The Influence of Artificial Intelligence on the Productivity and Customer Satisfaction in the Aviation Industry

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Abstract: This paper aims to study the influence of principles of Artificial Intelligence (AI), and the development of initial framework for AI system in the aviation industry, precisely at the touchpoint with passengers. This paper focuses on presenting some results for competing airlines and goes through existing problems that AI applications will be able to overcome. Also, it presents the most important factors affecting the passenger experience, and then applies the Interpretive Structure Modeling (ISM) methodology to determine priorities and their impact on each other during the framework development phase of the of AI applications.

Keywords: Artificial Intelligence, Aviation, Passenger Experience, touchpoints, Interpretive Structure Modeling

I. INTRODUCTION

With the beginning of the second millennium, AI has massively improved, and its applications became present in most vital sectors, such as online stores such as Amazon and eBay, entertainment systems such as Netflix and Pandora, and even in modern home management systems such as Siri and Alexa. Moreover, AI became a stand-alone industry and companies specializing in building AI systems entered this industry like Boxever and Narrative science not mentioning the existed companies that shifted or invested in AI fields to keep up with the evolution.

Despite the multiplicity of fields to study and discussion on applications of AI, in this paper the writers will focus on discussing the possible impact of AI applications on customer satisfaction in commercial airlines, which will allow him to measure the direct commercial impact and the experience enhancement from the customer's perspective, as industry experts believe that in the next five years more than 52% of Airline service providers will implement AI-powered tools to improve customer experience.

II. LITRITURE REVIEW

As an introduction to some of the applications currently present in airlines, we find that some companies have succeeded in managing some touch points with the use AI technology, such as:

1. Passenger Identification

The Transport Security Administration (TSA) in the US has activated artificial intelligence to identify potential risks from travelers in relation to passenger identification process, Security scanners, Machine Learning tools, and Biometric Identification.

2. Baggage Screening

Japan's Osaka Airport plans to install Syntech ONE 200 – an AI platform compatible with X-ray, screens baggage for multiple conveyor belts, the automatic scanning will determine the contraindications effectively and at a high speed.

3. Customer Support

As the researcher indicated, customer support offers great scope to leverage the power of Artificial Intelligence. Benefits include reduced operational and labor costs along with optimal resource utilization. Airline companies can use AI applications for quicker resolution of customer issues by delivering accurate information about future trips on Wi-Fi enabled devices.

4. Aviation-Russian experience

S7 Airlines, a Russian airline, uses artificial intelligence technology by employing Facebook Messenger chat bot to help passengers choose their tickets. Where the chat bot informs customers about flight status and availability and even suggest destinations.

Aeroflot also is planning to involve AI in pricing strategies and demand management. Thus, the airline will be able to avoid losses when entering new markets.

5. Artificial intelligence in air traffic

Airline AI now helps passengers choose their flight directions and tickets. Nowadays nor all people do need to go to the airport to inquiry about something when AI system (for example, chat bot) can in- dependently answer questions. For example, Google uses AI technologies in the "Flights" service, designed to track and book air tickets.

Moreover, there are many other areas in which AI applications in aviation industry can improve the output and enhance the customer experience, such as:

1. Recommendation and behavior tracking engines - as these engines study customer behavior and their preferences in services and products and then customized and suitable service to their needs instead of adopting ready-made product and services.

2. Sentiment analysis on social media - where algorithms can be used to evaluate customer reactions close to real-time in social media, enabling a more of accurate insight to the airline to determine the effectiveness of the services provided at the touch points and the extent of customer satisfaction with them.

3. Chatbots and customer service automation - Kayak for example enables you to plan your next trip directly from your Facebook Messenger app.

Therefore, in view of the rapid changes in global markets, the applications of AI have changed the methodology customers dealing with products or services and their suppliers. As the researcher illustrated, the aspects of AI applications are very broad, and in order to avoid the bifurcation that does not serve the interest of this paper, in this study, we will focus on the extent to which customers are possible affected by the services provided with the help of AI tools, and how did that affect the level of satisfaction, not on applications Artificial intelligence itself.

III. PROBLEM STATMENT

In light of the economic developments and reforms in the Kingdom of Saudi Arabia, and in light of the vision and transformation programs that aim to centralize the Kingdom among the strongest economies in the world, the struggle begins to shift from traditional systems to digital systems, which in turn enables governmental and semi-governmental institutions to automate systems by the

application of the principles of AI, to facilitate the flow of business processes and to raise productivity, and reach ultimate goals of entities.

