Open Access

OBM Genetics

LIDSEN Publishing Inc.

Original Research

The Screening Strategies Used to Establish Egyptian Women Entrepreneurs' Attitudes towards Genetic Technology

Nadia A. Abdelmegeed Abdelwahed *

Department of Business Management, College of Business Administration, King Faisal University, Al Hofuf, AlAhsa, Saudi Arabia; E-Mail: nabdelwahed@kfu.edu.sa

* **Correspondence:** Nadia A. Abdelmegeed Abdelwahed; E-Mail: nabdelwahed@kfu.edu.sa

Academic Editor: Gerhard Litscher

Special Issue: Auricular Medicine: Prevention, Auriculodiagnosis and Auriculotherapy using Evidence-Based Complementary Medical Methods

OBM Genetics
2024, volume 8, issue 2
doi:10.21926/obm.genet.2402241

Received: March 12, 2024
Accepted: June 04, 2024
Published: June 12, 2024

Abstract

In this quantitative study, the researcher examined the screening strategies used to establish Egyptian women entrepreneurs' attitudes toward genetic technology. Using a questionnaire, the researcher collected data from 318 Egyptian women entrepreneurs. From applying the path analysis through Analysis of Moment Structures (AMOS) version 26.0, this study's findings demonstrate genomic knowledge's positive effect on attitudes towards genetic technology ($\beta = 0.176$; $p = 0.003$). The path analysis shows that, on the one hand, the feasibility of screening procedures has a positive effect on attitudes toward genetic technology ($\beta = 0.171$; $p = 0.000$). On the other hand, this study's findings show that societal and health system issues negatively and not statistically significantly affect attitudes toward genetic technology ($\beta = -0.007$; $p = 0.556$). In addition, this study's findings help towards initiatives to improve genomic literacy through educational programs and in association with genetic experts. Moreover, this study's conclusions foster community assignation and open discourse to generate a knowledgeable and supportive environment, ensuring that policies and practices align with women entrepreneurs' unique needs and concerns about genetic technology.

Keywords
Attitudes towards genetic technology; feasibility of screening procedures; genomic knowledge; societal and health system issues; women entrepreneurs

1. Introduction

Genetic technology has assumed great importance in genetic testing [1, 2]. Predominantly, this test is the assessment of an individual's DNA. Genetic testing assists in diagnosing several situations that range from genetic disorders to susceptibility to specific diseases later in life [3]. Through the screening process, the individuals can identify gene transformations that may pose risks to their offspring and assist their family planning choices [4]. Pharmacogenomics uses genetic information to adapt medical preparations which reinforce safety and efficacy [5].

Furthermore, genetic testing detects genetic diseases [6]. Genetic technology provides healthcare professionals and individuals with crucial genetic information, transforms medical diagnostics, and nurtures personalized treatments for healthcare issues [7]. Therefore, developing individuals' attitudes toward genetic technology is an excellent way of avoiding several risks [8].

In the literature, several constructs, such as risks, genomic knowledge, the feasibility of screening procedures, and social and health system problems, are positive and significant predictors of attitudes toward genetic technology [9-12]. Moreover, genomic knowledge provides individuals with basic knowledge about genetic technology, which helps them to avoid risks [13]. Likewise, the feasibility of screening procedures is another significant predictor of attitudes toward genetic technology. Through this perspective, individuals can understand the availability of suitable tests and the whole screening procedure [13]. The recognition of attitudes towards genetic technology is shown by individuals' analysis of the diverse costs (economic, psychological, and social) arising from social and health system issues [13]. However, the existing literature does not examine Egyptian women entrepreneurs' attitudes toward genetic technology [14, 15] and, potentially, their influence on the decision-making processes [16]. Therefore, investigating Egyptian women entrepreneurs' attitudes toward genetic technology can provide insights that influence their adoption of new technologies and enhance their approaches to innovation, risk management, and business growth.

