# Queuing system at the entrance of klimahaus tourism essay

ASSIGN BUSTER

Waiting in line for service is part of everyday life. As consumption and production of service occur simultaneously, variations in demand for service as well as in service time requirements result in idle service capacity at some times and the formation of queues at others. A queue forms whenever the demand for service exceeds the existing service capacity. (Fitzsimmons & Fitzsimmons, 2006)

“ Experts suggest that no aspect of customer service is more important than the wait in line to be served.” (Bennett, 1990, cited in Fitzsimmons & Fitzsimmons, 2006, p. 389). The waiting experience, or more precisely the perception of waiting time, has a strong effect on customers´ overall satisfaction with the service ((Pruyn & Smidts, 1998). Moreover, if customers find a queue too long or slow-moving they may balk and decide not to join the service system at all or customers who have joined the queue may renege, which means that they leave a queue before receiving service. Both balking and reneging represent losses in revenue and goodwill to the service organization (Fitzsimmons & Fitzsimmons, 2006; Ou & Rao, 2003). Several service operations management techniques exist to reduce waiting time and hence customer balking and reneging, most common is the variation of service capacity. However, oftentimes the reduction of waiting time is not feasible due to the size of the queue, the space of the facility or cost factors in personnel which makes customer waiting inevitable (Pearce, 1989). If waiting time cannot be reduced service organizations are advised “ to find ways to make time pass as quickly and pleasantly as possible” (Maister, 1985, cited in Pruyn, 1998). (Pruyn & Smidts, 1998) even state that the waiting environment, namely the design, decoration and stimuli which

distract customers´ attention from waiting, is a stronger determinant of service satisfaction than the actual waiting time. Therefore they advise service managers to focus less on reducing waiting times but to pay attention to the waiting conditions instead.

The “ understanding of each feature of a queuing system provides insights and identifies management options for improving customer service” (Fitzsimmons & Fitzsimmons, 2006). In the following the features of a queuing system are being described and the current queuing system at the entrance of the Klimahaus® Bremerhaven 8° Ost, a science centre situated in the tourist quarter called “ Havenwelten” in Bremerhaven/Germany, is being evaluated. Subsequently, suggestions for improvement are being made whereby physical, psychological and economic factors are taken into account likewise.

## 2. Queuing Systems

Figure 1: Queuing System

Source: Fitzsimmons & Fitzsimmons, 2006Queuing systems occur in a variety of forms but the common essential features of queuing systems are the calling population, the arrival process, the queue configuration, the queue discipline and the service process as illustrated in the figure below (Fitzsimmons & Fitzsimmons, 2006).

In the following the individual features of a queuing system will be explained.

## 2. 1 Calling population

Figure 2: Calling Population

Source: Fitzsimmons & Fitzsimmons, 2006

Arrivals represent the calling population which can consist of a homogeneous group or of several subpopulations. Subpopulations have different waiting expectations and place different demands on services. In a queuing system the number of customers requiring service can be limited or unlimited (Fitzsimmons & Fitzsimmons, 2006). If the number is finite, the number of customers outside the queuing system will depend on the number of customers already in the system and if the number is infinite, the number of customers outside the system in not affected by the number of customers already in the system (Tadj, 1995).

## 2. 2 Arrival process

“ Any analysis of a system must begin with a complete understanding of the temporal and spatial distribution of the demand for service” (Fitzsimmons & Fitzsimmons, 2006). Arrival time data can be collected and used to calculate interarrival times. Generally the distribution of interarrival times is exponential. The exponential distribution gives the probability that the time between arrivals will be t or less (e. g. minutes between arrival) and the so called Poisson distribution gives the probability of n arrivals during the time interval t (e. g. arrivals per hour). Both distributions represent alternative views of the same process (Fitzsimmons & Fitzsimmons, 2006). Characteristic for the exponential distribution is the no memory-property which means that the probability distribution of the time until the next arrival is independent of the last arrival (Tadj, 1995).

