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Clustering Egyptian Railway Passengers Based on Needs

Abstract

Your fingers are not the same and customers too are different with their needs and wants. A literature review indicates that segmentation based on customer needs is considered one of the best ways to segment markets using causal factors rather than descriptive factors. There's limited studies clustered Egyptian railway passengers. Therefore, the aim of this study is to explore railway passenger needs in Egypt to identify distinct segments based on their needs and profiling the segments based on demographic characteristics, and train patronage. Passenger needs have been identified by conducting four focus groups and were further refined in a survey instrument. The analysis involved factor analysis based on needs sought and a cluster analysis based on the identified factors that related to passenger's needs. Study results shown three need segments of Egyptian railway passengers were identified: hedonic, functional, and ancillary and three need segments differed significantly in passengers' education, occupation and ticket class.

Keywords: Marketing Segmentation, Egypt, Railway.

1. Introduction

Companies usually cannot appeal to all buyers because of their different needs and wants (Kotler and Keller, 2009). The main idea of marketing is to match the needs and wants of customers to companies' capabilities in a way that achieve both parties' goals (McDonald and Dunbar, 2004). Current marketing practice recommends that organizations explore customer needs then segment customers in groups with similar needs, and finally target them with several products and services (Canever et al., 2007).

The concept of market segmentation which includes grouping customers with same needs is a strategic marketing management tool for resource allocation in a way that enhances customer satisfaction and improves organizational profitability (Epetimehin, 2011). Marketing segmentation process includes understanding how a company can fit its capabilities with customer needs and how to develop strategies and marketing programmes' to satisfy customers profitably in addition to understanding how and why customers buy (Murphy and Daley, 1994).

Segmentation studies have been conducted in several sectors like education, banking, shopping and mobilesetc. In current study, segmentation will be used and applied in public transportation sector particularly railway services in Egypt as a developing country. No research has been conducted in public transport that uses segmentation approach in particular developing countries, while in developed countries a few studies have been performed (Bamford et al., 1987; Pas and Huber, 1992; Lupas and Moisey, 2001; Krizek and El- Geneidy, 2007; Tao, 2008; Hagen, 2009; Mahmoud et al.,2012). Public transport systems have to become more market oriented and have competitive advantages, as they are viewed as service products(Lai and Chen, 2011). Today marketing of public transport offers many solutions, such as distribution, promotion, advertising, and branding. All these solutions have been driven from the application of the conventional marketing science that is based on the concepts of marketing mix, market segmentation, targeting and positioning (Suminaite and Fragidis, 2011).

Railway transport is an important element of the passenger system in the same time it's facing competition from highway and air transport. In Egypt passengers are more likely to be dissatisfied because of the gap between the expected and received services. Also, general public opinions indicate that Egyptian railroad doesn't provide good services (Helmy and Menshawy,2010; Liu and Guan, 2009). In order to gain a competitive edge in the competition, railway transport must determine their passengers need to identify possible segments and improve service quality (Liu and Guan, 2009).

Service researchers must embrace the concept that service customers are heterogeneous and driven by different preferences for service. By segmenting customers based on their preferences, managers and researchers can begin to develop unique strategies that accurately meet the needs of individual customer segments (Voorhees, 2006).

Transportation sector and market segmentation literatures confirm that railway services can and should be segmented. However, limited empirical studies have been conducted in railway services. According to this it will be very useful to identify proper segments for Egyptian market of passenger railway service based on the discovered segmentation schema. This study is trying to determine 'What are the profiles of railway passengers according to needs, demographic characteristics and train patronage?' Most previous segmentation research focused on market segmentation depending on customer demographics or common characteristics. Pas and Huber (1992) characterized the market for passenger rail service according to the needs and preferences of potential riders.They include five primary rail service attributes in their study that are rail travel time, cost, food service, seating type, and number of departures per day. Pas and Huber (1992) found that traveler clusters are: functional traveler, day tripper, train lover, leisure-hedonic traveler, and family traveler. Lupas and Moisey (2001) divided rail users to: fitness seekers, typical trail users, group naturalists and enthusiasts. The study of Dutch railways focuses on the psychographic needs of train passengers.They conducted six different need segments, according to a type of passenger: explorer, individualist, func-

tional planner, certainty seeker, socializer and convenience seeker (Hagen, 2009). While this study identified three need segments of Egyptian railway passengers: hedonic, functional, and ancillary and they significantly different according to passengers' education, occupation and ticket class.

The rest of this study is structured as follows. The next sections will discuss the literature review, and the methodology followed by discussion and analysis and conclusions in the final section.