SAUDIA Airlines, Saudi Arabia's flag carrier and main airline of the Kingdom, comes at the forefront of semi-governmental institutions, which have sufficient qualifications to make them a subject of study for this research. Where SAUDIA Airlines is one of the largest semi- government agencies that provide multiple services to a very large segment of customers inside and outside the Kingdom, as well as it has a great access to a huge data in the aviation market, this makes it one of the most vital sectors in the Kingdom that can show the impact of its automation and effects of applying the principles of artificial intelligence on the results.

The major problem for SAUDIA Airlines is in the customer satisfaction due to the way of providing services; where SAUDIA Airlines provides services in a generalized way to everyone without segmentations, and special requests is based on requests and availabilities, as it has to be submitted in each travel leg without saving customer preferences and benefiting from them. This neglect of preferences of repeated requests from a specific segment of customers (for example, people with special needs, elderly people, transit travelers and travelers through Sixth Freedom) will ultimately lead to low customer satisfaction for the services provided when a consumer can feel that the service is provided with a non-interactive mechanism, and his concerns that even the service may not be provided due to availability.

The root cause of this issue lies within not exploiting the huge amount of data to study preferences and options for providing the service, as by studying historical customer data, the company may avoid the additional costs resulting from wasted services elements that are provided to all segments without detailing the actual needs (e.g., over-catering meals), and it will easily predict the needed service ahead of travel time.

The application of the principles of AI is costly, as it needs a strong standing point financially and an advanced technical capability as investment in AI is an obsolete without determining the goals of this applications.

Therefore, to determine the drivers of such an investment that will obtain results that support the company's financial position indirectly by giving it preference in providing services, we must study the impact of services on the beneficiaries (travelers) and define their needs in order to draw up a clear implementation plan.

This research will discuss and evaluated SAUDIA Airlines position in terms of AI needs and what are the potential opportunities.

The main objectives of this study are as follows:

1- Analyze current situation and operating model to discover potential areas of applicable improvement

2- Building a framework to implement artificial intelligence systems that will cover those areas and impact "in a positive way" the journey of SAUDIA Airlines guests.

IV. METHODOLOGY

In this chapter, the writer talked about the mechanism of data collection, and also discussed the data patterns and the nature of it in order to reach an appropriate tool to use to analyze the conducted data for the purpose of reaching an accurate output that successfully achieves the goal of this research thesis.

1- Net Promoter Scores

Net Promoter Score is a customer loyalty metric was developed by Fred Reicheld, Bain & Company and Satmetrix in 2003. And it was introduced by Reichheld in his 2003 Harvard Business Review article, "The One Number You Need to Grow".

It is based on the perspective that every company's customer can be placed within three types (Promoters, Passives and Detractors)

2- Interpretive Structural Modeling (ISM)

Interpretive structural modeling (ISM) is a mathematical process that helps convert unclear and inappropriately detailed models of systems into well-defined models useful for use and decision making, ISM is proven to be a systematic and comprehensive method for integrating group judgments in the development of "first-cut" structural frameworks.

V. DATA ANALYSIS AND RESULTS DISCUSSIONS

A. AI transformation framework

For AI to be activated, the organization must be operating under digital systems.

Therefore, digital transformation is core process for AI implementation, it enables the use of the latest technologies to enhance existing processes and improve existing services. It creates the value by changing the way the system delivers value to beneficiaries.

SAUDIA Airlines already have the IT infrastructure to implement changes, and in this chapter the researcher will conduct a data analysis and a mathematical modeling in order to create and recommend the optimum creation and implementation of AI framework.

AI framework is perceived as a roadmap, reference point and root of digital transformation projects. It aims to improve business' digitization processes by identifying the goals of digitization and implement toward the goal.

