**The use of Automated Systems at Southwest Airlines**

Week-2 (Literature Review)

Submitted to

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**Articles that support problem statement 1**

**The use of Automated Systems at Southwest Airlines**

**Literature Review**

**Introduction**

Automation refers to the utilisation of varied machinery and computer software to create seamlessness in an organisation’s tasks. Seamlessness through automation comes about as a result of efficiency and effectiveness in the accomplishment of tasks and goals within the organisation (Reason, 2008). According to Reason (2008), automation enables the different functions performed within the various functions in an organisation to be integrated into a single system thus resulting in the ease of coordinating and executing functions within the organisation. David (2015), states that through automation, an organisation is able to save on both time and overhead costs as a result of efficiency in the organisational functions. This is because automation enables the organisation to minimise on human contact within organisational activities thus resulting in the minimisation of human weaknesses within the organisation. The various forms of human weaknesses in the running of the organisation include inconsistency, fatigue, burnout and limited working hours among others. However, automation coupled with mechanisation results in operational effectiveness and efficiency since the various organisational tasks and functions are accomplished in a consistent, timely and reliable manner resulting in the achievement of significant competitive advantages. The automation of an organisation’s activities results in the development of a system that functions towards the attainment of basic goals. Zeynal, Eidiani and Yazdanpanah (2014) argue that an automated system works by making decisions through an organisation’s decision making systems. The decision making systems in the organisation function with the help of information from within and outside the organisation in making decisions to result in efficiency. Due to the reliance on information in decision making, significant attention should be paid to an organisation’s information system. This is because correct information will result in correct decisions and subsequent efficiency in the organisation’s tasks and processes. Similarly, wrong information will result in wrong decisions and subsequent ineffectiveness in the organisation’s processing of tasks and functions. Automation can be defined as the use of information technologies and control systems to facilitate reduction of human work in a given organisation’s functionality (Zeynal, Eidiani & Yazdanpanah, 2015). The primary reasons for the adoption of automation in the aviation industry were to eliminate human error and maximisation of economic aspects resulting in overall effectiveness and efficiency. The elimination of human aspects in the aviation industry have played significant roles in the facilitation of efficiency in the aviation industry since human aspects linked to inefficiency such as accidents, output inconsistency and unreliability among others. On the other hand, automation has led to maximisation of business economic aspects such as minimisation of operational costs, maximisation of production capacities and economies of scale among others (Azar & Vaidyanathan, 2015).

An airlines company is an example of an organisational system that is made up of various components such as information systems, machinery, humans and the environment. The various components of the organisational system require systematic integration for effectiveness and efficiency of the output process. According to Sridhar and Kopardekar (2016), automation in the aviation industry has resulted in effectiveness and efficiency of flight related operations. Due to the introduction of automation in the aviation industry, the aviation industry has recorded improved margins with regard to flight safety, cargo and flight handling processes and processing of customer bookings among many others. Accidents in the aviation industry have significantly reduced as a result of automating airline processes resulting in an all-time low for the first time since the introduction of flight services. The automation of customer and cargo handling has resulted in improved margins of customer and cargo handling in a day resulting in higher levels of customer satisfaction and subsequent higher profit margins. This is because more people and more businesses currently prefer to utilise aviation services in the transport of people and goods in comparison to conventional transport means such as road, rail and water transport. This is because other that the timeliness of operations, traditional shortcomings associated with the use of air transport such as cargo misdirection and safety have been improved making them reliable and effective in the transport of people and goods (Sridhar & Kopardekar, 2016).

