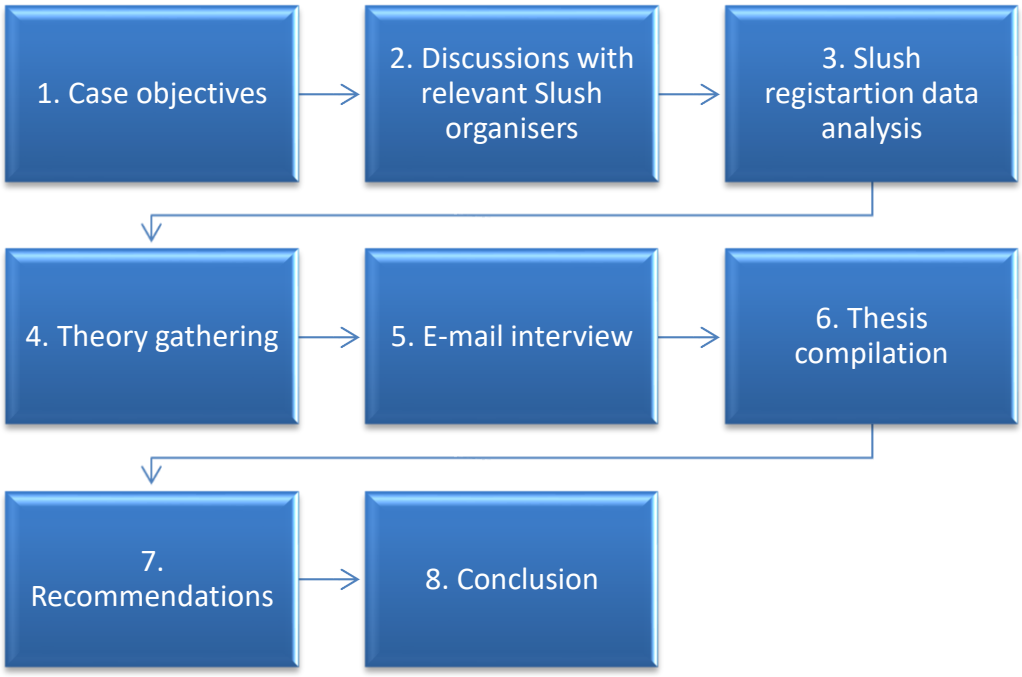

Figure 3. The Slush case study process work flow

3.2 Quantitative process

In order to better understand the registration process, it was vital to access and analyse the data that Slush automatically collects through their registration software. However, according to Dolenc, the logs from the registration system had not previously been exported out of the Slush database, as no one had previously had the intention or need to analyse and use the data. Excel spreadsheets provided by Slush contained the registration and pre-registration processing logs from 2015 and 2016.

As according to the privacy agreement regarding this thesis, the following information had been redacted by Slush: attendee name(s), ticket type, ticket code, ticket purchaser

and phone number. Further removal of clutter was made by the author, such as: *:location, :printedBy, :timestamp #inst*. The last eleven characters following the seconds indicator, example *19:35:19.475-00:00"* was reduced to *19:35:19* and remaining information was split up so that each date was confined in its own Excel tab. Several print logs were discarded for the year 2015, from 1064 down to 1060 and in 2016, 1459 were reduced to 1455. It was not viable to include entire Excel sheets of the data in the Appendix, due to the extensive scale of working with (for example) 1064 lines in Excel, therefore simpler excerpts were included in Appendix 2 and a small excerpt of the raw data registration can be seen in figure 4. As stated in the introduction, the volunteers contribute with their time and effort to take care of certain tasks or are responsible for specific areas. This thesis focused on the pre-registration volunteers and in order to protect their privacy, the volunteer names were changed to volunteer 1, volunteer 2 and so on. After the modifications, data filtering and analysis was easier.

	A	B	C	D
1	:location "Airport"	Volunteer 9	*:timestamp #inst "2016-11-28T*	13:14:40.618-00:00"
2	:location "Airport"	Volunteer 9	*:timestamp #inst "2016-11-28T*	13:24:50.019-00:00"
3	:location "Airport"	Volunteer 9	*:timestamp #inst "2016-11-28T*	13:26:59.681-00:00"
4	:location "Airport"	Volunteer 9	*:timestamp #inst "2016-11-28T*	13:28:49.964-00:00"
5	:location "Airport"	Volunteer 9	*:timestamp #inst "2016-11-28T*	13:32:13.457-00:00"
6	:location "Airport"	Volunteer 9	*:timestamp #inst "2016-11-28T*	13:34:06.896-00:00"

Figure 4. Raw registration data, Slush 2016

The first column in figure 4 specifies the print command location. The second column specifies the volunteer that was logged into the registration software at the time of attendee processing. The third column states the timestamp that is created when the print button is pressed in the registration software. Reading the timestamp from the left to the right, the year-month-day format can be seen followed by a capital "T" that precedes the time input in the format hour-minute-second. The thousandths of a second were discarded since the results would not be impacted, as the registration process is not accurate enough that a thousandth of a second would impact the process.

4 RESULTS AND INDICATIONS

Data collected by Slush through their registration software (made in-house) is used to gauge the effectiveness and provide relevant recommendations for optimisation. The data shows that there is room for improvement in the registration software. For example, according to the available data logs, the pre-registration points had been operational at the airport during 28-30.11.2016. However, Ahonen (2017) comments that the pre-registration service was operational during the 28.11.2016 and the 29.11.2016. He suggests that the "*volunteers might have forgotten to change the location in the computer settings*". Data from the 30.11.2016 was discarded due to this reason. (Ahonen 2017)

According to Ahonen (2017), the Slush registration process functioned as depicted in figure 5. An attendee approaches the pre-registration booth and is greeted by the volunteer. Currently, the registration software creates a timestamp when the software user presses the print button. (Ahonen 2017)

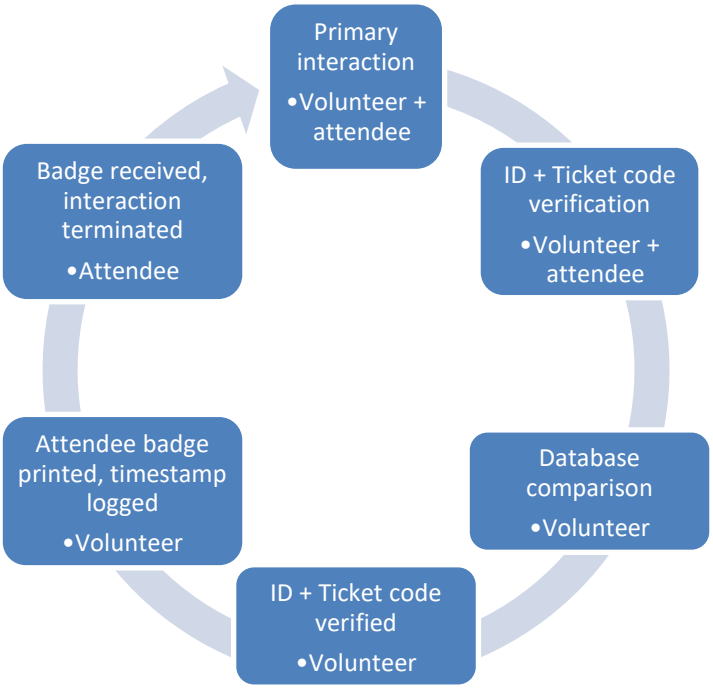

Figure 5. Current Slush registration and pre-registration process, Slush 2017

The advantage of the registration software (made in-house at Slush for Slush's use); is built to be simple and efficient, without distractions and complicated click-through processes. The registration software is designed only to allow an attendee to be

processed once, according to Ahonen (2017) there is an override function that can be enabled to print subsequent copies.

4.1.1 Registration and pre-registration at Slush

The Slush pre-registration process is a typical example of a queue case since the supply of service and the demand for service constitutes a queuing system. Both registration and pre-registration teams share the same volunteer training, technological equipment and electronic attendee database. The difference between the teams are the specific tasks. The registration team focuses on registering the attendee at the Slush event venue in Pasila during opening hours while the pre-registration team focuses on providing their service prior to the opening of the event.

4.1.2 Pre-registration area and process

During registration at Slush (ticketing), the Slush volunteer confirmed that the attendee had a valid ticket that allowed entry to the venue. Attendees, staff and volunteers were given crowd control bands that were needed to be worn during the event. The badge displayed the name of the attendee and the ticket type to the Slush organisers, as certain areas were only accessible with a certain badge and wristband types. Pre-registration was split during 2016 into two different locations in the arrival halls. Two booths were located in terminal one in front of the arrival exit and four booths in front of several restaurants in terminal two and the number of volunteers and recorded timestamps can be seen in table 1. Ahonen (2017) commented that attendees could have found the pre-registration booths more easily if signs were higher up in the air. Both locations can be seen in Appendices 3 “Terminal 1 Map Pre-registration” and “Terminal 2 Map Pre-registration”. He further stated that preparations were made in anticipation of the arrival of the Slush flight, but that the booths quickly became swamped since there was not enough supply to counter the demand, this resulted in queue abandonment. (Ahonen 2017; Finavia 2017).

Table 1. 2015 and 2016 Volunteer amounts and attendee registrations

	2015	2016
Number of volunteers	7	9
Total amount of timestamps	1060	1455

4.2 Quantitative results

Calculations were carried out on the available data in order to try to gain a greater understanding of the attendee pre-registration process. Table two contains abbreviations and their explanation that are mentioned in this chapter.

Abbreviation	**Meaning**
TS	Timestamp
TD	Timestamp difference
T0, T1	The time elapsed since the previous timestamp

Table 2 Chapter 4.2 abbreviations

For each timestamp was assigned a "timestamp difference" (TD) by calculating the time elapsed since the previous timestamp. For example volunteer 4's timestamp (T0) 13:24:50 (hours:minutes:seconds) was subtracted from (T1) 13:26:59 giving a time difference (TD) of 02:09 (minutes:seconds).