## 2. 3 Queue configuration

Queue configuration is the design of a waiting line system and refers to the number of queues, their locations and their spatial requirements. The queue configuration has an effect on the wait time and on customer behaviour. A queue is said to be finite if for example the spatial requirements are not sufficient to accommodate all waiting customers or if a public parking garage has not enough parking lots and arriving customers have to be turned away (Fitzsimmons & Fitzsimmons, 2006). The figure below shows several alternatives of waiting configurations and their advantages and disadvantages(Fitzsimmons & Fitzsimmons, 2006).

Figure 3: Queue Forms and Their Features

Source: Pearce, 1989

Another alternative is a virtual queue, usually on the telephone, which can be considered most frustrating for customers because oftentimes they do not know their position in line when they are placed on hold (Fitzsimmons & Fitzsimmons, 2006).

## 2. 4 Queue discipline

“ The queue discipline is a policy established by management to select the next customer from the queue for service” (Fitzsimmons & Fitzsimmons, 2006). If the management applies the first-come, first-served rule (FCFS) all customers are treated fairly and are served according to their position in line. This queue discipline is said to be static. In a dynamic queue discipline, however, the next customer to be served is selected according to one or

more attributes, for example in the shortest-processing-time approach (SPT) customers who require short processing times are given priority. This is done by placing arrivals in different priority groups on the basis of some attributes and by applying the FCFS within each group. This practice is said to minimize the average time a customer spends in the queuing system. A further procedure which is common in a medical context is triage, where priority is given to those who benefit most from an immediate treatment. The preemptive priority procedure is the most responsive queue discipline because service even is interrupted in order to serve an arriving customer with higher priority. This rule is applied in emergency services or fire ambulance services (Fitzsimmons & Fitzsimmons, 2006).

## 2. 5 Service process

Due to variations in customer needs and server performances, the service time distribution can be of any form. However, if the service is simple to perform the service time distribution frequently is exponential (Fitzsimmons & Fitzsimmons, 2006).

Figure 4: Classification of Service Processes

Source: Fitzsimmons & Fitzsimmons, 2006

According to (Fitzsimmons & Fitzsimmons, 2006) there are several possible service facility arrangements:

## Service Facility Server Arrangement

Parking lot Self-servicer

Cafeteria Servers in series

Toll booths Servers in parallel

Supermarket Self-serve, first stage; parallel servers, second stage

Hospital Service in parallel and series, not all used by each patient

A service facility arrangement with servers in parallel has the advantage that it is flexible in meeting variations in demand for service. The service capacity can be adjusted to meet changes in demand, especially if employees are cross-trained (Fitzsimmons & Fitzsimmons, 2006).

## 2. 6 Economic, physical and psychological aspects of customer waiting

## Economic cost of waiting

For the service organization the economic cost of waiting is the wage of an idle employee at times of low demand for service. Times of high demand for service and resulting excessive wait times for customers – or even the expectation of long waits – can lead to lost sales. For customers the cost of waiting is the forgone alternative use of that time at times of high demand for service plus the costs of boredom, anxiety, and other psychological distress (Fitzsimmons & Fitzsimmons, 2006).

## Physical needs of waiting customers

To make the waiting experience more comfortable it is advisable to provide shelter from rain, sun or wind. Usually “ people relieve fatigue by leaning, stooping and propping themselves against bars, rails and barriers” therefore

seats, queue rails, steps or leaning bars should be provided for waiting customers if possible.

## Psychological needs of waiting customers

According to {{21 Fitzsimmons, James A. 2006}} “ the perception of waiting often is more important to the consumer than the actual time spent waiting”. If the customer expectation exceeds the perception the customer is unsatisfied and contributes to a bad reputation of the service organization, if the perception exceeds the expectation the customer is satisfied with the service and contributes to a good reputation of the service organization {{21 Fitzsimmons, James A. 2006}}. Customers waiting in line should not be excluded from an attentive service. Customers should be given the feeling that the service company knows that they are there and that service has started already {{22 Pearce, Philip L. 1989}}.