2. Literature Review

2.1 The Concept of Market Segmentation

Customers have different requirements, preferences and needs, so companies use segmentation to know their customer's profile (Minhas and Jacobs, 1996; Akbar et al., 2017). From the views of marketing activities, segmenting customers are the most significant tasks to allocate resources effectively (Chen and Chang, 2004). Since company success depends on the ability to meet customers' needs and desires, they must know who their customers are, what they want, where they live and what they can give (Moyo, 2005; Soewartini et al., 2017). Levina (2010) mentioned that the concept of market segmentation has its roots starting from 1930s, when Chamberlin and Robinson proposed their theories of imperfect competition. In (1956) Wendell Smith introduced segmentation as an "alternative marketing strategy" in an environment where diversity had become the market habit, and defined as a subject of "viewing a heterogeneous market as a number of smaller homogeneous markets, in response to customers differences to en-

hance customers satisfaction" (Fiang, 2000, p.216; Alfansi and Sargeant, 2000). Mater and Gray (1995) demonstrated that the concept of market segmentation is based on differences between customers, differences of their demand and segments of customers can be isolated within the overall market.

Sarabia (1996) determined that the process for identifying customer segments begins with search and selection of information, creation of segments followed by detailed segment descriptions and an associated evaluation. On- ce a segment has been selected then the task of how to position the organization and which marketing mix variables to use can be determined. Bickert (1997) mentioned that marketers look to market segmentation systems to discover their key consumer segments, identify the diversity between segments to their businesses, understand each consumers individually, thus bridging the gap between mass marketing and a "one-to-one" emphasis, understand how consumers will respond to new products, modify brand loyalties, respond to different media, understand a customer needs, allocate resources more appropriate, and Identify market opportunities clearly.

2.2 Segmentation Approaches

There are two main approaches for market segmentation. The first named priori method, where the variables for the segments are pre-defined by the management. These variables include demographic, geographic, socio-economic characteristics, purchase frequency or other observable/behavioral characteristics (Rao and Wang, 1995; Allred et al., 2006 ; Visser, 2015). The second ap-

proach is an analysis-based method that allows the segments to be identified based on natural relations observed during the data analysis process, and usually using cluster analysis. This clustering is most often based on the importance of product attributes, lifestyles and behavior toward the product (Allred et al., 2006). An example of this approach is benefit segmentation that can be used in combination with product loyalty, lifestyle, perceptions, preferences, purchase intention and customer satisfaction (Wu, 2001).

koh et al. (2010) noted that benefit segmentation predicts performance better than demographic or geographic segmentation because it explain reasons to purchase the product or service, rather than just explain who they are as consumers in terms of socio-economic, demographic, or psychographic data. To satisfy the target consumer's needs, benefit needs and product attributes are the most accepted variables for segmenting the market and enhanced more effective marketing strategies (Wu, 2001). Behavioral approach is contrasting with the process of segmentation based on customer characteristics that focus more on customer needs. Need identification approach is more suitable than a classification of characteristics and more predictive of purchase behavior of each segment (Fouladifar et al., 2016; Visser, 2015).

Martin et al. (2000) mentioned that segmentation variables are classified according to their objective versus subject characteristics, general and specific characteristics. The general and objective variables such as demographic, socio-economic and geographic variables have been frequently used in the field

of services. In practice, the choice of segmentation approach depends on the purpose of the study, the nature of the market, the method of distribution, the media obtainable for market communication, the motivation of the buyers, and the choice of segmentation methods (Goyat, 2011).

Many studies which have been conducted in different sectors used different segmentation approaches (Krizek & El-Geneidy 2007; Mahmoud et al. 2012; El kayaly and Taher 2010; Martin et al., 2000; Gilbert & Wong, 2003; Tao 2008; Kaze & Skapars 2011; Kumar et al. 2012). Krizek and El-Geneidy (2007) used habits and preferences for users of the metro services. They cluster the respondent into four categories: captive riders with regular commuting habits, captive riders with irregular commuting habits, choice riders with regular commuting habits, and choice riders with irregular commuting habits. Mahmoud et al. (2012) measured the users' preferences towards bus service quality and determined their segments. Pas and Huber (1992) characterized needs and preferences of passenger rail service they identified five traveler clusters functional traveler, day tripper, train lover, leisure-hedonic traveler, and family traveler.

Dutch railways used a segmentation model which focuses on the psychographic needs of train passengers they determined six traveler clusters the explorer, the individualist, the functional planner, the certainty seeker, the socializer and the convenience seeker (Hagen, 2009). Lupas and Moisey (2001) divided rail users into five benefit segments: fitness seekers, typical trail users, group naturalists and enthusiasts.

Diez-Mesa et al. (2016) used socioeconomic and service quality attributes to segment rail transit service. El kayaly and Taher (2010) clustered Egyptian car buyers based on benefits. They mentioned that benefits influence customers' choice behavior and affect the customers' satisfaction. krizek and El-Ge-neidy (2007) used habits and preferences for both users and non-users of the metro services. Mahmoud et al. (2012) used passenger's preferences to determine the quality of bus service segments. Tung et al. (2014) used loyalty to categories customers in a bus service. Gilbert and Wong (2003) used expectation as a segmentation approach in airline.