Calculations were made on the available data, as can be seen in equation 1. The calculation was then repeated for all timestamps for each volunteer separately.

T1 - T0 = TD

13:26:59 - 13:24:50 = 02:09 = 129seconds

Equation 1. Time difference calculation

All scatterplots for each volunteer were compared and the results were similar for each volunteer during the same day. Even when comparing volunteers for different days there were similar patterns. As an example, volunteer scatterplots in figure 6 and 7 were chosen due to the similarity they portrayed when compared to each other. Volunteer 2 even had similar results and patterns both days. Figure 6 shows all of volunteer 2's timestamps (TS) for a day. The X-axis shows the time of day (hour:minute:second) and each TS with its corresponding TD on the Y-axis in seconds. As can be seen from the figure many of the TSs are found in clusters with relatively short TDs, divided by a single or a few TSs with much longer TDs. All volunteers for the same day were merged in one scatterplot, however this simply resulted in meaningless clutter and did not yield anything meaningful and was thus not included in the thesis.

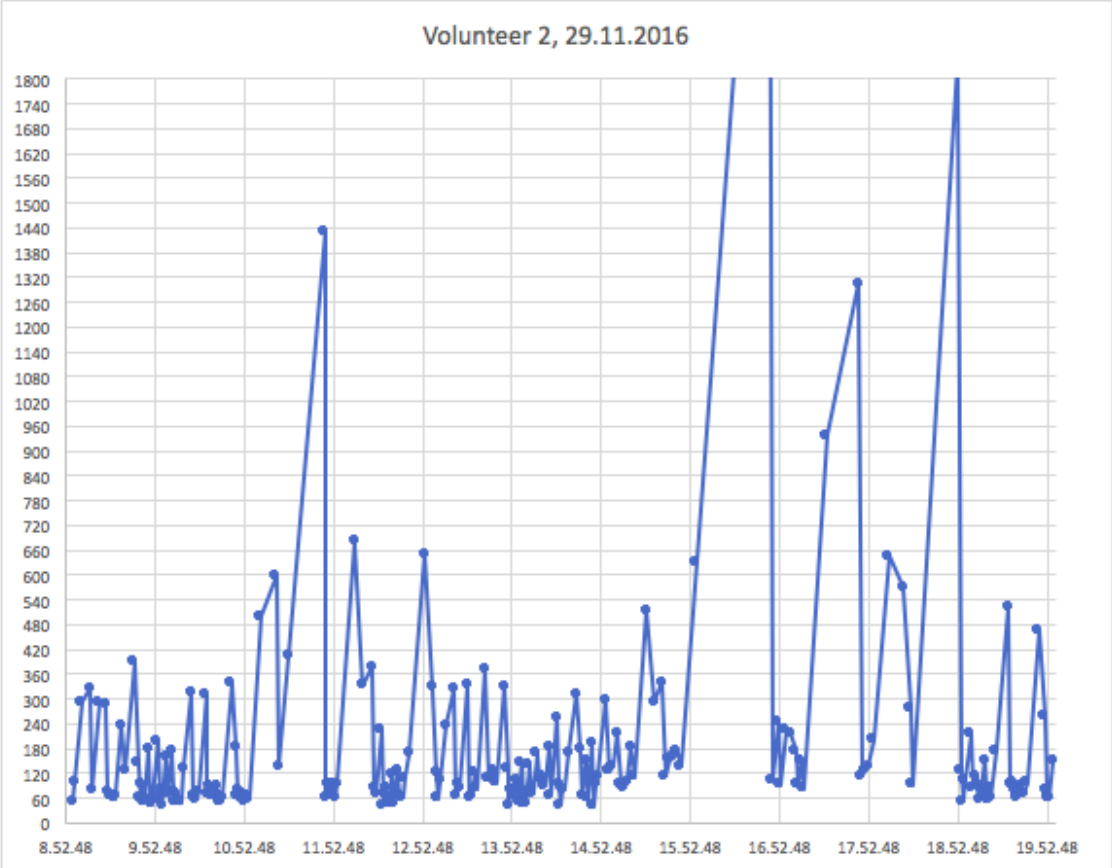

Figure 6. Scatterplot volunteer 2, 29.11.2016

Comparing figure 7 and 6 it can be seen that the distribution of TSs over time and their corresponding TDs look similar.

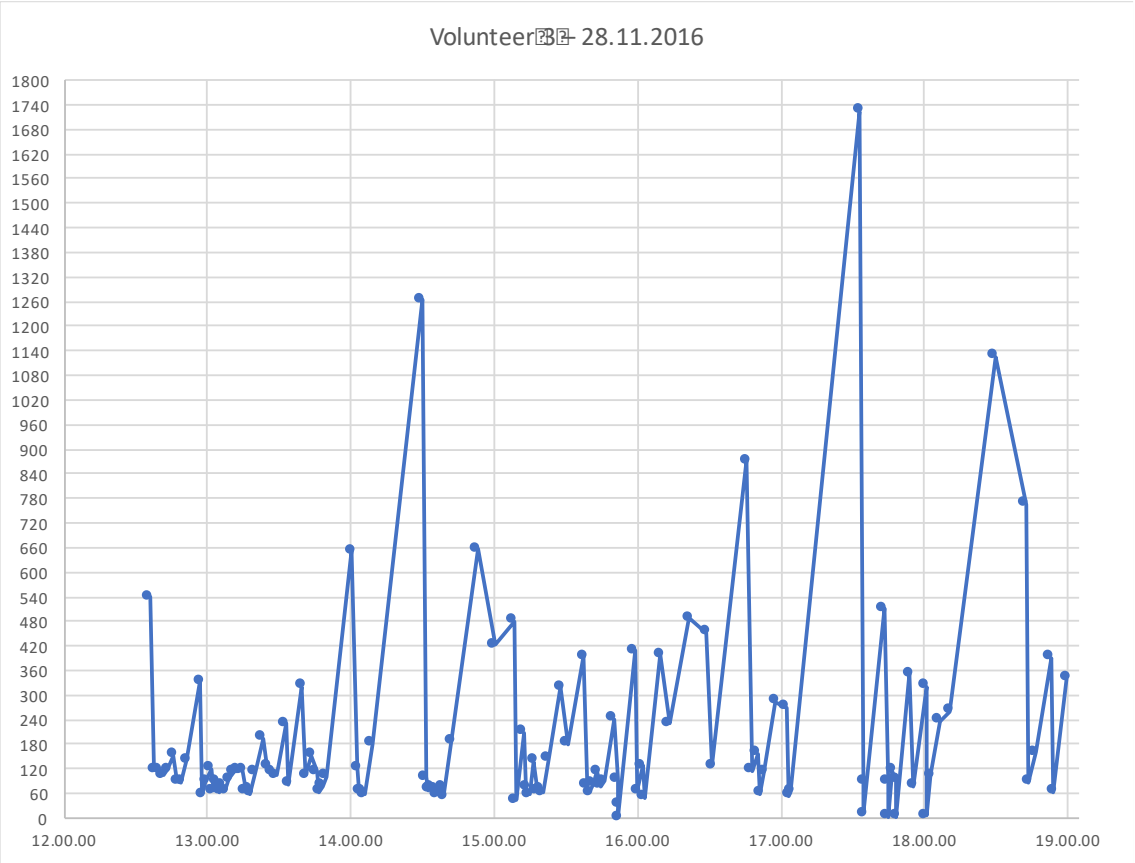

Figure 7. Scatterplot volunteer 3 28.11.2016

Figure 8 displays the same TSs of volunteer 2 as in figure 7, though sorted from low to high TD. There are a few anomalously short TDs, as seen on the far left of figure 8. The rest of the curve is smooth, with no clear dividing line between shorter and longer TDs. Most of the TDs are on the short side with a diminishing amount on the longer side.