Moreover, comparing these attitudes with those of other potential target groups can reveal the unique perspectives and challenges faced by Egyptian women entrepreneurs, thereby facilitating the design of tailored interventions and support mechanisms that effectively address their specific needs. By identifying new treatment opportunities, Egyptian women entrepreneurs are pioneering the development of genetic testing and personalized medicine. They can create business ventures and invest in biotechnology start-ups or genetic counseling services. In addition, Egyptian women entrepreneurs' behaviors help to provide them with the necessary training and financial assistance. They can make a significant impact on international competition in biotechnology and healthcare, and they can shape public opinion on the acceptance of genetic technologies. Nevertheless, they are confronted with substantial challenges in utilizing genetic technology. Keeping these essential aspects in view, the researcher aims to answer the following question in this study:

RQ1: What is screening strategies' role in developing Egyptian women entrepreneurs' attitudes towards genetic technology?

This study's findings aim not only to contribute to the existing literature on the adoption of technology adoption, entrepreneurship, and gender studies but also to offer practical advice for policymakers, educators, and business leaders who are seeking to endorse Egyptian women entrepreneurs taking a more inclusive role in terms of genetic technology. Policymakers can use this study's findings to develop consistent policies and guidelines that recognize the equality of women's rights in developing genetic technologies. By incorporating this information into their curricula and training, educators can improve Egyptian women entrepreneurs' knowledge and skills in using this technology. At the same time, business leaders can use the insights gained from this study to develop ideas and strategies that promote inclusion and diversity within their organizations, thereby creating more significant support for Egyptian women entrepreneurs embracing genetic technologies. This study's findings may lead to policy recommendations that promote a conducive environment for Egyptian women entrepreneurs' positive adoption of gene technology. By grasping the dynamics determining Egyptian women entrepreneurs' attitudes toward genetic technology, this study's findings may represent a significant step forward. In addition, this study's findings support the development of theoretical works and the opening of new research paths, specifically in developing countries. In addition to the introduction in section 1, this paper is structured as follows. Section 2 shows the literature review and the gaps that must be filled. Section 3 explains the method used in this study. Section 4 shows the analysis. Section 5 highlights the discussion. Section 6 is the conclusion, and Section 7 covers the implications of this study's findings, the study's limitations, and recommendations for future research studies.

2. Literature Review and Gaps

2.1 Genomic Knowledge

Knowledge is a set of prearranged declarations of facts or ideas that give either a coherent judgment or an experimental consequence [17]. Genomic knowledge encompasses understanding genomes' complex structures and functions and is crucial in shaping attitudes toward genetic technology [9, 18]. Genomic knowledge supports the development of confidence in the decision-making process and the adopting of genetic technology [19, 20]. According to the evidence [10], genomic knowledge develops ethics that help overcome societal pressures. Similarly, [21]'s findings demonstrate that genomic information reinforces clinical practices where individuals can obtain personalized medicine techniques.

2.2 Feasibility of Screening Procedures

The availability and feasibility of methods are prominent in developing attitudes toward genetic technology, an essential catalyst for shaping individuals' perspectives on cultural relevance. According to [22], the promising attitudes and Javanese mothers' acceptance can be predicted through appropriate feasibility. [12]'s, [23]'s and [24]'s findings show that the feasibility of screening procedures positively affects genomic attitudes and intentions. Also, in diverse contexts, factors such as accessibility and accuracy are substantial predictors of genomic attitudes [1, 24, 25].

2.3 Societal and Health Issues

Societal and health issues refer to the various challenges and concerns that impact individuals and society. In this study, such matters relate to perceptions about using genetic technologies. Attitudes toward genetic technology inform the community about adopting gene technology, which significantly affects societal and health issues. Public attitudes towards genetically modified foods positively impact broader societal concerns regarding perceptions of genetic technologies [26-29]. According to [30], legal and ethical social issues in health technology exploration, mainly genetic screening, highlight the need for a comprehensive evaluation process. According to [31, 32] the social and ethical implications of evolving medical technologies from the perspectives of individuals living with genetic conditions offer a crucial patient-centered viewpoint. Evaluating genomic technologies associated with genetic technologies being integrated into healthcare systems is helpful regarding economic considerations [33-35]. In low- and middle-income countries, there is a strong relationship between clinical genetic testing and several ethical, social, and cultural issues [11]. Similarly, the moral, legal, and social complexities surrounding noninvasive prenatal genetic testing hinder the decision-making process [36].