Park and Sullivan (2009) identified the segment of university student based on clothing benefits sought and develop a profile of each segment in terms of attribute evaluations, shopping orientations, and patronage behavior. Park et al. (2011) employed shopper segments based on benefits sought and profiled the identified segments in terms of personal characteristics, satisfaction and repurchase intentions.

Woo (1998) used customer perception to measure student's perception of service quality in distance education institution. Retail banking used service quality dimensions as a segmentation approach (McDougall and Levesque, 1994). On the other hand Kumar et al. (2012) focused on clustering e-banking consumer based on customer characteristics, behavior, life time value of a customer and demographic variables. Muk-iibi and Bukenya (2008) segmented grocery shoppers based on preferences, lifestyles and shopping habits. Kaze and Skapars (2011) analyzed consumer be-

havior by using lifestyle and human values based segmentation.

There are some models related to segmentation the first one is Bonoma and Shapiro's that reflect industrial market segmentation the second one is need scope that related to consumer needs and this study depends on it. Need scope is a unique tool that helps to reveal the consumer's needs. The heart of need scope is a psychological model that summaries human emotions. This provides a constant framework to develop and implement strategy. Consumers' needs can be distinguished in three categories the first and most accessible category is functional needs, such as safety, speed and ease (Wilson and Calder, 2006; Hagen, 2009). The second and core of all consumer behavior is emotional needs, such as the need for safety or the need for control (Hagen, 2009). These emotive needs are the real drives of brand choice and are satisfied by brand symbolism. At this level, consumer needs take two different forms which are gratification and expressive. Gratification needs are satisfied by a feeling, a change in mood, brand can make the person feel safe and secure. Expressive needs are about satisfying a personality ambition. The third and more difficult to understand are the social identity needs that mean every human being wants to belong to a certain group and to identify with it (Wilson and Calder, 2006).

Purchase decisions are determined by two kinds of needs: (1) functional- those satisfied by product functions and (2) emotional-deeper needs linked with the psychological features of product ownership. Only by understanding such deeper needs firms are capable to pro-

vide true value to the customer (Fellow et al., 2004).

2.3 Railways Market case of Egypt

Railways are characterized by high capital intensity, labor intensive and their complexity of business requires intensive management and coordination. Railways are information intensive and often base their activities on outdated technology and operating methods. They require from their employees highly specialized skills (Fularz, 2005).

On a daily base, approximately 2.3 million passengers use trains that managed by the Egyptian National Railway (ENR) to reach their destinations. ENR plays a major role in Egypt's economic activity since it was established (Nasr El-Din, 2005). According to a report about Egypt's economic status that done by The Organization of Economic Co-operation and Development, Egyptian transportation problems are due to the equipment quality, maintenance, security, and lately for safety reasons after more than one serious accident occurred (Badr-El-Din and Fathy, 2015). Passenger transport accounts for 92 % of the physical activity of ENR and 73 % of traffic revenue in 2004. The present market share of the railway is reportedly about 40% of the total public transport market (Baeumler, 2005). According to ENR, statistics number of railway passengers decreased by more than 40% in last 4 years (ENR, 2016).

Railways are a vital part of the transport network and play important role in facilitating trade. The performance of this sector affects the global competitiveness of products trade and the per-

formance of many other service sectors such as tourism. Over the past two decades, railways across the world have undertaken significant restructuring or liberalization, which has improved their productivity and efficiency. Railways are more energy efficient and environment friendly as compared to other modes of transport like roads (Mukherjee and Sachdeva, 2004).

ENR is taking part in the European Union Twinning Project: Egypt-France for reforming railway safety, a program that focuses on operational safety. The study team noted a serious lack of industrial safety protocols at many of the maintenance shop facilities. Poor working conditions cause lower productivity and low level of safety and are because of many things such as excess scrap, poor lighting, lack of personal protective equipment, scarcity of modern facilities with required equipment and a lack of safety practices, such as safety training. The study team developed a system safety plan and training program based on successful U.S. practices focused on a traffic management system. Investments in signaling, communications, computer technology for better operational systems and procedures, track upgrading and maintenance, training facilities and human resources and training are being made, along with organizational restructuring (Matherly, 2009).

The marketing objectives of railway must be relevant and reactive to the customers' needs and must reflect the principal facts of the corporate plan. For a railway passenger service the design and appearance characteristics of the product are: the direction covered ,the service frequency, the achieved journey

time, the coach seating standard and arrangement, decoration, cleanliness and riding comfort of the rolling stock, the nature and standard of meals provided, comfort ability, cleanliness and convenience of station or terminal facilities and the convenience of connections with other rail services or with other transport modes (Rahman, 2005).

Rail transport services is listed as a sub-sector of transport services and includes five sub-categories which are: passenger transportation, goods transportation, pushing and towing services, maintenance and repair of rail transport equipment and supporting services for rail transport services (Mukherjee and Sachdeva, 2004). Railway's customers can be segmented into broad market or business groups, such as: commuters, medium-long distance passengers, freight customers, parcels and express freight customers and commercial property lessors (ESCAP, 2007).