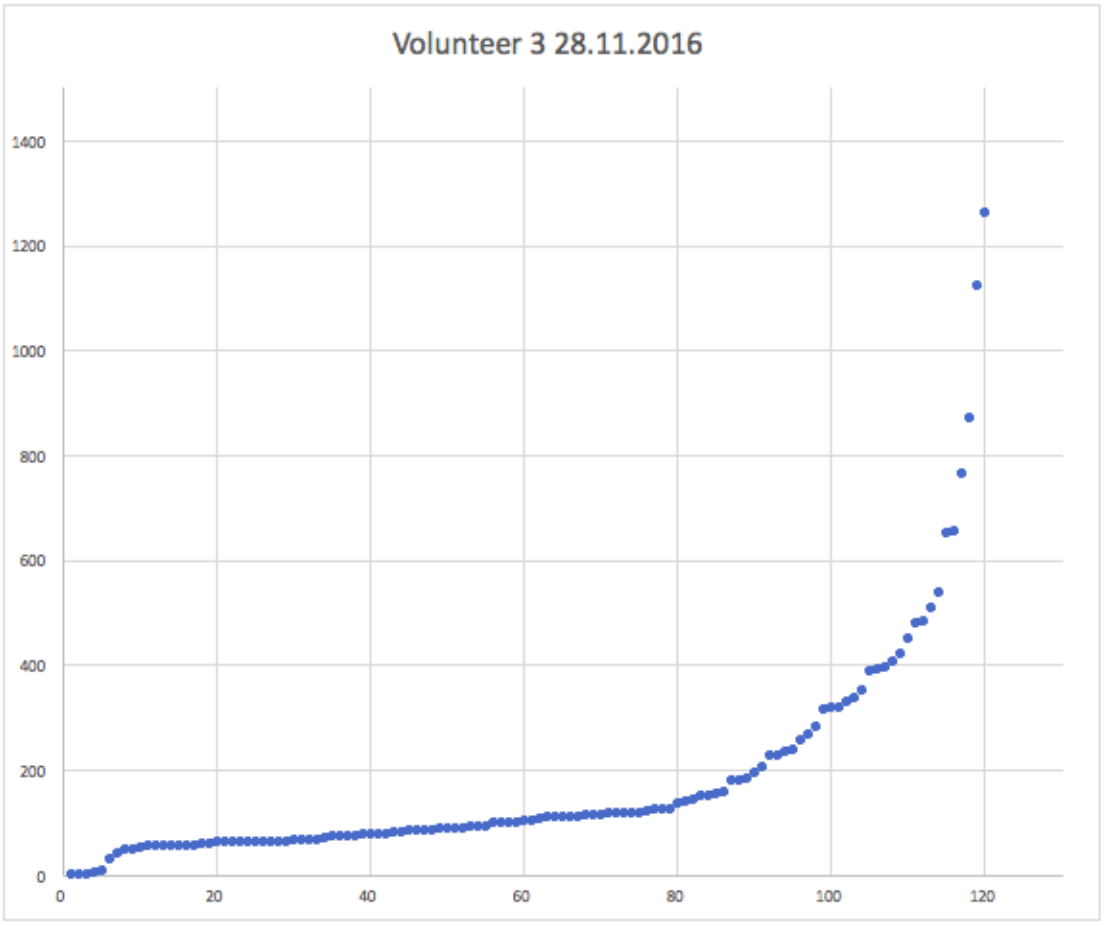

Figure 8. Volunteer 3 Timestamps sorted low to high 3 28.11.2016

All volunteer TDs for 2015 and 2016 were compared in figure 9. There were 395 more registrations in 2016 (yellow) than in 2015 (blue), thus 2016 has been compressed along the X-axis to fit lengthwise with 2015. The X-axis was removed due to not representing anything consistent, furthermore TDs over 1000 seconds were cropped from the Y-axis (total of 105 entries) TDs.

Both years show a similarly smooth curve. Also, the majority of TDs fall in the same range. The shortest TDs can be seen in the left corner of the curve, 11 seconds in 2015 and one second in 2016. The longest TD was 4446 seconds (74 minutes and 5 seconds) in 2015 and 15088 seconds (4 hours 11 minutes and 27 seconds) in 2016.

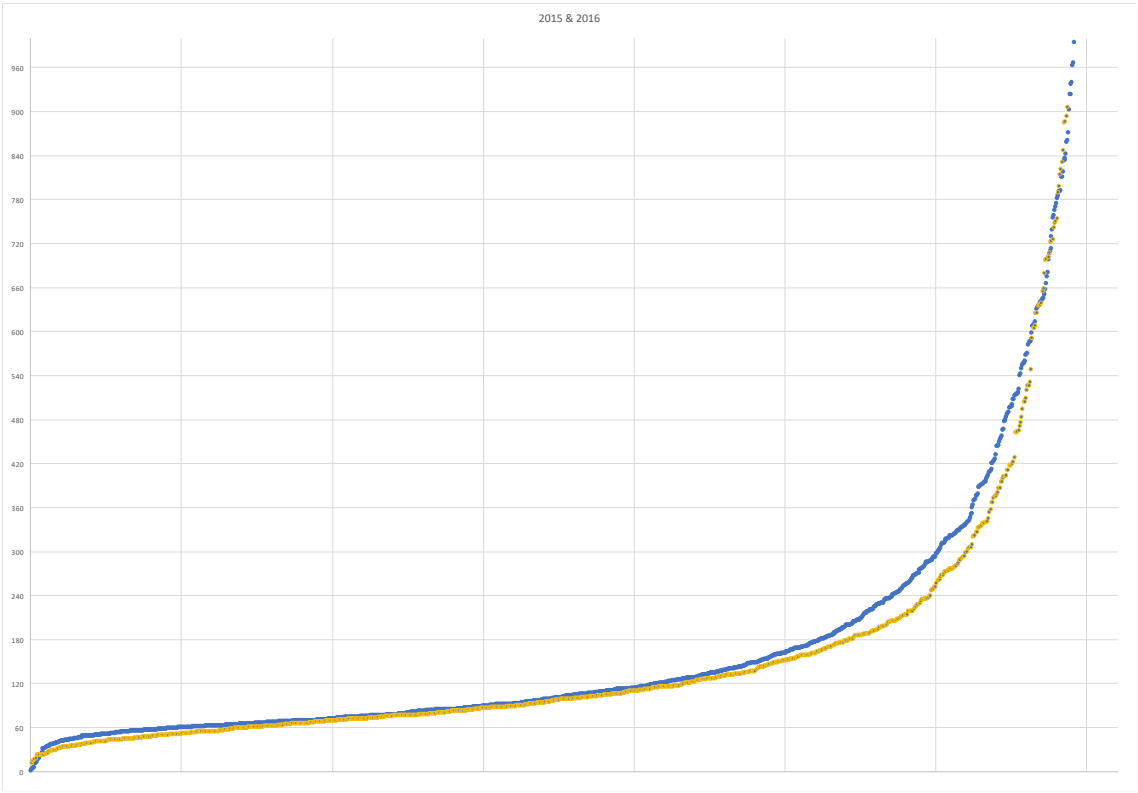

Figure 9. 2015 & 2016 TD Comparison

4.3 Quantitative analysis

As mentioned in the event management and event registration theory, the need for comprehensive data is paramount, to be able to analyse queuing issues and solving them. Without comprehensive data, the analysis is left much to guesswork. Such is the case regarding the simplistic registration data that was available from Slush.

Ahonen (2017) stated that the timestamp is the registered time when the print button is pressed. Due to the limited available data, a number of assumptions have been made in order to produce useful analyses. The main assumption made is that the time difference (TD) between timestamps (TS) would indicate processing time. Shorter TDs are assumed to correspond to true processing time, whereas longer TDs between timestamps were assumed to indicate either volunteer work breaks or intervals with no attendee contact. However, there is no clear cut-off point, for example, it is impossible to know from the data if a four-minute difference between timestamps indicates a problematic registration process or a break. This occurs due to the simplicity of the available data and severely hampers any attempt at deeper analysis.

The raw data contained TDs such as 00:00:00 or 00:00:02 (h:m:s), it is not known if these are due to input error by the volunteers. These are assumed to be anomalies since there is only a handful of them and a quite clear cut-off compared to most TDs. Furthermore, the location timestamps did not specify if the laptops running the software were located at terminal two or one, thus it is not possible to analyse the effectiveness of each pre-registration point separately.

Due to the tail end of extremely long TDs, the average of the TDs becomes useless for analysis. Choosing a cut off-point for TDs would remedy this, but due to the smoothness of the increase in the length of the TDs any such cut-off would not yield improved results. It is the author's opinion that a median better represents an expected TD as the extreme lows and highs do not affect the result. Based on this overly simplistic and available data it seems that the attendee could be expected to have been processed within the range of 60 to 120 seconds (one or two minutes), as can be seen in figure 12. The Y-axis displaying the amount of print commands logged. The X-axis marks the upper bound of the bin for the TDs. Thus “30” includes all TDs up to 30 seconds, “60” all TDs 31-60 seconds, and so on. TDs over 361 seconds are binned in “more”.

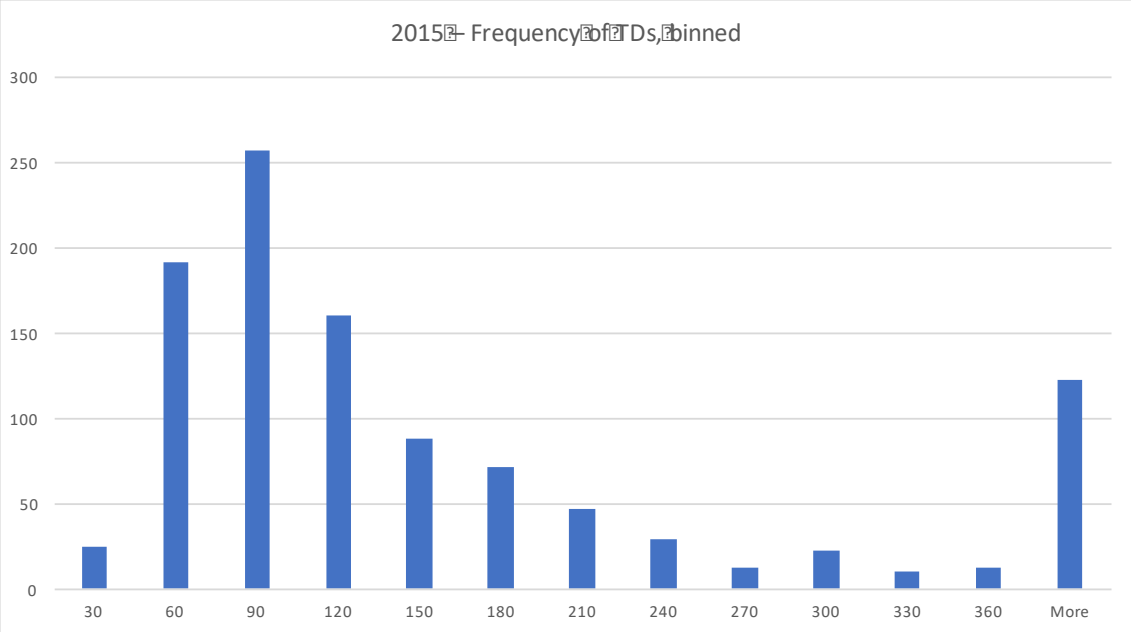

Figure 10. Frequency of all the TDs of 2015 in 30 second bins.