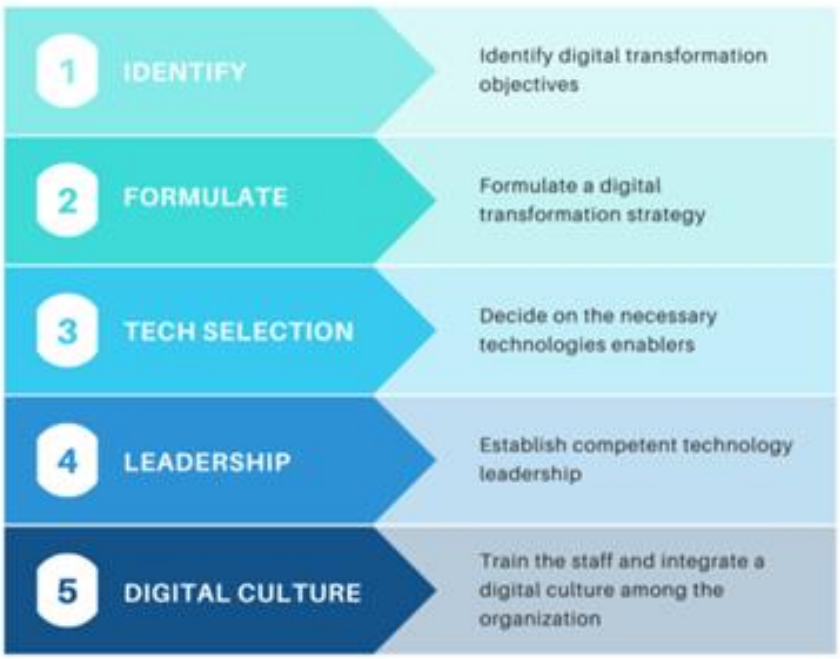

Figure 1: IBM stages of AI framework

B. Transforming Customer Experience

To start planning the ability of all touch points to be transformed into AI systems, we must first study and define all touch points related to customer experience, which are as follows:

Each touchpoint of above listed (30 touchpoints) has sub-elements (total of 170), for example, Seating touchpoint has sub-elements of 5 which are: seat cleanliness, comfort, condition, dimensions and functionality.

And for the sake of implementing a clear model, we retrieved a data of NPS from 2019 covering all operational year, we picked up the top 10 touchpoints that SAUDIA guest complained about "see table below" to narrow down the touchpoints to the ones that has a significant impact, and we ended up with the following:

1. On-Board Services (Seating, Food and Beverages, Entertainment etc.)
2. Arrival (Deplaning, Baggage, Transit, etc.)
3. Check-in
4. Food & Beverage
5. Baggage Services
6. Seating
7. Boarding
8. In-Flight Entertainment System
9. Booking and Ticket Purchase
10. Lounge

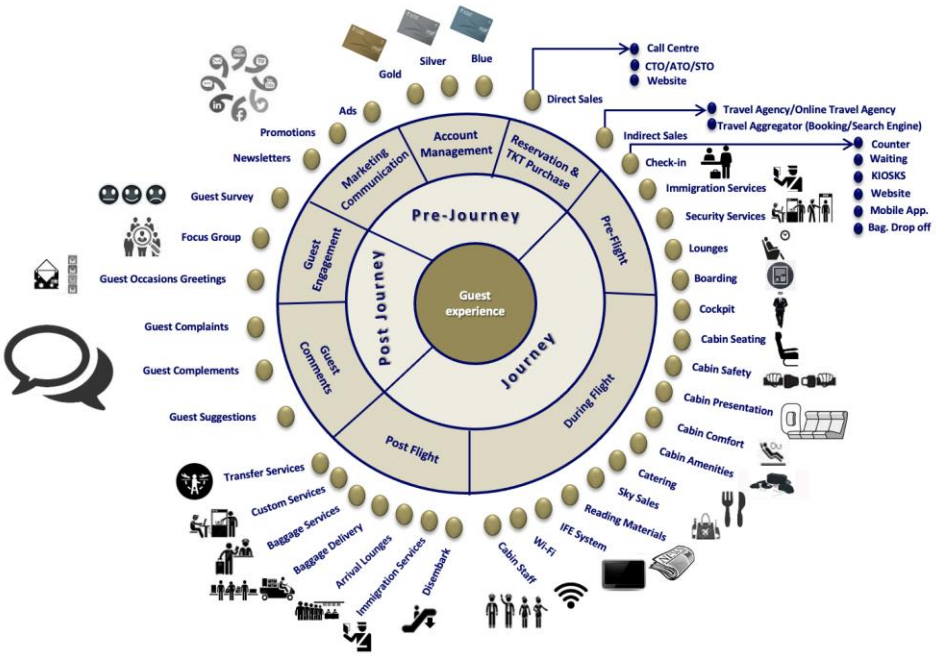

Figure 2: SAUDIA Touchpoints

Table 1: Touch Points NBS results

Category	Avg
On-board Services (Seating Food & Beverages Entertainment)	**13.5 %**
Arrival (Depending Baggage Claims etc.)	**10.1 %**
Boarding	**9.5 %**
Food & Beverage	**7.8 %**
Baggage Services	**6.9 %**
Seating	**6.8 %**
In-flight Entertainment System	**6.7 %**
Booking and Ticket Purchase	**6.6 %**
Lounge	**6.0 %**
Check-in	**5.8 %**