“ Psychological and physical needs of people in queues can be met with a range of innovative queue management techniques” {{22 Pearce, Philip L. 1989}}. Some methods to .. are named by {{21 Fitzsimmons, James A. 2006}}(Fitz..) are animation, discrimination, automation and obfuscation. Animation and distraction lead to a shorter perceived waiting time because the attention is drawn away from the internal clock” (Pruyn & Smidts, 1998). {{22 Pearce, Philip L. 1989}} considers information provision as one of the most important methods because “ frustration, boredom and a range of negative emotional effects follow from this lack of information to the waiting to the waiting public”.

# 3. The Queuing System of the Klimahaus® Bremerhaven 8° Ost

The Klimahaus® is a science centre in Bremerhaven which opened on 27th of June 2009. On an exhibition area of 11, 500 m² and 143 exhibition rooms the experiential museum presents data, facts and phenomena on climate and climate protection. As a relatively new attraction the museum experiences high demand and congestion, especially at weekends, holidays and in the summer season. 600, 000 visitors were calculated per year but due to the novelty effect, the Klimahaus® could welcome its millionth visitor after only 15 months of operation, on 22nd of September 2010. (www. klimahaus. de). Considering the opening hours of the Klimahaus® this gives on average 243 visitors/hour, whereby the Klimahaus® experiences significant variations in demand which lead to waiting times up to 2, 5 hours at some times. There are numerous attractions in the “ Havenwelten” and the risk is high that people change their mind when confronted with a long queue in front of the ticket counter and go somewhere else. To keep the high level of visitor numbers even when the novelty effect has faded, the Klimahaus® relies on satisfied customers who recommend a Klimahaus®-visit to others and are willing to visit the museum repeatedly, despite long waiting times that can occur. In the following the current queuing system of the Klimahaus® is being evaluated and the physical, behavioural, and economic aspects of the consumer waiting experience are taken into account in order to make suggestions for the improvement of the waiting line management.

## 3. 1 Calling population

The calling population of the Klimahaus® consists of walk-in customers (either locals or tourists) who arrive randomly and groups or school classes with reservations. For a group reservation a minimum of 15 people is required. While walk-in customers are not controllable group arrivals are planned and hence controllable. The number of walk-in customers is infinite whereas the number of groups on a specific day can be considered finite because group reservations need to be made at least a day in advance. Hence, the probability of future group arrivals on a specific day depends on the number of groups currently in the system. Groups and school classes can be expected to have significant lower waiting expectations compared to walk-in customers due to their reservations which are linked to a `front of the line-service´ upon arrival. Locals, again, can be expected to have lower waiting expectations than tourists because they can choose a less busy day or time for their Klimahaus®-visit or at least buy their tickets at less busy times to avoid waiting in line. Tourists oftentimes come to Bremerhaven at weekends or during holiday seasons and therefore may expect a longer wait. However, within each subpopulation the waiting expectations may differ significantly among customers due to their respective opportunity costs.

## 3. 2 Arrival process

The collection of arrival time data is necessary to get an understanding of the temporal and spatial distribution of demand for service in order to identify periods of high and low demand for service and measures to better match service capacity with service demand. However, no service demand data was available for this paper except from the visitor number of 1, 000,

000 on the 22nd of September 2010 which is published on the homepage and could be used to calculate the average number of visitors per hour in the first 15 months of operation with 243. As many other service organizations the Klimahaus® experiences variable demand and variable service times which leads to waiting times up to 2. 5 hours at busy times. Those variations in demand affect the requirements for service capacity. When possible, the number of servers is adjusted to match changes in demand. Although the cross-trained employees of the Klimahaus® are a perfect basis for adjusting service capacity to changes in demand, for the museum this strategy is only reasonable to a small extent. The exhibition itself has limited spatial capacity and increasing the level of staff would result in overcrowding and reduce the level of security. Therefore, this paper is going to focus on other strategies to reduce waits or to make them at least more tolerable.

## 3. 3 Queue configuration

As the figure below shows, the Klimahaus® applies a single line – multiserver model where customers form a single line and are served by the first server available.