There was a 27% increase in attendee pre-registrations in 2016 compared to 2015; 1455 and 1060 registrations respectively. Based on the frequency of the TDs it seems that the most probable attendee processing time both years was somewhere between 30 and 120 seconds. Also, the medians of the TDs point to the similarity of the datasets since the median for all volunteers in 2015 was 100 seconds and in 2016 was 104 seconds.

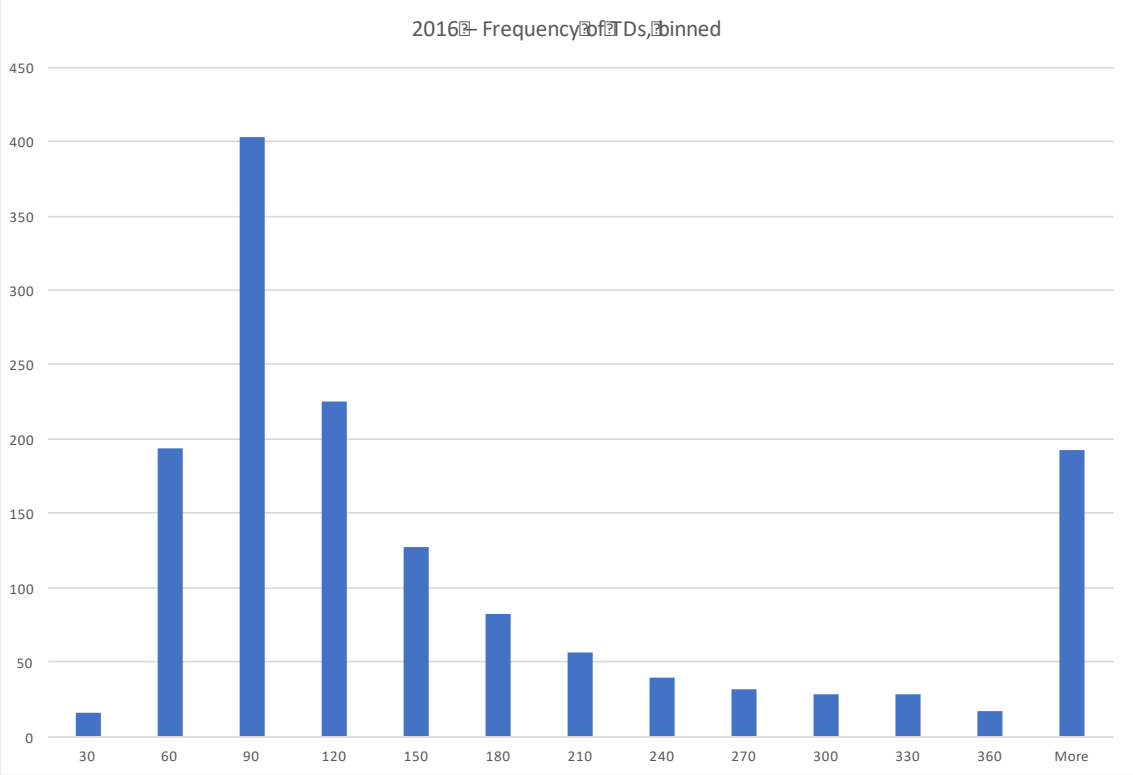

Figure 11. Frequency of all the TDs of 2016 in 30 second bins

5 DISCUSSION

The discussion chapter is divided into specific categories containing, advantages, disadvantages and a description of possible pre-registration modifications. Furthermore, the chapter has been split into two main possibilities: firstly, Slush chooses to keep the current processes, deploying all or a mix of the recommended adjustments, such as increasing preparations and resources, while focusing on distractions and the wait experience. These processes are examined in chapters 5.2 to 5.2.3. Secondly, modifying the pre-registration processes and radically changing the queuing nature, by introducing attendee participation through mobile queuing software are examined in chapters 5.3 and 5.3.1.

5.1 Attendee activities

Chapter 5.1 and following subchapters explore different possible ways to include the attendee in the pre-registration process.

5.1.1 DIY registration kits

Attendees could produce DIY (do it yourself) registration kits at home or in an office environment. **Advantage:** the attendee would have the complete registration-kit ready and on their person when requesting access to the event venue so the need for pre-registration would be greatly diminished or even completely negated.

Disadvantage: the attendee faces the following issues, availability of colour or colour variance in the printer cartridges, due to the abundance of printers and settings and paper type and quality. The problem arises in the consistent quality if attendees wear their DIY badges with variating colour, size, paper formats that would damage the professional branding of Slush. Printing the polyester wristband and plastic zip lock and plastic badge holder in a home environment is currently not feasible as 3D printers are not a common household appliance. Increased resources and thorough scrutiny by registration and security personnel would also be needed to verify DIY registration kits with the registration database, thus increasing the wait time to gain access to the events.

5.1.2 Registration kits sent by mail

Slush could pre-process the registration kits and send them by post globally. **Advantage**: the kits can be sent out well ahead of time thus negating the need for pre-registration points since the attendee would be verified at the event venue by the security staff. However, this scenario also has the **disadvantage** (as in 5.1.1) of the need for more registration resources at the event venues. Furthermore, several issues can also arise from delivery problems (lost/late/damaged) mail, identifying the right recipient, wrong delivery address or theft.

5.1.3 Self-service ticket terminal

Self-service ticket terminals could be installed at registration and pre-registration points that enable the user to input a confirmation code, name or other identification to print out their personalized pass. As an **advantage**, the attendee would assemble their own registration kit however, the **disadvantage** is that is not yet feasible at this point to print the wristband, plastic neck strap and plastic badge holder, thus interaction with the Slush volunteer is needed despite the technical solution. The terminals also require renting or partnership with external service providers possibly incurring high costs.

5.2 Optimising the current pre-registration process

Chapter 5.2 and its sub headers take into account the possibility of Slush choosing to keep the current pre-registration process yet modifying it. Since pre-registration at the airport is most likely the first face to face interaction with a Slush representative (volunteer) before the event, it is vital that it is a smooth first impression. Even with technical solutions that might reduce wait time and make queuing less frustrating, the interaction with the volunteer will heavily impact the perceived service level of the attendee, as Tum (2011) stated regarding "*friendly and helpful frontline staff*". (Tum 2011 p.61)

5.2.1 Update current registration software

As discussed previously in subchapter 4.3, the existing software does not give clear data that can be benchmarked and analysed. As an **advantage**, making modifications would enable analytics to be performed on the pre-registration process, since each attendee loop, break or non-existing attendee activity would be more clearly distinguishable in the data logs. One possibility would be for the software to notice WiFi changes with the following message: "WiFi change detected, is the print location still "AIRPORT"? Answering yes would let the user continue using the software immediately, answering no would prompt the user to select the location from a drop-down menu. **Disadvantage**s include the needed resources for modifying the software, as well as possible software issues that might arise from changing the underlying code.

5.2.2 Distractions

Since the Slush attendee waiting for the pre-registration service will likely be in the low-cost waiting state of mind (Cameron 2003 p.422-425), he or she might be positively influenced by music and videos played in the pre-registration area. In order to speed up the service and reduce the queue times, information could be conveyed to the attendee in the queue, informing them either verbally, in text on posters, via video or slideshow on a projected/video screen. The attendees would be informed that they should have their pre-purchased ticket number and personal identification ready to be presented to the Slush volunteer in order to receive prompt service. Ahonen (2017) wrote that volunteers were tasked with walking around the queue area and prompting the attendees to have their identification and ticket code ready at hand.

Advantages would include atmosphere build-up, as Tum (2011) stated "*the entertainment may help to build up anticipation and the feeling that the event has already begun. Providing entertainment during the time people may be waiting reduces frustration and consequent problems"* while at the same time marketing Slush to airport travellers passing through the area. Other distractions could be a welcome to Finland video, video material from previous Slush years, reminders to download the Slush mobile application using the airport Wi-Fi, convenient information and fun facts. However, **disadvantages** could include attendees becoming frustrated by the music or entertainment, thus negating the distraction efforts. (Tum 2011 p.141)

5.2.3 Wait experience

Modifying the waiting area could positively impact the wait experience. Electronic signs that display the average waiting time and that are updated continuously, either manually or automatically. These features could be coded and integrated into the registration application. If the average process time increases above a pre-defined threshold the average waiting time would increase. A manual solution would be to use Slush floor stickers, the volunteers would then gauge the queue time manually. The time would then be manually inputted into a laptop that is connected to several screens/projectors, this sets the benchmark of five minutes in order to under promise and over deliver.

The **advantage** would be the psychological benefit of exceeding expectations (Norman 2008) by under promising and over delivering. The margin of two extra minutes gives the volunteers extra time if unexpected situations arise and require extra attention or time to be solved. With the positive aspect that if the attendee only has to queue for three minutes, then he or she might have a positive experience of the faster service, whereas if the total queue time is around five minutes then the expected queue time is still concurrent. A **disadvantage** could be that if the attendee has to queue longer than advertised, then there is the risk of frustration and queue abandonment. (Norman 2008 p.6)

5.3 Modifying the current pre-registration process

Due to the nature of Slush and the demographic that attend it, it is highly likely that attendees will have access to a smartphone. Thus, the download and use of either the current Slush partnership app or an external third-party application is not an issue. This enables Slush to use the possibility of virtual queuing with a FIFO system (Jaffeux 2013), by either modifying the current Slush partnership app or to partner with an external queuing application provider. **Advantages** of both solutions enable the volunteers to print out and prepare the badge and wristband for the attendee by buffering the virtual queue, since when the attendee enters the virtual queue the attendee database updates with a real-time queue list. (Jaffeux 2013 p.377)

If there is a gap in completed registration kits that are waiting for the attendee to be picked up, the volunteer can simply notify the next in line that their turn is up next, in a sense this is a mix of FIFO and SIRO, as established by Jaffeux (2013 p.377).