**Title of problem statement 2**

**Automation at Southwest Airlines**

Just like other airline companies in the world, aviation processes have been automated at southwest airlines to facilitate minimisation of human shortcomings and maximization of economic factors. However, the southwest airlines has not been significantly automated since a significant amount of the airline’s activities entail a huge level of human input. The automation of aviation activities at Southwest Airlines will result into significant advantages such as cost minimisation through improved control of the airline’s operational activities, higher cargo and passenger handling capacities and flexibility with regard to environmental factors. Other than functional operational efficiencies in the administration of the airlines’ activities, significant advantages will also be realised in other aspects such as the improvement of safety through empowering pilots with on-board automation and the profitability to Southwest Airlines as a business (Boyd and Stolzer, 2016). Most accidents in the aviation industry were initially linked to activation failure and the lack of access to information by the pilot to facilitate decision making in critical conditions. However, through automation, chances of activation failure are significantly minimised as the aircraft’s functional system automatically activates itself resulting in flight control efficiency. On the other hand, automation empowers the pilot with information thus enabling him/her to make appropriate decisions in critical conditions (Naranji, Sarkani & Mazzuchi, 2016). Based on IATA’s accidents graph, the introduction of automation has played significant roles towards the minimisation of accidents in the aviation industry. Based on the graph, the number of accidents significantly declined in the early 1970’s as a result of the introduction of automated systems in aircrafts. However, in the mid 1970’s the level of accidents rose up again and was attributed to lack of sufficient information access by the pilot. This necessitated pilot information availability as courses such as cockpit resource management were made mandatory in the pilot’s curriculum and entailed topics such as conflict resolution, leadership, communication skills and decision making among others (IATA, 1994). The philosophy behind the adoption of increased on-board automation was founded on the assumption that human error was the primary trigger in most of the aviation accidents. In order to fix the shortcoming in the accident chain, the aviation industry shifted from manual to automated system. The introduction of fully automated systems in the aviation system in the 1980 resulted in a more significant decline in the number of accidents. This is because the human input that was responsible for triggering the accident was eliminated thus resulting in fewer accidents. The continued occurrence of accidents despite the significant elimination of the human aspect in flight control was attributed to other factors such as weather, natural calamities, terrorism and mechanical failures among others (Dekker, 2003). According to the Flight Safety Foundation (2003), humans are not alternatives to machines in the facilitation of air travel safety but alternatives whose integration play significant roles towards the facilitation of flight safety. The attainment of the correct balance between the two components is thus critical towards ensuring safety in the aviation domain (Flight Safety Foundation, 2003).

**Title of problem statement 2**

**Automation Issues in the aviation Industry**

Despite the fact that automation has improved the aviation process in numerous ways, it has also come along with a number of issues that have emerged out of its use. Issues linked to automation are as listed below.

**Title of problem statement 2.1**

**Situation awareness**

Situation awareness refers to prior knowledge of the automated systems course of action and the ability to predict the next course of action. This enables the pilot to detect anomalies in the airplane by facilitating control of the airplane. However, in situations that are fast paced such unclear skies, terrain proximity and unfavourable weather conditions, the pilot should pay significant attention to the various parameters. Should the situation start improving, the pilot is allowed to delegate the duties back to the automation system (Ancel & Shih, 2014).

**Title of problem statement 2.2**

**Poor design of the user interface**

Various studies have been conducted with regard to optimal presentations which range from indicators to displays and alarms among others with regard to pilot use. Conventional displays were designed to provide data to specific domains only such as the thermometer for temperature and altimeter for altitude. As a result, this made is cumbersome for the pilot to use since he/she has to keep on alternating his view of the meters. The use of multiple meters is an example of poor designing of the user interface since it should have been put in a manner that facilitates ease of coordinated use. The problem has been solved through the use of integrated instruments that enable the pilot to glance at all the functions in a single glance (Ancel & Shih, 2014).

**Title of problem statement 2.3**

**Complacency as a result of automation**

Due to the wide capabilities of the automated systems in flight management, the pilot has a high likelihood of being complacent in his/her control of the plane. Although basic rule mandates that the pilot should at least be five minutes ahead of the plane to facilitate effective control of the plane, the automated system often controls the plane in an effective and efficient manner thus making the pilot complacent with regard to plane control. This is very risky since the pilot is often not in a position to avert a wanting situation in a timely manner (Ancel & Shih, 2014).

**Title of problem statement 2.4**

**Pilot selection**

The selection of pilots is also a headache to the aviation industry due to the change of needs as a result of automated systems. As a result, there is a dilemma as to the selection of older pilots or younger pilots due to the variation in their respective capabilities and learning processes (Dudley et al., 2014).

**Article that support the recommendations**

**Title of recommendation 1**

**The Benefits Associated with Automation in the Aviation Industry**

Automation in the aviation industry has come about with significant advantages from a holistic perspective. Other than safety, operational and economic benefits, other significant benefits to the aviation industry include operational flexibility and cost minimisation. This section of the literature review seeks to highlight the different benefits associated with automation in the aviation industry.

**Title of recommendation 1.1**

**Fuel Consumption**

Geels-Blair, Rice and Schwark (2013), state that a significant aspect of an airline’s costs is attributed to fuel. This is because airplane utilise significant amounts of fuel on a daily basis hence accrue high costs. The ability to save on fuel by airline companies is one of the strategic steps towards improved profit margins and subsequent competitiveness in the market. Automation in the aviation industry has resulted in the development of concepts such as “fly by wire” to aid in minimisation of fuel consumption levels (Geels-Blair, Rice & Schwark, 2013). The “Fly by wire” concept helps to minimise fuel consumption through three key areas mainly balance weight and the prediction of data. With respect to weight, the “fly by wire” concept works by transferring information from the flight systems to the pilot through optic cables. As a result, there is no need for the use of weighty devices such as rods and wheels in information transfer thus significantly minimising the aircraft’s weight and subsequent fuel consumption. This is because less weight requires less power in lifting thus less fuel consumption. The second attribute of the “fly by wire’ concept is saving fuel through the maintenance of aircraft balance. Since the aircraft must be balanced to retain longitudinal stability, a stable aircraft concentrates weight in on the front part of the aerodynamic mean chord. As a result, the stabilizer should be slanted downwards to compensate for the movements in the wing. This makes the aircraft to revert to its default original equilibrium state upon deviation thus utilising less fuel in control. However, in traditional aircrafts, the pilot makes continuous corrections with regard to stability in order to make the aircraft manoeuvrable. Unstable aircrafts consume higher levels of fuel in manoeuvring to increase the smoothness of smooth flying. The third aspect of the “fly by wire” concept is data prediction. As a result, database from the aircraft is used to compute airplane variations either on a horizontal or vertical profile. Aspects of the database include alternative shorter routes, mileage calculations, optimum altitudes and best consumption speeds among others. The use of the database enables the pilot and other crew to choose optimum options in order to facilitate fuel saving (Lee, Hwang & Leiden, 2014).