Figure 5: Ticket counter at the Klimahaus®

Source: www. nordsee-zeitung. de

Figure 6: Queue configuration of the Klimahaus® Bremerhaven 8° Ost

(Fitzsimmons & Fitzsimmons, 2006) name the advantages and disadvantages of a single queue as follows:

Generally a single queue arrangement “ guarantees” fairness because customers are served in order of their arrival (first-come, first-served). However, as can be seen on Picture 2, the waiting line system of the Klimahaus® does not prevent people from cutting-in because the biggest part of the waiting line is in front of the Klimahaus® at the so called Havenplaza where no barrier ropes are being used. This fact, on the other hand, allows single members of a family or small group to leave the queue and e. g. to have a look at the Klimahaus® -shop or the nearby shopping centre or to get some brochures from the tourist information.

Since there is only one queue, customers do not feel anxious about whether they have selected the fastest line.

Wait time is affected by the design of the waiting line system the single line model is more efficient in terms of reducing the average time that customers spend waiting in line.

Figure 7: Havenplaza

Source: www. nordsee-zeitung. deA single-line approach comes with higher spatial requirements compared to a multiple lines – approach because there is one long queue instead of several shorter queues. The Klimahaus®-queue can be said to be infinite because the Havenplaza in front of the museum and the parking garages in the immediate vicinity offer sufficient capacity to accommodate arriving customers.

Figure 8: Queue configuration of the Klimahaus® Bremerhaven 8° Ost (high demand)Customers may interpret a long queue as evidence of a long wait

and decide not to join the queue. (Fitzsimmons & Fitzsimmons, 2006) suggest hiding a long waiting line from customers, e. g. by integrating the queue into the design of the building, to prevent customers from balking. The approach of integrating the queue into the design was not adopted by the museum, presumably due to space or cost reasons or because it is not that common for museums.

(Pearce, 1989) on the other hand states that customers may prefer to see the end of a queue because it gives them a feeling of certainty. Although, in case of the Klimahaus® visual access from the back of queue is poor as can be seen on Picture 2. However, to avoid frustration among arriving customers and to give them a feeling of certainty in order to make them join the queue, it is advisable to make information on the expected waiting time available (Fitzsimmons & Fitzsimmons, 2006; Pearce, 1989).

The single queue arrangement proves to be flexible at times of high demand because the number of servers can be adjusted, especially if employees are cross trained as it is the case in the Klimahaus®. However, as mentioned earlier the Klimahaus® itself has limited spatial capacity and increasing the level of staff would result in overcrowding and reduce the level of security.

A disadvantage of the single line-approach is that people have to stand in line in contrast to the take a number-approach where people are free to wander around. The take a number-approach can be an attractive alternative because there is no need for a formal line and customers could go to the Klimahaus®-shop or to the nearby shopping centre. On the other hand,

customers have to stay alert otherwise they risk missing their turns for service.

Queue width also plays an important role. In contrast to a one-person wide queue, a wider queue like the one used by the Klimahaus® is desirable because it enables family members to stand side by side in the queue which enables conversation and children have more room to stretch and interact (Pearce, 1989).

When considering the physical needs of people waiting in line, it can be noted that the Havenplaza is a roofed hall which provides shelter from the sun or rain and has public toilets. On the other hand customers waiting in line have no possibilities to sit or lean (e. g. on hand rails) to relieve from fatigue.

As mentioned earlier, animation and distraction lead to a shorter perceived waiting time because the attention is drawn away from the internal clock (Pruyn & Smidts, 1998). Above the ticket counter there is a tv screen that shows pictures and information regarding the exhibition but unfortunately it is only visible for customers waiting inside the building. When the wait time is especially long, occasionally an employee is deployed at the Havenplaza in order to answer questions of waiting customers, to hand out flyers to adults or balloons, gummi bears etc. to children. Moreover, sometimes the mascot of the Klimahaus®, Max the climate mouse, animates children waiting in line.

## 3. 4 Queue discipline

Generally the queue discipline of the Klimahaus® is first come, first service, except for groups with reservations who benefit from a common ´front of the line service´ upon arrival.