Slush pre-registration sends out e-mails reminders that attendees should have their ticket codes and ID ready. Thus, instructions to download and use the application can be included. Preferably this is to be done in two instances, the first e-mail would be sent a few weeks earlier informing the attendee of the new process and a second e-mail containing a reminder and clearly defined steps to take before boarding their flight.

The attendee enables GPS location to determine the closest pre-registration point. When the application indicates that the user is within a pre-determined geo-fence, a virtual queue number will be generated and then the user prompted to have their smart phone's sound and vibration enabled. An algorithm would calculate an estimated wait time, so the attendee can make the informed choice on how they spend the wait.

Since the third party mobile application is already available for iOS, Android and Windows Mobile, there is no need to build the queuing function/app from scratch, also the need for the attendee to download a secondary app simply for pre-registration and queueing is negated. GPS (Global Positioning Service) is already integrated within the mobile app and would be one of the features in identifying where the attendee is located since there are several different pre-registration locations. Potential **disadvantages** involve the attendee not having enough charge left in their smartphone to download the needed application over the airport Wi-Fi or to use the queueing app while waiting for their turn. Furthermore, the attendee might not notice the notification of their upcoming turn or temporarily be unable to retrieve their kit. Technical problems such as poor GPS signal, airport Wi-Fi connection issues could hinder use.

5.3.1 External mobile queueing application

Queuing management solutions were inspected as optimisation alternatives. Since the market keeps changing, no direct companies were included in the thesis. The aim of the thesis was not to provide software options but to provide optimisation recommendations. Both mobile application solutions would be a green option since there is no need for further hardware to be installed, such as a self-service terminal or a ticket dispenser that simply prints a piece of paper indicating a queue number and no need to use a queue number screen.

Advantages offered by queuing management software include solutions with virtual queuing, dashboards for staff to manage the queues and customers not having to wait in a physical line. Customers can distract themselves by browsing shops or refreshing themselves at cafés. **Disadvantages** of third-party queuing software could be compatibility issues with Slush's registration database. Thus, volunteers might need to

manage both software programs side by side and keep both updated, this can lead to errors that like information asymmetry. This could require volunteer's time, to solve issues instead of serving attendees. External applications also require the attendee to download and signup for an external service, potentially causing frustration and abandonment of the pre-registration service, thus increasing the registration bottleneck at the event venues.

5.4 Recommendations

The research aim was to **help analyse and optimise the registration processes**. Data collection and calculations were performed using the qualitative and quantitative methods covered in chapter 3. The results were then analysed in chapter 4 and the suggestions to answer the research question on how the pre-registration process can be optimised were included in chapter 5.2 and its sub-sections.

One of the research questions was **the waiting times at the pre-registration points during 2015 and 2016.** The collected data was analysed in chapter 4.3 and even though the data was not very comprehensive, it gave insight to the process time more than the actual waiting times.

Chapter 5.4 and their subchapters include both the short and long-term recommendations for pre-registration and answer the research question of **what modifications of technical or management strategies could improve the waiting experience at the airport.** Furthermore, chapter 5 included alternatives on how attendees could be included in pre-registration process activities that could impact the wait experience. The following alternatives were considered: DIY registration kits, registration kits sent by mail and self-service ticket terminals, but ultimately disregarded all of them as viable recommendations. The reasons were the impacts of the many disadvantages, that can be summarised by cost versus benefit, security and too much responsibility placed on the attendee, such as the aspect of processing 17500 registration kits that can be lost or damaged on the post route around the globe.

5.4.1 Software update and virtual queuing

In order to improve the pre-registration data output, the software is recommended to be modified as in figure 12. The timer would continue ticking while the volunteer is waiting for the printer to finish the badge and while inserting the printed badge into the plastic badge holder and adding the right colour wristband. Once all the steps are done the attendee would press a button indicating that the attendee has been processed successfully, directly after the complete loop, the software would allow the volunteer to enter the next attendee into the system, thus repeating the procedure.

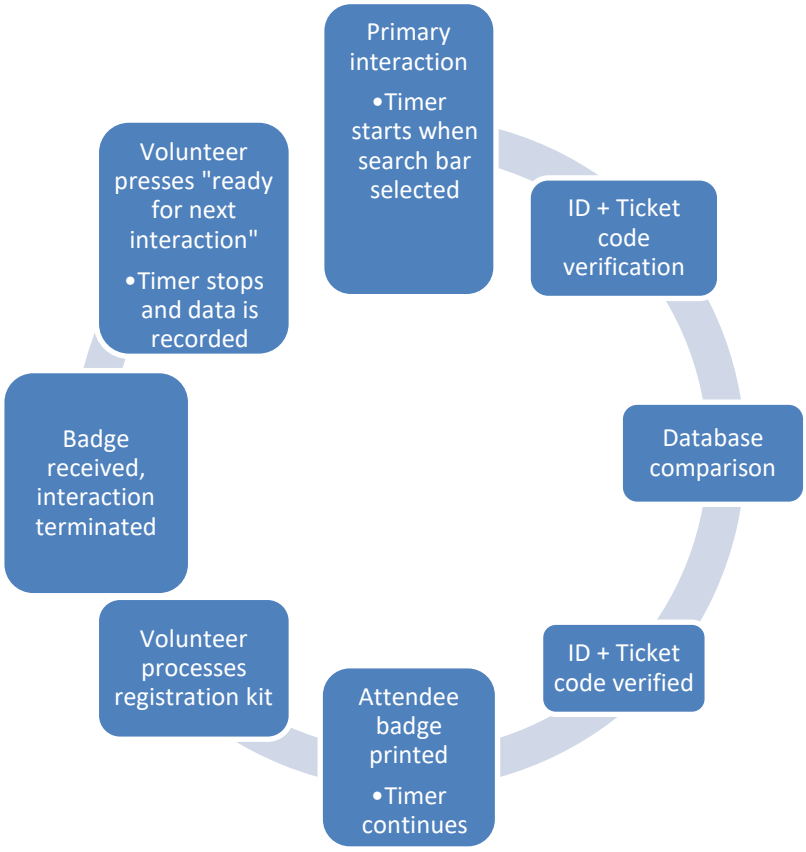

Figure 12. Suggested modifications to Slush registration and pre-registration process

As part of the virtual queuing implementation, volunteers would work in pairs per booth, one providing the back-office task of buffering the attendee registration kit and the other in dispensing the said kit to the attendee. The attendee simply arrives at the booth to pick up his or her registration kit upon verifying their ticket code number and

the virtual queue number from the mobile phone screen. The suggested flow can be seen in figure 13.

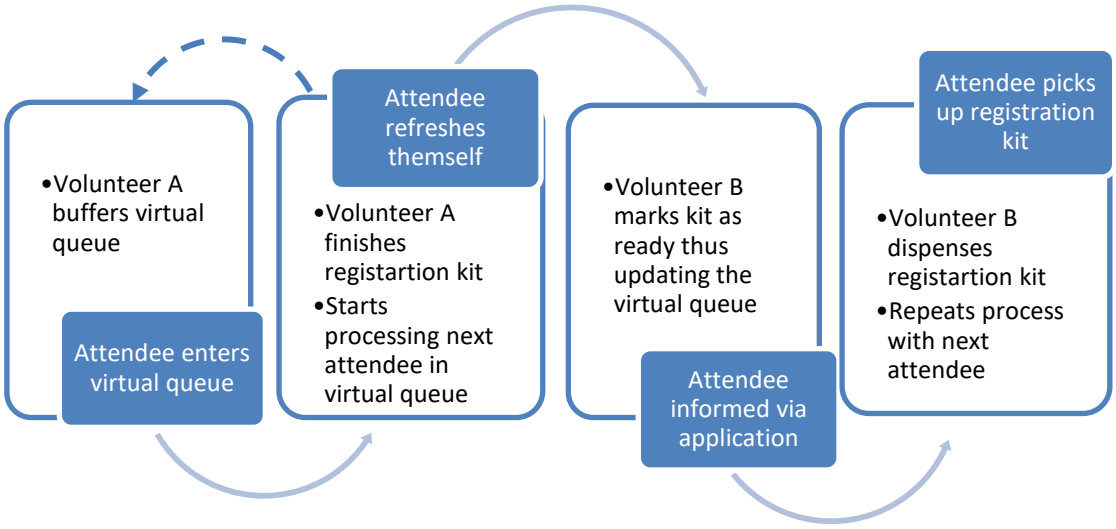

Figure 13. Virtual queue recommendation

5.4.2 Distracting the attendees

In the current situation, the volunteers were tasked with walking around the waiting area to prompt the attendees to have their ticket code and identification ready. It is recommended that repurposing the volunteers to assist the pre-registration process at the booths and instead using video screens, to deliver the same information would be more efficient. As part of the distractions it is recommended that looped video consisting of the average queuing time and a prompt for the attendee to have their identification and ticket code ready. Video screens can also show other material, at the same time being both distracting and informative.

Distributing water bottles/cups to attendees at the pre-registration area is not recommended due to Slush's aim to be more environmentally friendly (Dolenc 2017), however, partnerships with shops, cafés, restaurants at the airport could be a way to distract and refresh the attendee. (Dolenc 2017)

5.4.3 Process modifications

If the volunteer does not have the required resources, the pre-registration process cannot be completed or is delayed until the resources become available. Therefore, it is recommended to analyse and plan the number of volunteers and booths and to use the Tum (2011) chase demand model to "*adjust the capacity to match the fluctuations in demand*". This can be done by clearly communicating within the team that volunteers are needed at the designated booths to help with the increase in service demand. (Tum 2011 p.203)

According to Finavia, the distance from arrival terminal one and terminal two is approximately 300 meters, the maps in Appendix 3 shows the pre-registration areas. Ahonen (2017) elaborated regarding the volatile fluctuations of service demand, that guidelines were provided for the pre-registration volunteers. They were requested to not move between the pre-registration points. Thus, in the scenario of long queues in terminal one and virtually no queues in the other, the volunteers at terminal two would potentially be idle. Even with the fluctuations in mind, it is suggested that several volunteers be added per shift under the supervision of the group leader, with the task of chasing demand, as defined by Tum (2011). For the process to be effective, real-time communication and evaluation is needed between the group leads at terminal one and terminal two. (Tum 2011 p.141; Ahonen 2017; Finavia 2017).