Now, after identifying the top 10 points of contact with customers, we must look, in a systematic mathematical process, to the extent to which these points affect each other, and as was previously suggested, we will use Interpretive Structural Modeling (ISM) to prioritized factors in which has more potential to influence customer satisfaction if AI was introduced.

C. Interpretive Structural Modeling (ISM)

As discussed in the previous chapters, it is very important to arrange the touchpoints in order of priority and to study the dependency among them to make a clear roadmap as the arbitrary application of AI may result in high costs in addition to unsatisfactory effectiveness.

According to (Alidrisi, 2014) ISM is an effective method that simplifies the complex relationship between specific factors (touchpoints in our case). This is a great tool in making the decision and will enable us to understand the current situation in a different way. Alidrisi summarized the implementation steps as follows:

1. Identifying related factors to be considered in the mathematical model, and we will symbolize the factors in this stage for easier miasmatical handling.
2. Defining a contextual relationship between mentioned factors.
3. Conducting a Structural Self-interaction Matrix to create a pairwise relation between the factors (initial reachability matrix).
4. Constructing the reachability matrix and define the reachability matrix for transitivity.
5. The reachability matrix will be going into iterations to create diagraph based on final reachability matrix.
6. Translating the diagraph to ISM model.

The below Tables show Interpretive Structural Modeling (ISM) steps:

a. Identifying and symbolizing factors.

The above table shows the factors that impacting satisfaction and to be transformed. Every factor has been assigned with short label such to make the steps easier.

b. The structural self-interaction matrix (SSIM)

Below for symbols will be used to initiate the SSIM:

- V: if TP i leads to successful implementation of TP j

- A: if TP j leads to successful implementation of TP i
- X: if both TP i and TP j lead to successful of implementation if each other
- O: if both TP i and TP j doesn't lead to successful of implementation on each other

Table 2: Touch Points Factors

TPF (TouchPoint Factors)	Acronym
On-Board Services (Seating, Food and Beverages, Entertainment etc.)	TP1
Arrival (deplaning, baggage, transit, etc..)	TP2
Check-in	TP3
Food & Beverage	TP4
Baggage Services	TP5
Seating	TP6
Boarding	TP7
In-Flight Entertainment Systems	TP8
Booking and Ticket Purchase	TP9
Lounge	TP10

Table 3: The Structural Self-Interaction Matrix (SSIM)

TPs	TP10	TP9	TP8	TP7	TP6	TP5	TP4	TP3	TP2	TP1
TP1	O	O	X	O	X	O	X	O	O	
TP2	O	O	O	O	O	X	O	V		
TP3	A	V	O	A	O	A	O			
TP4	X	O	O	O	O	O				
TP5	O	O	O	O	O					
TP6	O	O	O	O						
TP7	V	V	O							
TP8	O	O								
TP9	O									
TP10										

The above table shows the Structural Self-Interaction Matrix (SSIM). It indicates the relation between factors. For example, the intersection between TP1 and TP3 has O which means both factors don't lead to successful of implementation on each other.

After that we will go the following:

1. The initial reachability matrix
2. Final reachability matrix
3. Levels of TPs (1st iteration)
4. Levels of TPs (2nd iteration)
5. Levels of TPs (3rd iteration)

Until we reach the fourth iteration, as follow:

6. Levels of TPs (4th iteration)

After implementing above steps, figure 3 shows the final ISM.

Table 4: The above table shows that TP 7 will be in 4th level.