2.4 Attitudes towards Genetic Technology

Individual attitudes towards genetic technology refer to people's thoughts, opinions, and feelings about something and, in the case of this study, genetic technology. According to [37], trust, belief in public efficacy, and attitudes toward genetic science are positively connected. More particularly, [38]'s findings demonstrate the positive and substantial impact of genetics experience on attitudes toward germline gene editing. Attitudes towards gene technology help to develop trust in institutions [39]. According to [40], parenthood positively affects attitudes toward information about genetic testing; similarly, students support gene technology [41].

3. Development of the Hypotheses

3.1 Genomic Knowledge and Attitudes towards Genetic Technology

Knowledge of genetic technology develops individuals' attitudes towards its adoption of technology. The increased understanding of genetics and genetic testing tends to correlate with more positive attitudes toward genetic technology [42-47]. This shows that, as individuals become more informed about the scientific principles and applications of genetics, they are more likely to have a favorable view of genetic technology and recognize its potential benefits in various domains, such as healthcare and agriculture. On the contrary, intellectual capacity hinders individuals from adopting genetic testing [48, 49]. Skepticism about genetic testing may arise from either ambiguities or misconceptions concerning its ramifications, apprehensions regarding privacy and prejudice, or ethical deliberations about genetic alterations. In the same vein, numerous scholars, such as [50-52], suggest and have highlighted and emphasized the massive roles played by practical educational approaches and communication in positively supporting the development of attitudes towards genetic technology.

Consequently, genomic knowledge and education are massive and substantial predictors of attitudes toward genetic technology. Ultimately, this rapidly changing field leads to informed

decision-making processes and responsible governance. Nevertheless, as far as Egyptian women entrepreneurs are concerned, genomic knowledge is a requirement if genetic technology is to be adopted. This assists in developing ethics and, in turn, helps to overcome societal pressures. Therefore, the researcher formulated the following hypothesis:

H1. *Genomic knowledge positively affects Egyptian women entrepreneurs' attitudes towards genetic technology.*

3.2 Feasibility of Screening Procedures and Attitudes towards Genetic Technology

The feasibility of screening processes is necessary in determining attitudes towards genetic technology [53]. [54]'s findings show that general practitioners' expanded carrier screening significantly predicts attitudes. [55]'s findings highlight that genomic newborn screening for rare diseases is the technical aspect of implementing advanced genetic screening technologies. The relevant studies' findings signal that attitudes toward genetic technology reflect the positive effect of societal perceptions and the readiness for genetic technologies [1, 36]. The study findings of several researchers, such as [56, 57], show that families' mindsets towards screening mindset positively enhance attitudes toward genetic technology. Similarly, patient attitudes about genetic carriers support the adoption of screening [58]. The feasibility of telegenic counseling plays a meaningful role in developing policies [59, 60]. Consequently, the literature mentioned above underscores the necessary attitudes about the feasibility and implementation of genetic screening programs that bring together technical, ethical, and societal considerations. However, there is a need for further investigation among Egyptian women entrepreneurs about the screening process's role in developing their attitudes toward genetic technology. Based on this lack of empirical evidence, the researcher formulated the following hypothesis:

H2. *The feasibility of the screening process positively affects Egyptian women entrepreneurs' attitudes towards genetic technology.*

3.3 Societal and Health System Issues and Attitudes towards Genetic Technology

The health system's and society's problems are significant barriers that must be overcome to develop positive attitudes toward genetic technology. According to [61], public perceptions about the US healthcare system's human genome editing have raised concerns regarding ethical implications and equitable access. Considerations of inclusivity and disability rights within precision medicine and genetic technologies [62]. [63] demonstrate that societal perceptions of genetically modified products influence the healthcare system's use of gene technology. [64]'s findings give historical perspectives on the societal and medical consequences of the Human Genome Project and highlight the positive impact on healthcare policies and practices. According to [65], public safety and ethical concerns about genetic engineering in agriculture run parallel to those in healthcare. Soc societal responses affect public acceptance of technological advances in the healthcare system [66]. According to [67], there are several global challenges regarding the use of genetic technologies in healthcare systems.