Modifying the waiting area could positively impact the wait experience. Electronic signs that display the average waiting time and that are updated continuously either manually or automatically. These features could be coded and integrated into the registration application. Using Slush floor stickers, the volunteers would gauge that a certain sticker would indicate a queue time of for example three minutes from that location. Due to the psychological benefit of exceeding expectations (Norman 2008) by under promising and over delivering, it is recommended that a buffer is added to the total estimated queue time. The buffer also has the positive aspect of the attendee only queuing for three minutes, then the attendee might have a positive experience of the faster service, whereas if the total queue time is around five minutes then the expected queue time is still concurrent with the earlier estimation. (Norman 2008 p.6)

6 CONCLUSION

In conclusion, based on the theory, qualitative and quantitative research, Slush should implement the included suggestions for distractions in the short term, as well as introducing a virtual queuing application in the long term, so that the attendees could roam freely to refresh themselves while waiting for their pre-registration turn.

Due to the high value and low cost of the volunteers, that clearly outweigh mailing the registration kits, DIY kits and self-service ticket terminals, it was concluded that attendee self-service activities were non-viable (for the time being). Furthermore, the 2016 TD results showed that the majority were in the range of 60 to 120 seconds, this differs slightly from Ahonen's comment that attendee processing would take "*maybe 30sec-1min per attendee*". The data on all volunteers were compared and combined with the comments, they indicate that all volunteers were efficient and consistent in their work. Further modifications to the software would make more in-depth analysis possible in the future.

To secure quality and scope, two follow-up studies would be recommended. The first, an in-depth qualitative study conducted by observing how long it takes to process attendees and why certain attendee pre-registrations take longer than others. This would increase the possibility to more accurately gauge and analyse what effects the recommendations in this thesis (or any other changes) had if Slush decided to apply all or any recommendations. With analysable data educated guesses could be made on the number of volunteers need to be present, potentially avoiding idle time. The second would be to look at forecasting attendee arrival amounts and times at the airport. This forecast could then be implemented in order to allocate a sufficient number of volunteers when there is a higher demand for pre-registration. Improving the waiting experience could improve the overall satisfaction of attendees since Slush is already an internationally known and respected event, full of potential to continue growing and branding Finland as a hotspot for entrepreneurship.

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APPENDICES

Appendix 1/1(3), Ahonen e-mail interview

Gmail Gustav Thomasson [redacted]

Slush Pre-registration 2016

Sami Ahonen <sami.ahonen[redacted] Wed, Nov 22, 2017 at 8:58 AM
To: Gustav Thomasson <gustav.thomasson[redacted]

Hi Gustav,

Here is my answers for the questions as we talked when we met!

1. The registration data that I received from Slush indicates that the pre registration points at the airport in 2016 were operational during the 28.11 to the 01.12.2016, is that correct?
a. Nope, they were only open during the 28.11 between 15-21 and on the 29.11 between 8-21, the volunteers might have forgotten to change the location in the computer settings.

2. How many individual pre registration booths were at the airport and what were their location:
a. We had 6 registration booths, 4 at Terminal 2 in front of Burger King and 2 at Terminal 1 after security check.

3. How many volunteers were stationed at the airport?
a. There was 12 volunteers + group lead. There were some volunteers from the info team that answered general questions about Helsinki and Slush.

4. Were there queues
a. Yes there were queues during the rush hours

5. When did Slush's branded Finnair flight land and how many attendees were aboard?
a. There were 247 Slush visitors and they landed 15:00 on the 29.11

6. I understood there was some issues with the Slush flight pre-registration?
a. There was especially a lot of confusion and queues when they arrived, we had received lists from our colleagues at Slush HQ with the names of those on the Slush flight. W e were supposed to print out badges and have them ready to handed out, but there were just so many people queuing and we didn't have enough volunteers so we were overwhelmed and a lot of attendees left the airport without their badge. I think it was about 100 tickets that we had to destroy afterwards.

7. Is it possible for a person to buy a Slush pass at the pre reg point?
a. No, the only way is to buy the pass online through webshop and then go to the pre reg point with the ticket code. Anyways most of the ticket types were sold out.

<u>Pre registration Process:</u>

1. How were the volunteers trained to process each attendee case and what were the volunteer supposed to say and do
a. We had a first come first serve rule and the volunteer was told to greet the attendee in a customer friendly way but not to talk too much about other things. Then ask for the ticket code and to see ID. Then they would put the info in the program and search for the person and print out the badge and put it in plastic with the right wristband.

2. Did the pre registration points have any sort of priority or problem desks?
a. Not really, we had the first come first serve rule and if there were any problems then the group lead would sort it out.

3. Was the attendee informed by volunteers or marketing to have their ID and ticket code ready before

Appendix 1/2(3), Ahonen e-mail interview

approaching the pre reg desk?
a. Yes, we had volunteers walking around and telling them to have the info ready and we had sent out emails a few days before.

4. Were there any problem cases that took extra long time?
a. Sometimes the attendee wants to check that their title is correct, so for example it can be CEO, prince etc. These modifications can take a bit longer to make in the system. And sometimes a company representative would walk up and show the ticket codes for 15 tickets but the tickets have no name, in this case we had to contact the ticket team to verify the purchase and then coordinate the names with them, this could easily take a long time to solve. Also we had some cases where a person had been given tickets from several different companies as a gift. This also took some time to solve that which company ticket we should use.

5. What kind of database did the volunteer use to print out the personalised badges?
a. We used a custom registration software that Slush had made for us. You would put in the attendee name or ticket code like in Facebook and klick the person and the select print. It was very simple.

6. What kind of resources were available at the pre registration points?
a. Printers, laptops, different colored paper for the badges, plastic badge holders and straps and different colored wristbands.

7. Does the pre registration team divide the attendees in different queue lines according to ticket type?
a. No, it's first come first serve

8. Does the attendee partake in any part of the pre registration process at the airport
a. No

9. Was there a goal for how fast the pre registration process should be per attendee?
a. I think we had counted maybe 30sec-1min per attendee but we didn't measure the actual times.

10. Is the registration software timestamp when the volunteer hits enter or when the attendee name is inserted into the software?
a. I think it's the print time

11. Are there volunteer breaks
a. Of Course ,they were organized as needed

12. If the there are several long queues in T2, can the volunteers at T1 point go help out in T2?
a. They were too far away from each other so we had told them not to run back and forth.

13. Were any instructions or guidelines given to the volunteers regarding what to do if the queues were way too long and there was a high risk of the attendee being frustrated?
a. Yes, I had instructed the group leads to inform the people in the end of the queue that in the city we have more pre reg points.

14. How big was the pre registration budget for the airport and how was it split into signs etc. and hardware?

a. We had ordered about a 1000€ worth of signs and banners as marketing material and the laptops had been bought for 8000€, the printers we had already from previous years, I don't know from where though.

The attendee badges:
1. What attendee information does the pre registration team receive from the Slush ticket team?
a. The basic stuff, first + last name, email address, ticket code, phone number, who bought the ticket, ticket type

2. What information is showed publicly on the attendee's badge?
a. The first + last name adn company/organisation
b. Badge type in color and name → same color as wristband
Resources:

1. What is included in the package that the attendee receives at the booth?
a. Badge, plastic badge holder, plastic strap and wristbands,

Appendix 1/3(3), Ahonen e-mail interview

2. What preparations did your team make before arriving at the pre registration point at the airport?
a. We had a workshop style thing where we together connected the plastic strap to the plastic badge holder and checked that all the laptops and printers worked.

3. What resources would be needed in the future to provide more efficient service?
a. We had nice modern printers that were fast to print many pages but slow to print only one page, and mostly we printed one page per time. So faster printers would be nice, and more volunteers.

4. Did the volunteers know how to solve equipment problems?
a. Yes we went over some basics, how to change the color in the printer and use the software, paper jams etc.

Distractions:

1. Were any sort of distractions such as music, lights, video (using a screen or projected) or any sort of entertainment used at the airport?
a. We had music at the other pre registration points in Helsinki, but Finnavia was very precise what we could do and not do. We couldn't hang stuff such as signs from the ceiling if it could possably cover a camera or exit, so we ended up just having the booths. We didn't ask if we could have lights or show videos or play music, that might be a good idea for 2017. Also we could have used signs that were higher up in the air so that Slush visitors could have seen the booths when there were a lot of people in front of the booths. I think that many people didn't notice the pre registration place because they just walked by.

2. Were any refreshments offered to the attendees that were queuing?
a. No

3. Were the attendees informed somehow how long the estimated waiting time is?
a. No

Hope these answers help with your thesis!