3. Research hypothesis

According to the literature review and research objective, the hypotheses of this study are:

- H₁:** Railway passengers can be segmented based on needs.
- H₂:** Needs segments are related to demographic variables.
- **H_{2a}:** Needs segments are related to gender.

- **H_{2b}:** Needs segments are related to age.
- **H_{2c}:** Needs segments are related to education.
- **H_{2d}:** Needs segments are related to occupation.
- **H_{2e}:** Needs segments are related to income.

H₃: Needs segments are related to train patronage.

- **H_{3a}:** Needs segments are related to ticket class.
- **H_{3b}:** Needs segments are related to purpose of travelling
- **H_{3c}:** Needs segments are related to frequency of using train.

Based on the hypothesis, the conceptual framework of this study is developed and shown in figure 1. For railways companies, customers' needs should be the starting point of the services. By understanding the needs of different types of passenger's unfulfilled services can be developed. As illustrated in Figure 1, the passenger needs (i.e. functional, emotional, and social) are identified as segmentation variables. The segments are described based on demographic variables (i.e. gender, age, occupation, income, and education), and train patronage variables (i.e. frequency, trip purpose, and ticket class) to represent passenger characteristics.

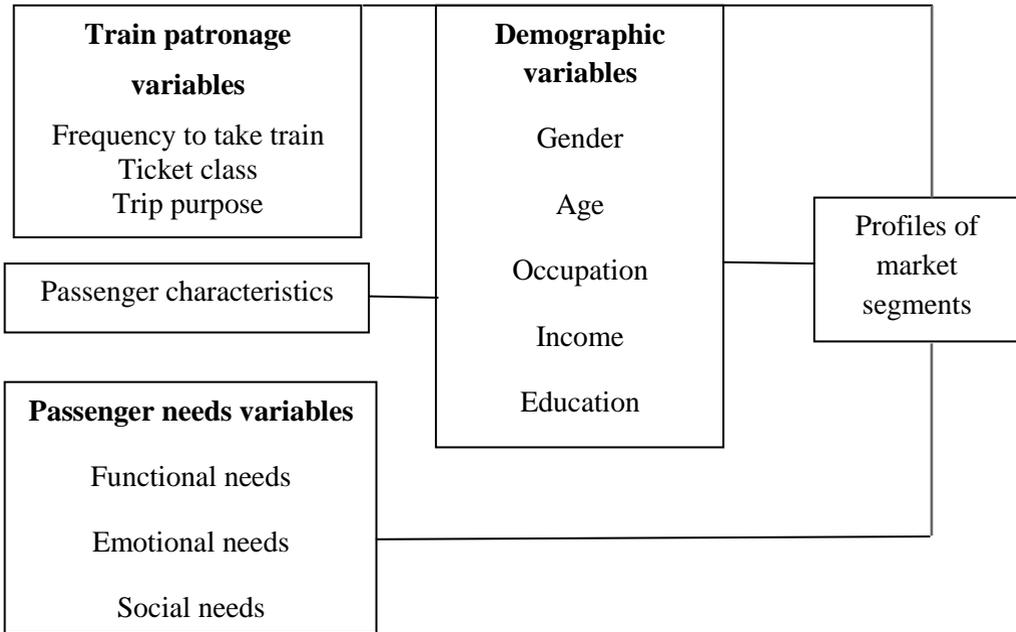


Figure 1 – Conceptual Framework

4. Methodology

This study is exploratory in nature using qualitative method through focus group and quantitative method through survey instrument. The fundamental reason of mixing qualitative and quantitative is that no separate method is enough to confine the trends and details of the conditions but using them in mixture yield a more complete analysis (Garbarino and Holland, 2009). Because of complexation of travel behavior a deep understanding of people’s perceptions, attitudes and behavior is needed. Qualitative method used to explore the needs of Egyptian railway passengers since focus group allow grasping the individual’s own explanations of behavior, needs and attitudes (Beirao uand Cabral, 2007).The other method is questionnaire to determine the Egyp-

tian ra-ilway passengers segments based on

demographic characteristics and train patronage.

Data has been collected from four focus group discussion (each consist of 8-10 participants) one was conducted in Alexandria and three in Cairo over three week to identify the relevant passenger needs. Focus groups were conducted with 25 participants male and 13 females, and heterogeneous with respect to age, education and occupation. Each focus group discussion was recorded to produce reliable data and reduce bias. After coding, transcription and themed analysis, a structured questionnaire survey developed. The sampling procedures in this study involve convenience sampling was used in focus group dis-

cussions, and quota sampling used for the questionnaire.