Public attitudes towards gene-edited foods reflect cultural influences on perceptions of genetic technologies [68]. Similarly, [69]'s findings identify the facilitators and the barriers to the delivery of gene service models. These underscore the impact of health system issues in shaping attitudes

towards adopting genetic technology. Consequently, the literature mentioned above describes the complex association between societal attitudes, health system dynamics, and the adoption of genetic technologies in healthcare systems. However, it is noteworthy that these relationships are outside the Egyptian context, precisely that of women entrepreneurs. Therefore, the researcher formulated the following hypothesis:

H3*. Societal and health system issues positively affect Egyptian women entrepreneurs' attitudes toward genetic technology.*

Consequently, in the literature mentioned above, it is crystal clear that constructs, such as genomic knowledge, the feasibility of screening procedures, and social and health system issues, are positive and significant predictors of attitudes towards genetic technology [9-12, 18, 20, 33]. However, gaps in the existing literature still need to be filled. For instance, no model combines the existence of genomic knowledge, the feasibility of screening procedures, and social and health system issues related to attitudes toward genetic technology. Moreover, contextually, there is also a lack of empirical evidence among Egyptian women entrepreneurs. Based on these existing associations and to fill these gaps, the researcher recommends the following model (see Figure 1) for confirmation.

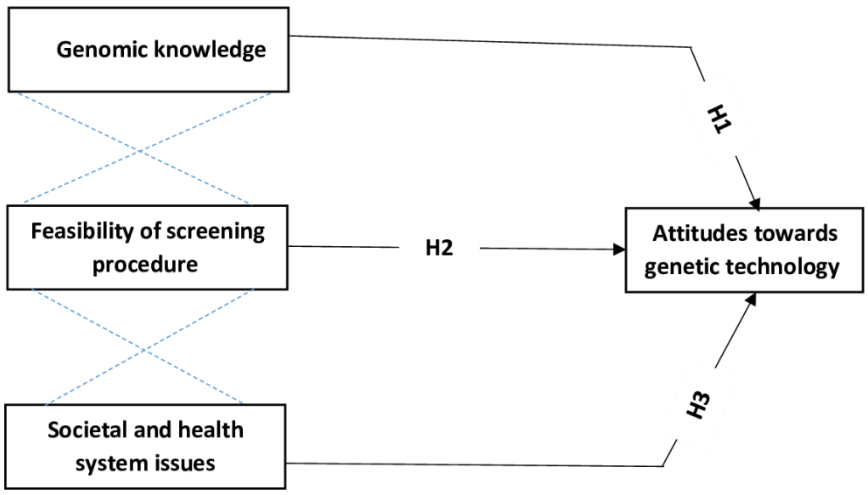

Figure 1 Model of the study. Source: Developed by the author.

4. Materials and Methods

4.1 Research Design and Respondents

The researcher based this study on quantitative methods, which are significant in the social, management, business, and medical fields [70]. This is the best approach for this study due to its deep involvement in numbers and because it provides valuable insights and consequences in numbers and figures [71]. In their previous studies, several scholars, such as [9, 11, 12, 14, 15, 18, 33, 47], have applied this approach to their investigations of the different perspectives of genomic technology. The researcher targeted Egyptian women entrepreneurs because of their unique visions and comprehensive understanding of societal attitudes toward genetic technology [14, 15]. By classifying new treatment opportunities, Egyptian women entrepreneurs are ground-breaking in

developing genetic testing and using adaptive medicine. They can create business ventures and invest in biotechnology start-ups or genetic counseling services.