**Title of recommendation 1.2**

**Maintenance Costs**

Automation enables significant minimisation of costs related to aircraft maintenance and overhauling. Conventional aircrafts requires the replacement if aircraft devices in case of a malfunction. Since aircraft have as many as one million spare parts, the traditional approach entailed change of entire systems. However, automation through the glass cockpit concept enables detection of faulty devices in the systems through a computerised detection system. As a result, only few spare parts will be required in the hangar as the maintenance process will involve change of single spares which will be detected through computerised systems (Dudley et al., 2014).

**Title of recommendation 1.3**

**Minimisation of Selection and Training Costs**

Automation has significantly changed the role of the pilot in the airline industry over the past few decades. Over the past few decades, the primary trait that established the pilots to be hired was sufficiency of aircraft flying skills since the pilot has very many duties to perform within the plane. The process of teaching a pilot was also significantly costly since the pilot had to be taught in a real time environment. However, pilot automation has resulted in the hiring of pilots based on other attributes such as leadership, learning flexibility and reliability among others. This is because automation has facilitated change in the airline industry since most of the aircraft tasks are automated thus making pilot trainees to be able to fly airplanes with a short amount of training. The development of aspects such as virtual reality have also minimised the training costs since trainees are not required to undertake flight lessons in a real time plane but a simulated environment that is representative of the real situation. This process method is effective in training large aircraft carrier pilots since it is more costly to train pilot trainees on a large carrier (Dudley et al., 2014).

Similarly the process of pilot selection has been significantly made easier since it was more costly to evaluate pilots based on their aircraft flying skills. Due to automation, a pilot can be evaluated from a simulated flying environment that provides the pilot with challenges similar to those in the real life situation. In addition, other additional features are evaluated from the pilot’s personality in determining a resourceful and valuable employee to the organisation (Malik & Gollnick, 2016).

**Title of recommendation 1.4**

**The attainment of operational flexibility**

A pilot who is flying an aircraft with little aid is limited in a number of ways due to various limitations such as physiological, physical and mechanical among others. However, automation enables overcoming of these limitations since the pilot has very little input to make towards controlling the plane. This is because on-board meters and instruments enable the pilot to achieve the best out of the flight by flying through optimum conditions which would have been more difficult when using manual control systems. Through automation, the pilot is able to benefit from lower consumption levels as a result of high flying and higher speeds hence earlier destination reach. The integration of the automated systems with the control tower has also facilitated effectiveness and efficiency of the processes of landing and take-off in the aviation industry by facilitating precision and coordination in the landing and take-off processes. As a result, accidents associated with the processes of landing and take-off due to inaccuracies in coordination have been significantly minimised. Dismukes, Berman and Loukopuolis (2008) state that despite the fact that automation facilitates operational effectiveness and efficiency in the aviation industry, operations that are beyond the capabilities of humans should reconsider the responsibility concept when dealing with automation. This is because the dynamic nature of a flight may put a plane at risk thus requiring the application of the pilot’s practical skills in solving the problem at hand. As a result, the automation process should have manual aspects that allow the pilot control situations that mandate practicality to avert the situation. In other instances, the automated system may be faulty due to mechanical issues thus mandating the use of manual systems (Dismukes, Berman & Loukopuolis, 2008).

An automatic surprise can be defined as the provision of an unexpected outcome by the system as a result of the interaction between the pilot and automated systems. Automated surprises take place in the aviation industry when the systems controller is unaware of the pattern the system is following. One of the basic tenets of aviation is that the pilot should always be ahead of the airplane to facilitate management of rapid flight changes. The responsibility concept calls for the facilitation of shift capabilities between automated and manual in the case of automation surprises. As a result, the shift from automatic to manual will enable the pilot to take full control of the plane thus averting any wrong situation. However, the failure of automation increases the pilot’s workload exponentially since automation is primarily about the minimisation of the workload (Dudley et al., 2014).

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