The population for this study is Egyptian railway passengers who are: both males and females of age above 18 years (age groups: youth, middle age and elders); varying income level (low, medium and high levels); varying educational levels (university graduate and post graduate or professional degree) and varying occupation (government, private and professional). Based on the populations divided into two classes, where the first class has around four coaches each with 48 seats and second class has around six coaches with 60 seats so, this represent an average of around 40% for the first class and 60% for the second class. Accordingly, the sample size selected 415 responded with 159 first class and 256 second class. The questionnaire was distributed to passengers regularly using Alex-Cairo line on the platform during August and September 2017. In addition, the questionnaire was distributed to friends and relatives frequently using Alex-Cairo line. Alex-Cairo line was applicable to this study because this line is heavily used by different users and represents 40% of total long distance lines revenues (ENR, 2011).

Respondents were asked to evaluate the relative importance of various needs in railway services, by rating 15 statements on a five-point likert scale ranging from 1= extremely unimportant to 5= extremely important (functional and emotional needs). While social needs represent 5 statements on a five point scale ranging from 1= strongly disagree to 5 = strongly agree. The needs sought in the statements were drawn from the literature (Nathanail, 2008; Huang and

Hsieh, 2011) and from the four focus groups.

The questionnaire survey consisted of three parts. The first part contains questions that focus on the needs of railway passengers which are measured by 3 different types of needs: functional, emotional and social needs. The second part is train patronage variables and the third is socio-demographic characteristics to obtain the description of the respondent.

A pre-test was conducted to refine the survey questions and a questionnaire was given to 30 respondents in this stage. Cronbach's Alpha coefficient was used to evaluate the reliability of the measures. The Cronbach's Alpha coefficient for the three types of needs (functional, emotional, social) value was 0.909 indicating that these items are reliable for measuring the passenger needs constructs in an exploratory setting. According to the rule of thumb of Cronbach's Alpha coefficient (Zikmund 2003), the reliability of data set is acceptable if Cronbach's Alpha is above 0.7. The data obtained were analyzed using the SPSS software, where factor analysis was used to obtain the initial needs factors. Cluster analysis was used to cluster Egyptian railway passengers and grouping respondents with same needs.

5. Analysis and Discussion

In each focus group session a warm up discussion questions were asked about the frequency of using train as a mode of transportation; and the experiences with the train. Specific discussion questions were asked about the main purposes of using the train as a mode of

transportation; the core elements that must be in the train; the extra elements that passengers need; the social elements; and the overall train experience. The results show that 56% are a regularly train users, and 44% use train occasionally. Passengers like to use train for many reasons such as its high speed, saving time, safety and comfort ability. The most important elements that passengers care of are cleanliness of train, punctuality, safety, healthy atmosphere, good furnishing quality (floor, window, chairs) and finally air condition. But some passengers mentioned that they would like to have entertainment facilities (movie, newspapers, and magazines), smoking area, children lounge area, and café/food lounge in trains. The social elements were to make new friends and meet new people. Passengers train experience includes fun, traditional habit and entertaining mode of transportation. Passengers demonstrated that functional needs are the most important. This also is compatible with their current perception about train in Egypt "as low quality" in general as they are more interested in having the basic/core needs in trains and they may be think about social and emotional needs to be satisfied. However, the above different types of needs mentioned by participants helped in defining study variables.

An exploratory factor analysis was performed to examine if the items for a construct share a single underlying factor, whether items can be deleted, or a

new structure for the three constructs comprising scales of passenger needs can be obtained. Review of correlation matrix for 20 items of the passenger needs instrument reveals that approximately 71% are significant at the 0.01 level while only 6% are significant at the 0.05 level, which provide adequate basis to perform a factor analysis for each item and for the overall basis. It is also worth noting that approximately 22% are found to be insignificant.

To conduct an exploratory factor analysis (EFA) the Kaiser-Myer-Olkin (KMO) (Table 1) used as an additional step to examine the suitability of the data and support analysis. The Kaiser-Myer-Olkin (KMO) measure of sampling adequacy is found to be 0.882, higher than the acceptable value of 0.6 suggested by Pallant (2001), indicating that the sample size is large enough to factor analyze 20 variables and the KMO test is judged to be marvelous (Hair et al., 2006). Additionally, the Chi-square value of Bartlett's Test of Sphericity shows a strong statistically significant correlation in the intercorrelation matrix

$(\chi^2 = 3630.204; p - \text{value} < 0.01)$.

This indicates the suitability of the intercorrelation matrix of the 20 variables for factor analysis. Thus, the sample size and the nature of the data are both fit for the EFA.

Table 1: KMO and Bartlett's Test for passenger needs

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.882
Bartlett's Test of Sphericity	Approx. Chi-Square	3630.204
	Df	190
	Sig.	.000

Table 2 shows the total variance explained and un-rotated factor loading matrix regarding the 20 items comprising passenger needs with four possible factors solutions and their relative explanatory powers. The importance of each component and the ideal number of factors can be selected using the eigenvalues. Using the default extraction of eigenvalues greater than 1, four fac-

tors were identified from the 20 items of passenger needs and the solution only explained approximately 60% of the variance.