Moreover, their behavior helps support and provide the necessary training and financial assistance. By shaping public opinion and the acceptance of genetic technologies, they can significantly impact international competition in biotechnology and healthcare. The inclusivity guarantees that this study reflects real-world demographics and, in doing so, offers a more representative and unbiased analysis. Egyptian women entrepreneurs' potential influence on decision-making processes, their role in the adoption of innovative technology adoption, and their engagement in ethical discussions are all aspects that make their participation essential in this study [16].

4.2 Data Collection Instrument and Assessment of Its Reliability

As adopted from the literature, the researcher used a questionnaire in both English and Arabic to collect the data. Before moving to collect the large-scale data, the researcher used a pilot study between 15 and 25 September 2023 to confirm the questionnaire's validity and reliability. The researcher used convenience sampling to collect data from 16 people by visiting them personally. Regarding the questionnaire's reliability, the researcher used Cronbach's alpha to confirm its internal consistency. The researcher found good overall reliability (0.796), while the reliability of every construct appeared to be greater than 0.70 (fair) [32].

In addition, the researcher sent the questionnaire to two university professors to ensure the SEM analysis was done through AMOS and content, format, and language. One was Professor Mohammed Ali Mustafa of Saudi Arabia's King Faisal University, and the other was Professor Naimatullah Shah (of Saudi Arabia's Al Yamamah University, Saudi Arabia. After minor modifications, the researcher issued a valid and reliable questionnaire to collect large-scale data from the respondents.

4.3 Data Collection Methods and Sample Size

The researcher used a questionnaire to collect the data between 1 October 2023 and 31 January 2024. The researcher collected the data both online and offline. Regarding online collection, the researcher used social media networks such as Facebook, Twitter, Instagram, LinkedIn, WhatsApp, and Email. Regarding offline collection, the researcher did this personally by visiting the participants. The researcher employed the convenience sampling technique to identify the participants, which saved me time and money, given its ease of use. Before issuing the questionnaire, the researcher ensured the participants' ethical values by informing them about this study's aim and objectives and assuring them of their responses' confidentiality and privacy. Also, the researcher asked the participants to sign a consent form, and the researcher collected 318 reactions for the final analysis.

4.4 Measures

The researcher adopted all the scale items from the literature. More specifically, the researcher used four items to measure genomic knowledge. The researcher used three items each to measure the feasibility of screening procedures and societal and health system issues. Finally, the researcher adopted three items from [72] to evaluate attitudes toward genetic technology [See details in the

Appendix]. The researcher used a five-point Likert scale ranging from “strongly agree = 1 to disagree strongly = 5” to measure all the items.

5. Results

5.1 Demography of Respondents

The respondents' demographic information suggests that most Egyptian women entrepreneurs were between 21 and 30 years of age (n = 210 or 66.04%), and a smaller number (n = 13 or 4.09%) were less than twenty years of age. In terms of their education system as per the Egyptian educational system, a majority of respondents had higher education (bachelor's degrees (n = 170 or 53.46%); 20.75% (n = 66) had Masters/M.Phil. 15.09% or n = 48 had professional diplomas and only 0.63% or n = 2 had qualified PhD). Furthermore, 47.80% (n = 152) had 6 to 10 years of business experience, and only 13.21% (n = 42) had 21 or more years of business experience (see Table 1).

Table 1 Demography of respondents.

Construct	Category		Frequency	%
Age [years]	<20		13	4.09
	21-30		210	66.04
	31-40		77	24.21
	41 and >		18	5.66
	Total		318	100.0
Education	Primary school		04	1.26
	Preparatory school		06	1.89
	High school		22	6.92
	Higher education	Professional diploma	48	15.09
		Bachelor	170	53.46
		Masters/MPhil	66	20.75
		PhD	02	0.63
	Total		318	100.0
Experience in business [years]	<5		68	21.38
	6-10		152	47.80
	11-20		56	17.61
	21 and >		42	13.21
	Total		318	100.0

Source: Estimated by the author.

5.2 Descriptive Statistics

The descriptive statistics show a high mean score for attitudes towards genetic technology (3.782) and a small score for societal and health system issues (2.008). Similarly, the higher standard deviation scores relate to societal and health system problems (1.989), while the more minor mean scores relate to genomic knowledge (1.132). Turning to correlations, all the constructs are positive

except for societal and health system issues and, more particularly, concerning attitudes toward genetic technology (see Table 2).