BR,
Sami

[Quoted text hidden]
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[redacted]
Sami Ahonen
[redacted]

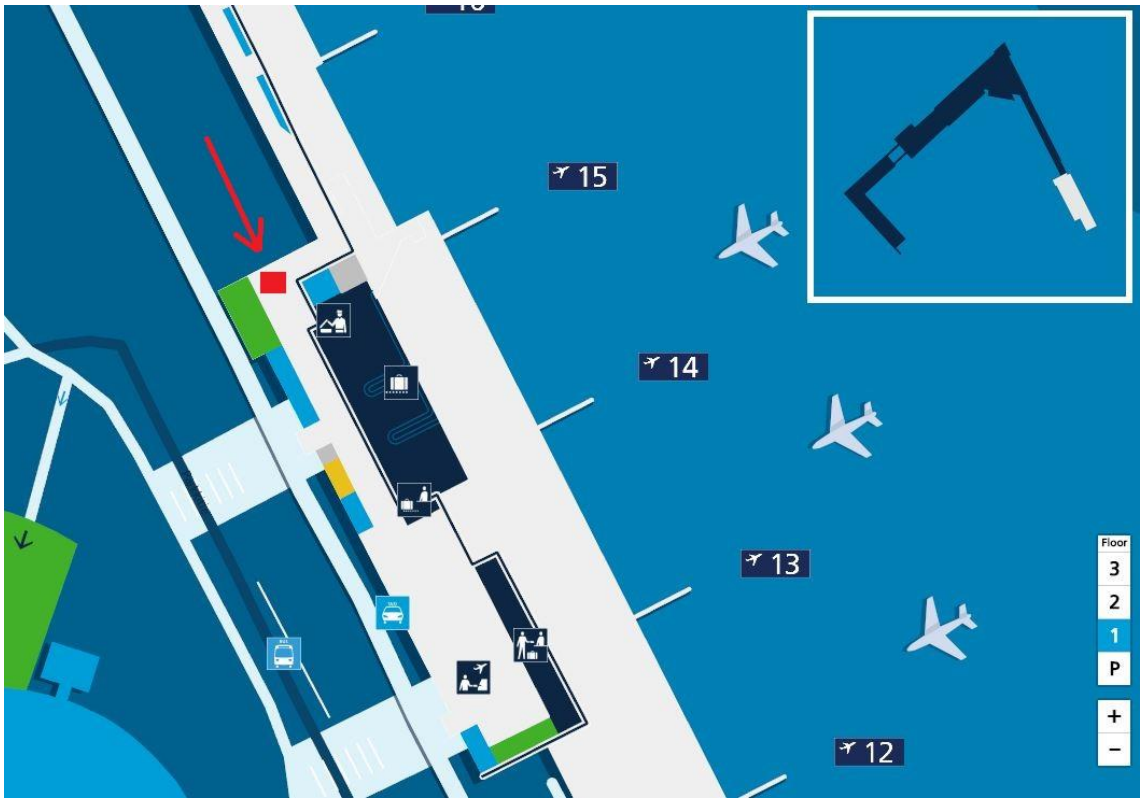
Appendix 2, Slush Airport Pre-registration data 2/1(2)

	A	B	C	D	E	F	G	H
35	Airport	Volunteer 3	2015-11-10T	11:40:55.678Z	11:40:55		11.40.55	77
36	Airport	Volunteer 3	2015-11-10T	11:42:11.771Z	11:42:11		11.42.11	76
37	Airport	Volunteer 3	2015-11-10T	11:44:07.772Z	11:44:07		11.44.07	116
38	Airport	Volunteer 3	2015-11-10T	11:46:12.752Z	11:46:12		11.46.12	125
39	Airport	Volunteer 3	2015-11-10T	11:47:43.463Z	11:47:43		11.47.43	91
40	Airport	Volunteer 3	2015-11-10T	11:48:54.734Z	11:48:54		11.48.54	71
41	Airport	Volunteer 3	2015-11-10T	11:59:01.608Z	11:59:01		11.59.01	607
42	Airport	Volunteer 3	2015-11-10T	12:00:16.576Z	12:00:16		12.00.16	75
43	Airport	Volunteer 3	2015-11-10T	12:02:48.476Z	12:02:48		12.02.48	152
44	Airport	Volunteer 3	2015-11-10T	12:05:16.111Z	12:05:16		12.05.16	148
45	Airport	Volunteer 3	2015-11-10T	12:07:26.676Z	12:07:26		12.07.26	130
46	Airport	Volunteer 3	2015-11-10T	12:08:53.642Z	12:08:53		12.08.53	87
47	Airport	Volunteer 3	2015-11-10T	12:10:09.818Z	12:10:09		12.10.09	76
48	Airport	Volunteer 3	2015-11-10T	12:11:26.389Z	12:11:26		12.11.26	77
49	Airport	Volunteer 3	2015-11-10T	12:16:31.353Z	12:16:31		12.16.31	305
50	Airport	Volunteer 3	2015-11-10T	12:19:02.600Z	12:19:02		12.19.02	151
51	Airport	Volunteer 3	2015-11-10T	12:23:38.601Z	12:23:38		12.23.38	276
52	Airport	Volunteer 3	2015-11-10T	12:25:17.930Z	12:25:17		12.25.17	99
53	Airport	Volunteer 3	2015-11-10T	12:26:34.594Z	12:26:34		12.26.34	77
54	Airport	Volunteer 3	2015-11-10T	12:39:43.441Z	12:39:43		12.39.43	789
55	Airport	Volunteer 3	2015-11-10T	12:42:52.304Z	12:42:52		12.42.52	189
56	Airport	Volunteer 3	2015-11-10T	12:46:48.383Z	12:46:48		12.46.48	236
57	Airport	Volunteer 3	2015-11-10T	12:49:40.514Z	12:49:40		12.49.40	172
58	Airport	Volunteer 3	2015-11-10T	12:51:41.282Z	12:51:41		12.51.41	121
59	Airport	Volunteer 3	2015-11-10T	12:53:18.009Z	12:53:18		12.53.18	97
60	Airport	Volunteer 3	2015-11-10T	12:55:10.764Z	12:55:10		12.55.10	112
61	Airport	Volunteer 3	2015-11-10T	12:56:39.999Z	12:56:39		12.56.39	89
62	Airport	Volunteer 3	2015-11-10T	12:59:13.812Z	12:59:13		12.59.13	154
63	Airport	Volunteer 3	2015-11-10T	13:02:25.103Z	13:02:25		13.02.25	192
64	Airport	Volunteer 3	2015-11-10T	13:04:01.842Z	13:04:01		13.04.01	96
65	Airport	Volunteer 3	2015-11-10T	13:06:18.223Z	13:06:18		13.06.18	137

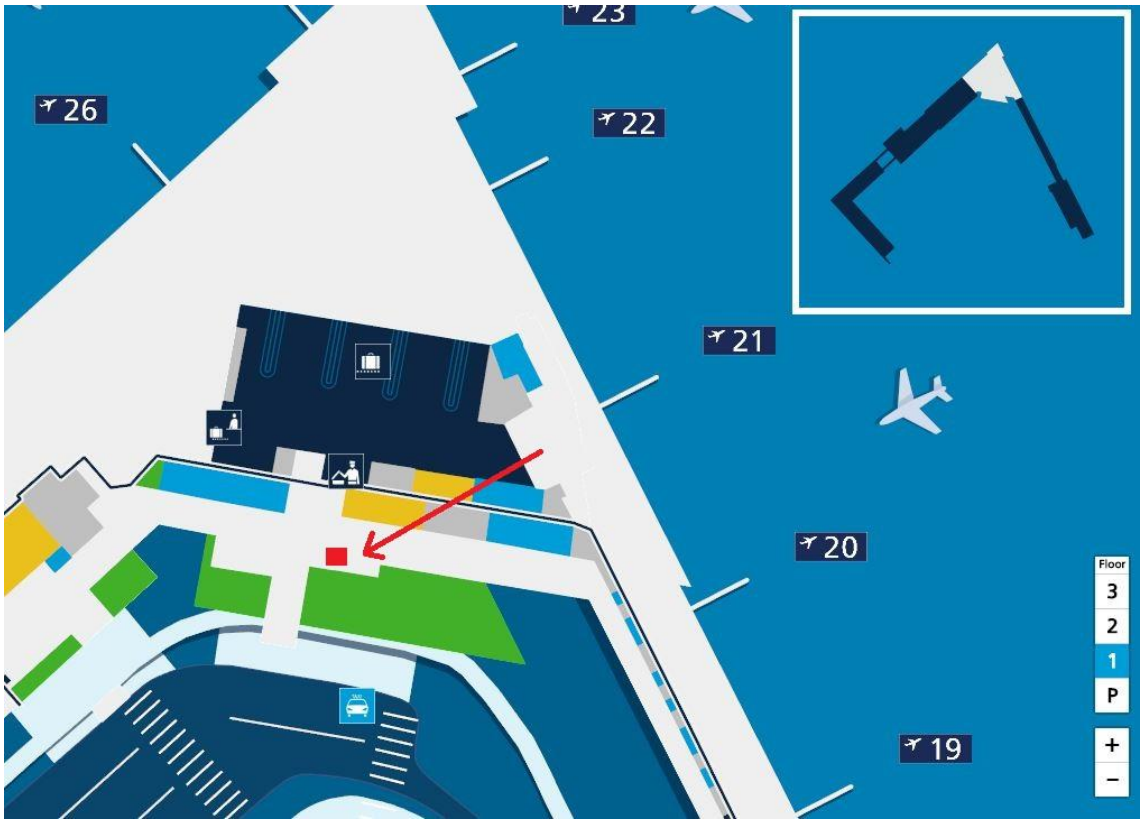
Appendix 2, Slush Airport Pre-registration data 2/2(2)