Table 2 shows that factor (1) accounts for approximately 29% of the variance (eigenvalue 5.94), factor (2) for 17.36% (eigenvalue 3.42), factor (3) for 7.55% (eigenvalue 1.51) and factor (4) for 5.97 (eigenvalues 1.19).

Table 2: Total variance explained and un-rotated loading matrix for passenger needs

No.	Items	Factors				Communalities
		Factor 1	Factor 2	Factor 3	Factor 4	
EN2	Understanding needs	.696	-.143	-.296	-.345	0.712
FN6	Professional appearance of staff	.680	-.021	-.047	.256	0.531
EN3	Availability of staff	.675	-.165	-.386	-.249	0.694
EN1	Dealing in a caring fashion	.645	-.161	-.300	-.348	0.653
FN8	Luggage storage facility	.644	-.172	-.083	.049	0.454
FN7	Adequacy of restrooms	.634	-.111	.182	-.114	0.460
FN4	Cleanliness of train	.599	-.309	.277	.095	0.539
FN2	Comfortable seats on train	.596	-.276	.297	.170	0.548
EN6	Atmosphere inside the train	.591	-.001	-.294	.047	0.438
FN5	Ventilation and air-condition	.554	-.229	.249	.307	0.516
EN5	Entertaining experience	.530	-.028	-.404	.369	0.580
FN3	Punctuality	.525	-.357	.467	-.077	0.627
FN9	Food inside the train	.498	-.027	-.311	.474	0.570
SN3	know more people	.352	.822	.171	-.051	0.832
SN2	Make new friends	.378	.804	.191	-.077	0.832
SN5	Identify myself with train community	.299	.728	-.077	.044	0.627
SN4	Meet people with similar interest	.430	.727	.126	.014	0.729
SN1	Interact with others	.380	.710	.083	-.022	0.656
FN1	Safety on train	.431	-.309	.496	.014	0.527
EN4	Security inside the train	.399	-.144	.097	-.546	0.488
	Sum of squares (eigenvalues)	5.938	3.421	1.511	1.194	11.965‡
	Percentage of trace	29.194	17.355	7.553	5.970	60.073‡

‡. Total sum of squares (eigenvalues) and total cumulative percentage of variance (trace).

The rotated factor matrix for the whole set of 20 items of passenger needs with the corresponding four factor solutions are shown in Table 3 The variance explained in this factor solution (accounting for 63.56% using 17 items after deleting 3 items being luggage item from functional need, atmosphere from

emotional need, and professional appearance of staff from functional need due to its cross-loading on second and fourth factor) can be considered excellent and the relationship that is shown are generally sensible and show how different needs for railway passengers are likely to be linked.

Table 3: Total variance explained and rotated factor loading matrix (VARIMAX) for passenger needs

No.	Items	Factors				Communities
		Factor 1	Factor 2	Factor 3	Factor 4	
Social Needs						
SN3	know more people	.912				0.833
SN2	Make new friends	.909				0.832
SN4	Meet people with similar interest	.844				0.733
SN1	Interact with others	.804				0.656
SN5	Identify myself with train community	.761				0.619
Functional Needs						
FN3	Punctuality		.765			0.641
FN1	Safety on train		.723			0.529
FN2	Comfortable seats on train		.698			0.558
FN4	Cleanliness of train		.676			0.534
FN5	Ventilation and air-condition		.644			0.538
FN7	Adequacy of restrooms		.519			0.454
Emotional Needs						
EN2	Understanding needs			.806		0.742
EN1	Dealing in a caring fashion			.777		0.677
EN3	Availability of staff			.777		0.732
EN4	Security inside the train			.553		0.499
Ancillary Needs						
FN9	Food inside the train				.762	0.642
EN5	Entertaining experience				.705	0.588
	Sum of squares (eigenvalues)	3.665	2.994	2.544	1.603	10.806 [‡]
	Percentage of trace	21.557	17.610	14.965	9.429	63.525 [‡]

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Note: Factor loadings below 0.4 have been suppressed and items have been sorted by size on each factor.

Factor one is mainly concerned with social needs of railway passenger with 5 items explaining 21.56% of the needs of railway passengers with corresponding eigenvalues equal to 3.67 after rotation. Factor two is functional related

needs and is linked to 6 items of the original 9 items. Luggage (FN8) and professional appearance of staff (FN6) have been deleted from the functional construct, while the remaining item which are food inside the train (FN9)

has been fused into a newly created construct called ancillary need (i.e. Factor 4). Accordingly, the functional need new construct explaining 17.61% of the needs of railway passengers with corresponding eigenvalues equal to 2.994 after rotation.