Table 2 Descriptive statistics and correlation.

Variables	Mean	Std. Dev.	1	2	3	4
1. Attitudes towards genetic technology	3.782	1.150	---			
2. Genomic knowledge	3.699	1.132	0.331**	---		
3. Feasibility of screening procedure	2.986	1.316	0.401**	0.382**	---	
4. Societal and health system issues	2.008	1.989	-0.188	-0.129	0.178*	---

Source: Estimated by the author. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

5.3 Measurement Model

Initially, the researcher used the measurement model to observe convergent validity assumptions that assess the level to which the scale items are theoretically connected. In the measurement model, assumptions, such as Composite Reliability (CR), Average Variance Extracted (AVE), and loadings, should be noted [73, 74] . In the measurement model, the loading values should be >0.70, the AVE value should be >0.50, and the CR value should be >0.70 [73]. In the case of this study, as mentioned in Table 3, the factor loadings values are >0.70 for the rest of the items except GK3 (Therefore, due to low loadings, GK3 was omitted). Moreover, the researcher noted that the AVE was >0.50 and the CR was >0.70, which were acceptable scorers. Furthermore, the researcher found that Cronbach's alpha (internal consistency) among the items was within acceptable ranges (>0.70).

Table 3 Measurement model.

Construct	Item	Loading	Cronbach's alpha	Composite reliability	Average variance extracted
Genomic knowledge	GK1	0.873	0.862	0.879	0.708
	GK4	0.833			
	GK2	0.818			
Feasibility of screening procedure	FSP1	0.879	0.818	0.900	0.759
	FSP2	0.866			
	FSP3	0.852			
Societal and health system issues	SHSI1	0.763	0.762	0.782	0.544
	SHSI2	0.731			
	SHSI3	0.718			
Attitudes toward genetic technology	ATGT1	0.878	0.808	0.887	0.723
	ATGT2	0.844			
	ATGT3	0.829			

Note(s): Deleted item = GK3. Source: Estimated by the author.

In the second phase of the measurement model, the researcher observed the correlation among the variables by assessing the discriminant validity. The researcher applied discriminant validity to gauge "the square root of the average variance extracted"; this was greater than its correlations with all other constructs" [75]. Consequently, this evidence established the satisfactory discriminant validity (see Table 4).

Table 4 Discriminant validity.

Construct	ATGT	GK	FSP	SHSI
ATGT	**0.732**			
GK	0.661	**0.772**		
FSP	0.092	0.116	**0.682**	
SHSI	0.133	0.06	0.082	**0.762**

Note: Diagonals represent the square root of the average variance extracted, while the other entries represent the squared correlations—source: Estimated by the author.

5.4 Structural Model

5.4.1 Model Fit Evaluation

The researcher ensured the model's fitness with the available data [76]. Initially, the researcher confirmed chi-square statistics (χ^2 or CMIN/df) to ensure initial fit. The researcher noted that the values of χ^2 or CMIN/df were 2.602; this indicated good fitness < 3 or p > 0.005 [73]. Likewise, the researcher found that the other fit indicators were within acceptable ranges (GFI = 0.909; AGFI = 0.928; NFI = 0.927; CFI = 0.939; and RMSEA = 0.043). These scores confirmed the data's good fitness with the model [73, 77, 78] see Table 5 and Figure 2).

Table 5 Model fit indices.

Fit measures	Acquired values	Suggested values	Status
Chi-square/df	2.602	<3.00	Fit
GFI	0.909	>0.90	Fit
AGFI	0.928	>0.80	Fit
CFI	0.939	>0.90	Fit
NFI	0.927	>0.90	Fit
RMSEA	0.043	<0.08	Fit

Source: Estimated by the author.