(Friedman & Friedman, 1997) states that customers with high opportunity costs, e. g. tourists who have a short stay in Bremerhaven or explicitly come to Bremerhaven for a Klimahaus®-visit or customers who just do not like to wait in line, might be highly sensitive to long waits and be willing to pay a premium for a faster service in a separate line to avoid waiting. Waiting line segmentation might be an option for the Klimahaus® to reduce waiting for the customers in the regular queue and the customers in the fast queue. If the premium covers the cost of the additional server, waiting line segmentation is a simple, cost-free strategy for increasing profit, employment, efficiency and customer satisfaction (Friedman & Friedman, 1997).

## 3. 5 Service process

No service time data is available and need to be collected but the service time distribution can be considered to be exponential because the service is simple to perform.

In case of the ticket counter at the entrance of the Klimahaus® servers are arranged in parallel which has the advantage that variations in demand for service could be met by adjusting the number of servers to meet demand. Nevertheless, to avoid overcrowding in the exhibition there are regularly

three but no more than four servers at the ticket counter at times of high demand.

(Fitzsimmons & Fitzsimmons, 2006) advise service managers to keep in mind that " sustained pressure to hurry may increase the rate of customer processing, but it also sacrifices quality".

## 4. Suggestions for Improvement

Since adjusting service capacity to meet high levels of demand cannot be considered a reasonable strategy for the Klimahaus® to reduce waiting, other strategies like differential pricing to encourage customers to use the off-peak hours should be taken into consideration (Fitzsimmons & Fitzsimmons, 2006). Usually in the latter part of the day, the Klimahaus® experiences lower demand because a visit takes 3 – 5 hours on average. For this reason it might be useful to offer an afternoon ticket which is cheaper the usual day-ticket to level demand. It needs to be analysed if such an offer would have a cannibalizing effect or a positive effect on revenue from entrance tickets.

A further strategy to reduce waiting is waiting line segmentation which could also be an option for the Klimahaus® because it is a simple, cost-free strategy for increasing profit, employment, efficiency and customer satisfaction. However, before implementing such a strategy the service organization would have to do some testing to determine the optimal size of premium and to determine the acceptance of customers. Customers who decide to stay in the regular queue or cannot afford to take the more expensive fast lane might perceive this practice as unfair and catering to the

rich which can result in a negative image of the Klimahaus® (Friedman & Friedman, 1997).

Due to the significant variations in demand waiting in line for a ticket is inevitable and therefore the waiting experience should be made as pleasant as possible under the given circumstances. Because the biggest part of the queue forms not in the Klimahaus® itself but at the Havenplaza, the Klimahaus® could be advised to prove the possibility of installing benches or leaning bars for the customers to relief from fatigue.

Customers waiting in line should not be included in an attentive service and questions of arriving customers should be answered to give them security. If it is not feasible for cost reasons to have an employee answering questions in person, wait time-signs should be set and a FAQ-sheet which all important information should be made available to arriving customers. Also “ display panels or sheets (alongside the queue) which ask the waiting public questions, or which set them tasks to solve, assist both the information needs of the public and their perception of time” (Pearce, 1989). Furthermore, the mascot, Max the climate mouse, is relatively unknown and could be used more often to animate children waiting in line with their families.

## 5. Conclusion

By analysing the features of the queuing system at the entrance of the Klimahaus® useful insights could be gained. Due to significant variations in service demand, waiting in line to get a ticket is inevitable at times when service demand exceeds service capacity. Increasing the number of servers

at the ticket counter at times of high demand would compound overcrowding in the spatial limited exhibition and therefore increasing service capacity to meet demand cannot be considered an appropriate strategy for the Klimahaus® to reduce waiting. Further investigation on this topic could be helpful to identify the optimal staffing level in consideration of the space limitation of the museum and to develop measures to reduce overcrowding in the exhibition.

Possible strategies to shorten waits could be identified like waiting line segmentation or price differentiation. However, in order to effectively implement those strategies, service demand and service time data need to be collected and analysed. Moreover, by taking into account the physical and psychological needs of customers waiting in line, methods to make wait more tolerable could be identified to improve customers´ queuing experience, A more pleasant queuing experience can not only reduce balking, reneging and thus lost sales for the Klimahaus® but also increase the customers´ overall satisfaction with the service.