	Reachability set	Antecedent set	Intersection	Level
TP1	1,4,6,8	1,4,6,8	1,4,6,8	I
TP2	2,5	2,5	2,5	III
TP3	3	2,3,5,7,10	3	II
TP4	1,4,6,8	1,4,6,7,8,10	1,4,6,8	I
TP5	2,5	2,5	2,5	III
TP6	1,4,6,8	1,4,6,8	1,4,6,8	I
TP7	7	7	7	IV
TP8	1,4,6,8	1,4,6,8	1,4,6,8	I
TP9	9	2,3,5,7,9,10	9	I
TP10	10	7,10	10	III

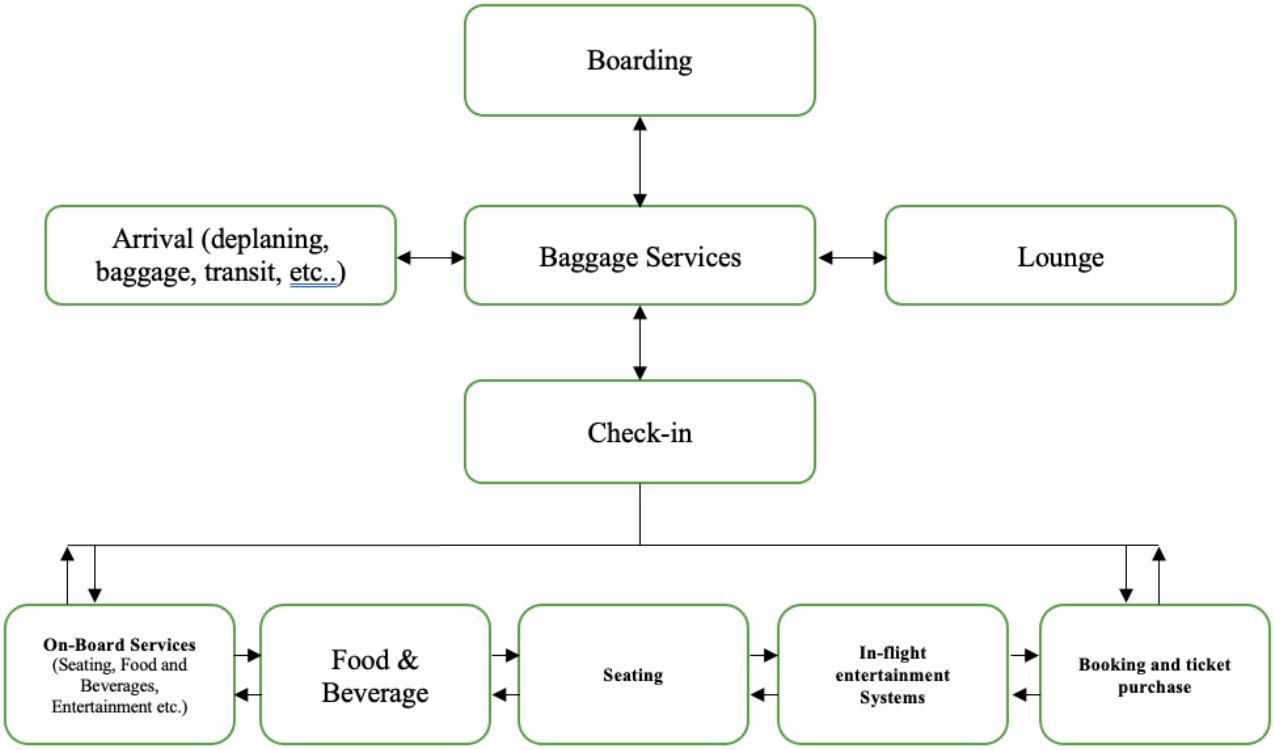

Figure 3: The Final Interpretive Structural Model

VI. CONCLUSIONS AND RECOMINDATIONS

Finally, as the researcher mentioned at the beginning of this thesis, the applications of AI are inevitable in almost all industries we recognize today and have already begun in the global transportation industry.

We can notice that airlines keep coming up with news about the applications of AI and its uses. It has become inevitable to reconsider the current methods of work systems.

Moreover, aviation industry is an excellent example of studying the methodology of the transformation of AI, where products are characterized by prolong lifetime of products and time takes to introduce new products due to the complexity of the field and the multiplicity of touchpoints.

Finally, the researcher's recommendation is still standing, to transfer into systems driven by AI according to the hierarchical conducted by the methodology mentioned in the previous chapter, as it

helps not to disrupt the workflow and smooths up the transition to modern technologies and eventually improve the experience of travelers.

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Ethical statement: The authors declare that they have followed ethical responsibilities.

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