Factor three is allied to emotional needs and is composed of 4 items of the original 6 items after deleting atmosphere (EN6) and entertaining experience (EN5) amalgamated into the newly created factor called ancillary need (i.e. factor 4). As a result, the emotional need construct explaining 14.97% of the needs of railway passengers with corresponding eigenvalues equal to 2.544 after rotation. Factor four is more difficult to reconcile. The items comprising this factor are formed from one functional need and one emotional need. These items are "food inside the train with loading 0.762 and entertaining experience with loading 0.705. The naming of this new construct follows the recommendation by Hair et al. (2006) in that the items with higher loading contributes to naming the new latent variable (i.e. factor 4). As a consequence, the new latent variable "ancillary needs" have been considered with the items food inside the train with loading of 0.762 and entertaining experience with loading 0.705 contributing to the naming of the new construct. Therefore, the ancillary need construct has been formed with 2 items contributing to explaining 9.429% of the needs of railway passengers with corresponding eigenvalues equal to 1.603 after rotation.

A split sample analysis has been performed to obtain a degree of generalizability of the results of factor solutions to the population (railway passenger tr-

avelling on train between Cairo and Alexandria) and both split samples have shown stability within the two samples.

To test research hypothesis a combined cluster routine has been used. First, a hierarchical clustering method has been performed using the Ward's algorithm based on Squared Euclidean Distance as a linkage method and that resulted in deleting 19 cases from the sample. As a second step, a *K*-means procedure (non-hierarchical) with an initial seed generated from Ward's-method (hierarchical), as suggested by Hair et al. (2006) has been followed on a reduced sample of size 396 cases. Using the non-hierarchical procedure 3, 4, and 5 clusters were tested. A decision regarding the selection of the number of cluster has been in favor of 3 clusters. The reason for this decision was that four heterogeneous clusters were obtained but the cluster solutions fail to coincide with the Ward's method, while five clusters solution could not achieve heterogeneity of clusters. The final cluster analysis has generated three distinct passenger groups based on needs sought from railways: functional passengers, hedonic passengers, and ancillary passengers (Table 4). The three groups showed strong significant statistical differences ($p < 0.01$) with respect to the four based factor needs scores: functional passengers ($F = 7.103$), hedonic passengers ($F = 216.801$), and finally ancillary passengers ($F = 249.599$). Thus, H_1 positing that railway passengers can be segmented based on needs was supported.

Table 4: Results of cluster analysis

Railway passenger needs	Cluster means ^a			F-values
	Cluster 1 Functional	Cluster 2 Hedonic	Cluster 3 Ancillary	
Social	-0.175	0.143	-0.141	4.285*
Functional	0.193	0.009	0.278	7.103**
Emotional	-1.424	0.437	0.297	216.801**
Ancillary	-0.302	-0.747	0.879	249.599**
Cluster Size	79	165	152	
Percentage of Sample	19.95	41.67	39.38	

Notes: ** $p < 0.01$; ^athe cluster means are based on factor scores

* $p < 0.05$

Cluster 1, functional passengers, accounting for 19.95% of the respondents, was distinguished from other segments by their higher functional need seeking. They demonstrated negative score on the rest of the classification variables. Cluster 2, hedonic passengers, representing 41.67 percent of the sample showed a relatively higher score on emotional needs and the lowest score on functional needs. Finally, Cluster 3, ancillary passengers, representing 39.38 percent of the sample, displayed high score on ancillary needs and the second highest score on emotional need, while lowest score on functional needs. It appears from the cluster solution that the classification variable social passenger was not relevant to the Egyptian railway; this was demonstrated through negative

score in cluster 1 and 3, while relatively low score in cluster 2.

Testing H2 based on the results of cluster analysis, chi-squared test was performed to determine if the three clusters differ in demographic characteristics (Table 5). The results showed that the cluster groups differed significantly in education ($\chi^2 = 13.174, p < 0.05$) and occupation ($\chi^2 = 13.068, p < 0.05$) supporting H_{2c} and H_{2d} . However, they showed no difference in gender status ($\chi^2 = 1.257, p = 0.533$), age ($\chi^2 = 13.74, p = 0.089$), and income ($\chi^2 = 2.394, p = 0.664$), not supporting either H_{2a} , H_{2b} nor H_{2e} .

Table 5: Demographic profiles of the cluster segments

Variables	Cluster 1	Cluster 2	Cluster 3	Pearson χ^2
	Functional $n_1(\%)$	Hedonic $n_2(\%)$	Ancillary $n_3(\%)$	
Gender				
Male	54(68.4)	110(66.7)	94(61.8)	1.257
Female	25(31.6)	55(33.3)	58(38.2)	
Age				
16-24	29(36.7)	54(32.7)	41(27)	13.740
25-34	17(21.5)	51(30.9)	53(34.9)	
35-44	20(25.3)	23(13.9)	35(23.0)	
45-54	5(6.3)	18(10.9)	14(9.2)	
55 and More	8(10.1)	19(11.5)	9(5.9)	
Education				
College Student	23(29.1)	28(17.0)	27(17.8)	13.174*
Certificate below college/Diploma	7(8.9)	27(16.4)	23(15.1)	
College graduate	24(30.4)	76(46.1)	59(38.8)	
Post graduate	25(31.6)	34(20.6)	43(28.3)	
Occupation				
Government	13(16.5)	31(18.8)	25(16.4)	13.068*
Private	24(30.4)	37(22.4)	56(36.8)	
Professional	19(24.1)	31(18.8)	34(22.4)	
Other	23(29.1)	66(40.0)	37(24.3)	
Income				
less than 1000	23(29.1)	52(31.5)	37(24.3)	2.394
1000 to < 3000	31(39.2)	63(38.2)	68(44.7)	
More than 3000	25(31.6)	50(30.3)	47(30.9)	