	A	B	C	D	E	F	G	H
160	Airport	Volunteer 4	2015-11-10T	18:08:59.239	18:08:59		18.08.59	133
161	Airport	Volunteer 4	2015-11-10T	18:10:38.156	18:10:38		18.10.38	99
162	Airport	Volunteer 4	2015-11-10T	18:16:31.139	18:16:31		18.16.31	353
163	Airport	Volunteer 4	2015-11-10T	18:17:41.213	18:17:41		18.17.41	70
164	Airport	Volunteer 4	2015-11-10T	18:18:16.916	18:18:16		18.18.16	35
165	Airport	Volunteer 4	2015-11-10T	18:19:03.636	18:19:03		18.19.03	47
166	Airport	Volunteer 4	2015-11-10T	18:19:46.721	18:19:46		18.19.46	43
167	Airport	Volunteer 4	2015-11-10T	18:23:10.108	18:23:10		18.23.10	204
168	Airport	Volunteer 4	2015-11-10T	18:23:58.638	18:23:58		18.23.58	48
169	Airport	Volunteer 4	2015-11-10T	18:24:39.161	18:24:39		18.24.39	41
170	Airport	Volunteer 4	2015-11-10T	18:25:14.607	18:25:14		18.25.14	35
171	Airport	Volunteer 4	2015-11-10T	18:26:24.538	18:26:24		18.26.24	70
172	Airport	Volunteer 4	2015-11-10T	18:27:09.270	18:27:09		18.27.09	45
173	Airport	Volunteer 4	2015-11-10T	18:28:05.242	18:28:05		18.28.05	56
174	Airport	Volunteer 4	2015-11-10T	18:28:41.804	18:28:41		18.28.41	36
175	Airport	Volunteer 4	2015-11-10T	18:29:12.369	18:29:12		18.29.12	31
176	Airport	Volunteer 4	2015-11-10T	18:30:05.399	18:30:05		18.30.05	53
177	Airport	Volunteer 4	2015-11-10T	18:30:42.291	18:30:42		18.30.42	37
178	Airport	Volunteer 4	2015-11-10T	18:32:29.924	18:32:29		18.32.29	107
179	Airport	Volunteer 4	2015-11-10T	18:33:07.318	18:33:07		18.33.07	38
180	Airport	Volunteer 4	2015-11-10T	18:33:41.684	18:33:41		18.33.41	34
181	Airport	Volunteer 4	2015-11-10T	18:34:09.409	18:34:09		18.34.09	28
182	Airport	Volunteer 4	2015-11-10T	18:35:04.819	18:35:04		18.35.04	55
183	Airport	Volunteer 4	2015-11-10T	18:35:54.714	18:35:54		18.35.54	50
184	Airport	Volunteer 4	2015-11-10T	18:36:28.443	18:36:28		18.36.28	34
185	Airport	Volunteer 4	2015-11-10T	18:37:22.966	18:37:22		18.37.22	54
186	Airport	Volunteer 4	2015-11-10T	18:42:25.793	18:42:25		18.42.25	303
187	Airport	Volunteer 4	2015-11-10T	18:44:07.884	18:44:07		18.44.07	102
188	Airport	Volunteer 4	2015-11-10T	18:44:53.098	18:44:53		18.44.53	46
189	Airport	Volunteer 4	2015-11-10T	18:45:29.177	18:45:29		18.45.29	36
190	Airport	Volunteer 4	2015-11-10T	18:46:04.341	18:46:04		18.46.04	35

Appendix 3/1(2), Terminal 1 Map Pre-registration Location



Appendix 3/2(2), Terminal 2 Map Pre-registration Location



Appendix 4, Sammandrag på svenska

Företag kan gå miste om potentiella kunder om företagen misslyckas med att analysera och agera då personer överger eller undviker en kö, vilket innebär att kö optimering samt analys kan gynna företag. Därför kan möjligtvis denna avhandling och dess optimeringsrekommendationer vara tillämpningsbara för evenemang, så som på musikfestivaler, konferenser och mässor. Teknologi- och uppstartsevenemanget Slush bidrog med ämnet för denna fallstudie, och syftet var att analysera och bidra med optimeringsrekommendationer gällande Slush förhandsregistreringem på Helsingfors-Vanda flygfält, samt att göra vänte upplevelsen mer behaglig för evenemangsdeltagarna. Fallstudien tog ett logistiskt perspektiv på köer och de problem som var förknippade med dem i samband med evenemangsplanering, mer specifikt hos företaget Slush och deras årliga evenemang i Helsingfors, med ungefär 17500 deltagare. Studien undersökte förhandsregistreringen ur följande forskningsaspekter: plats, teknik, väntetid samt vänte upplevelse. Forskningsfrågorna lydde:

• Vilka var kötiderna vid förhandsregistreringspunkterna 2015 och 2016?

• Vilka ändringar av tekniska eller strategiska lösningar kan förbättra vänte upplevelsen på flygplatsen?

• Hur kan förhandsregistreringsprocessen optimeras?

Avhandlingen begränsades till Helsingfors-Vanda flygplats eftersom Slush specifikt önskat analys och förslag för att optimera förhandsregistreringen på flygplatsen. Eftersom ett okänt antal deltagare väljer årligen att ignorera eller att inte använda förhandsregistreringentjänsten på flygplatsen så är målet med förbättringarna att locka fler deltagare att förhandsregistrera sig vid flygfältet, som alternativt skulle använda registereringspunkterna på huvud evenemagsplatsen och orsaka längre köer där. Förhandsregistreringsprocessen är ett typiskt exempel på ett kösystem, eftersom behovet av service och tillgången till service inte alltid är på samma nivå. Teoriavsnittet omfattade evenemang, registrering och köer på grund av deras inverkan på servicekvaliteten. Detta gällde bland annat alla kundens kontaktillfällen som deltagaren hade före, under och efter evenemanget med Slush volontärer. Gällande

förhandsregistreringenpunkterna på flygplatsen inkluderades teori om minskning av kötiden med hjälp av logistikmodeller och hur man förbättrar flödet. Dessa aspekter inkluderades eftersom huvudmålet med denna avhandling var att ge rekommendationer om hur man optimerar köprocessen och minskar väntetiden för deltagare. Väntetidupplevelse och teori om distrahering utgjorde en viktig del av optimeringsdelen i avhandlingen.

För att bättre kunna förstå registreringsprocessen var det viktigt att få tillgång till och analysera den data som Slush samlat in automatiskt via sitt registreringsprogram. Enligt Dolenc (2017) hade dock loggarna från registreringsprogrammet inte tidigare tagits ur databasen, eftersom ingen tidigare hade haft behov av att analysera och använda data. Registreringsloggarna från Slush interna databas användes för att kartlägga och analysera tidsstämpel för att försöka mäta och jämföra effektiviteten. För att samla in feedback om fördelarna och nackdelarna med förhandsregistreringenpunkterna gjordes en e-postintervju med förhandsregistreringsarrangören för året 2016. Under 2015 och 2016 fanns det 1060 och 1455 förhandsregistreringar. (Dolenc 2017)

Förhandsregistreringen år 2016 delades upp på två olika platser på flygfältet. Två bås var placerade i terminal ett framför ankomstutgången och fyra bås framför ankomstutgången i terminal två. Ur registrerings loggen räknades en skillnad mellan tidsstämpel genom att beräkna tiden som förflutit sedan föregående tidsstämpel. Till exempel subtraherades tidsstämpel 13:24:50 (timmar: minuter: sekunder) från 13:26:59 vilket gav en tidsskillnad på 02:09 (minuter: sekunder). Detta justerades sedan om till 129 sekunder. Beräkningen upprepades sedan separat för alla tidsstämplar och för varje volontär och data analyserades i sambandsdiagram och alla dessa diagram jämfördes sinsemellan och resultaten följde liknande mönster för varje volontär. Även när volontärer för olika dagar jämfördes fanns det liknande mönster. Mångsidiga data är viktig för att kunna analysera kö problem och lösa dem. Utan mångsidigheten blir analysen mera ett antagande. Detta problem gällde den enkla registreringsdata som var tillgänglig för avhandlingen.

På grund av den tillgängliga begränsade data har ett antal antaganden gjorts för att ge användbara resultat. Huvudantagandet var att tidsskillnaden mellan tidsstämplar skulle

syfta till en processeringstid, samt en kortare tidsskillnad antas motsvara processeringstiden, medan en längre tid mellan tidsstämplarna antogs syfta att antingen volontärerna var på paus eller det fanns stunder utan kundkontakt. Det gjordes dock ingen klar begränsning, eftersom det inte var möjligt att veta på basis av data om en fyra minuters skillnad mellan tidsstämplar syftade på en problematisk registreringsprocess eller en paus. Detta sker på grund av enkel data och hindrade djupare analys.

Forskningsmålet var att analysera och optimera registreringsprocesserna. Datainsamling och beräkningar utfördes med hjälp av de kvalitativa och kvantitativa metoderna som beskrevs i kapitel 3. Resultaten analyserades sedan i kapitel 4 och rekommendationerna om hur förhandsregistreringenprocessen kan optimeras inkluderades i kapitel 5.2 och dess underrubriker. En av forskningsfrågorna gällde kötiderna vid förhandsregistreringenpunkterna åren 2015 och 2016. Data analyserades i kapitel 4.3 och trots att data inte var lika omfattande som hade hoppats gav den insikt i (den antagna) processtiden mer än en själva kötiden. Kapitel 5.4 och deras underrubriker innehöll både de korta och långsiktiga rekommendationerna för förhandsregistrering och svarade på forskningsfrågan om vilka tekniska modifieringar eller strategier som kunde förbättra vänte upplevelsen på flygplatsen. Dessutom visade kalkylerna för år 2016 att majoriteten av tidsskillnaderna var 60 till 120 sekunder, detta antogs som en deltagares processeringstid. Rekommendationerna gällde förbättring av vänte erfarenheten och att distrahera köaren för att öka trivseln. Huvudrekommendationerna inkluderade:

• Att ändra registreringsprogrammet så att den samlar in mångsidigare tidsrelaterade data om registreringsprocessen
• Distrahera köaren med musik och video, så fokuset inte ligger på själva kötiden
• Implementera en virtuell kö som frigör deltagaren att röra på sig

Uppgifterna om alla volontärer jämfördes och kombinerades med intervjun, och tillsammans indikerade de att alla volontärer var effektiva och konsekventa i sina arbeten. Ytterligare modifieringar av registreringsprogrammet kunde möjliggöra en mer djupgående analys i framtiden.