Notes: * $p < 0.05$; values given in parenthesis are calculated in percentage

In testing H3 based on the results of cluster analysis, chi-squared test was performed to determine if the three clusters differ in patronage profiles (Table 6). The results showed that the cluster groups differed significantly in ticket class ($\chi^2 = 7.365, p < 0.05$) sup

porting H_{3a} . However, they showed no difference in purpose of travelling ($\chi^2 = 5.888, p = 0.436$) and frequency of using train ($\chi^2=6.552, p=0.586$) not supporting H_{3b} and H_{3c} ; respectively.

Table 6: Patronage profiles of the cluster segments

Variables	Clusters			Pearson χ^2
	Cluster 1 Functional	Cluster 2 Hedonic	Cluster 3 Ancillary	
	$n_1(\%)$	$n_2(\%)$	$n_3(\%)$	
Ticket Class				
First class	29(36.7)	54(32.7)	72(47.4)	7.365*
Second class	50(63.3)	111(67.3)	80(52.6)	
Purpose of travelling				
Work	43(54.4)	79(47.9)	64(45.5)	5.888
Entertainment/shopping	6(7.6)	21(12.7)	26(17.11)	
Education	14(17.7)	28(17)	20(13.2)	
Visit friends/relatives	16(20.3)	37(22.4)	37(24.3)	
Frequency of using train				
Daily	7(8.9)	8(4.8)	8(5.3)	6.552 ^a
1-2 per week	23(29.1)	36(21.8)	38(25.0)	
1-2 times per month	29(36.7)	70(42.4)	66(43.4)	
Weekend	7(8.9)	23(13.9)	12(7.9)	
Others	13(16.5)	28(17.0)	28(18.4)	

Notes: * $p < 0.05$; values given in parenthesis are calculated in percentage

a. Some cells have expected counts less than 5.

A direct approach for validating the cluster solution has been obtained by comparing solutions obtained from the hierarchal method (i.e. Ward's Method) and the non-hierarchal method (i.e. quick cluster) in which case the number of

cluster and cluster solution have been found to be in agreement.

6. Conclusion

This study aim to identify Egyptian railway passenger segments based on

their needs and profiled the identified segments into demographic characteristics and train patronage. Findings indicate that passenger needs sought generated four factors: social, functional, emotional, and ancillary needs. Social needs construct have remain unchanged with the same items and explain 21.56 % of the needs of railway passengers which contribute the variation of need matrix. However, the functional needs construct have been changed due to the cross loading in the professional appearance of staff item and explained 17.6% of the needs of railway passengers. Also, emotional needs construct have been changed and explained 14.97 % of the needs of railway passengers. Because of the change occurred in the functional and emotional needs construct, the factor four is a newly created construct which called ancillary needs. This type of needs has been formed with two items which are food inside the train and entertaining experience. While, Hagen (2009) used need scope segmentation and identified six different need segments of Dutch railway which are the explorer, the individualist, the functional planner, the certainty seeker, the socialize and the convenience seeker. Also, Pas and Huber (1992) identified five railway traveler groups based on traveler needs and preferences in the Piedmont region of North Carolina which are functional traveler, day tripper, train lover, leisure-hedonic traveler, and family traveler. However, Egyptian railway passengers want new type of needs which is ancillary needs.

Findings also indicate that cluster groups differed significantly in education, occupation, and ticket class. However, they showed no difference between clusters according to their gender, age, income, purpose of travelling, and frequency of using train. Train patronage profile reported that hedonic passenger had the highest percentage of second class compared to the two segments. The findings of this study support the theoretical point of view that different categories of customers have different needs and preferences toward service, and emphasis on the important need to analyze the different needs of each category to enhance customer satisfaction and improve customer services.

This study has some limitations such as the participants of this study were not random sample, but on a convenience base, limiting its power to generalize the results to all railway passengers in Egypt. This study depends on need segmentation approach. Thus, future research will need to extend other types of segmentation bases such as lifestyle, values, personality, and psychographic segmentation, to examine railway sector from different perspectives. Also, using cluster analysis sometimes reflecting unreal results and only depending on data statistical view. Future research can avoid this limitation through validating the cluster solutions through criterion variables that have a relationship with the clustering variables, and usually related to outcomes measures such as satisfaction, loyalty or repurchase intentions (Hair et al., 2006).

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