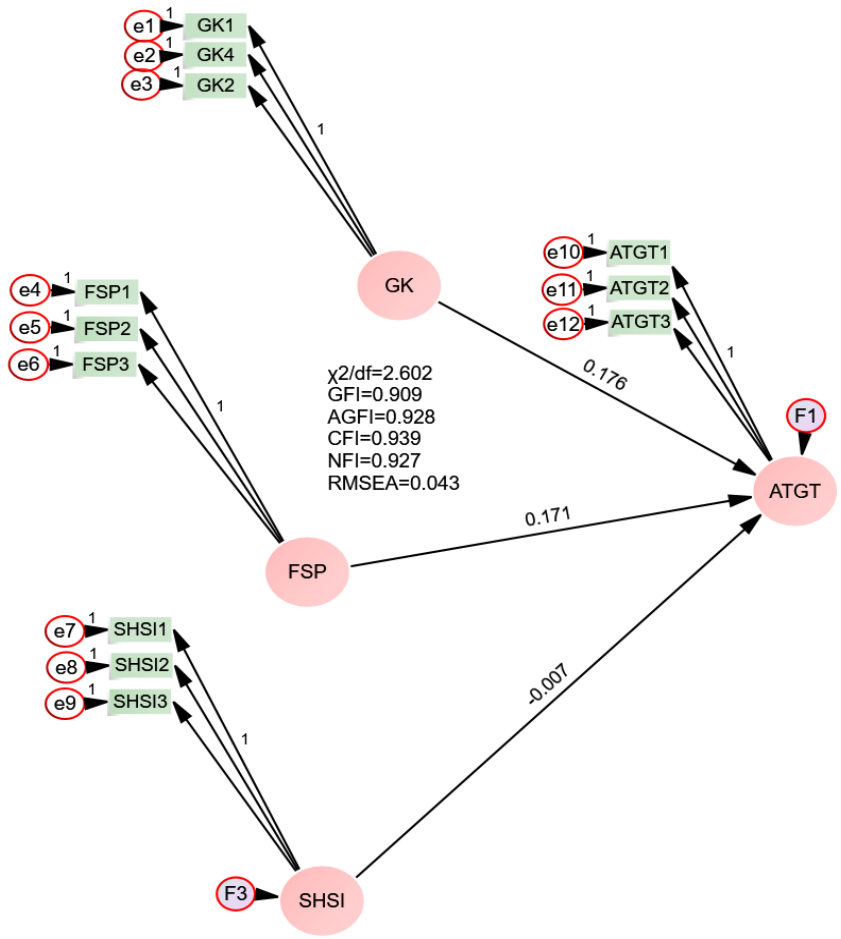

Figure 2 Path analysis. Significant at: $p < 0.001$. Source: Estimated by the author. Note(s): GK = Genomic knowledge; FSP = Feasibility of screening procedure; SHSI = Societal and health system issues; ATGT = Attitudes towards genetic technology.

5.4.2 Assessment of the Hypotheses

The researcher applied path analysis through AMOS to ensure the proposed effects. The researcher noted that the model's total R^2 was 0.349. In this study, the researcher found that genomic knowledge positively impacted Egyptian women entrepreneurs' attitudes toward genetic technology. Therefore, hypothesis H1 is accepted (β = 0.176; CR = 2.986; p = 0.003). Moreover, on the one hand, the feasibility of the screening procedure has a positive effect on Egyptian women entrepreneurs' attitudes toward genetic technology (β = 0.171; CR = 3.565; p = 0.000). Therefore, hypothesis H2 is accepted. On the other hand, societal and health system issues harm Egyptian women entrepreneurs' attitudes toward genetic technology (β = -0.007; CR = 0.589; p = 0.556). Therefore, hypothesis H3 is rejected (see Table 6 and Figure 2).

Table 6 Path analysis.

Hypothesis	Std. estimate	SE	CR	p-value	Decision
H1: Genomic knowledge → attitudes towards genetic technology	0.176	0.059	2.986	0.003	Accepted

H2: Feasibility of screening procedure → attitudes towards genetic technology	0.171	0.048	3.565	0.000	Accepted
H3: Societal and health system issues → attitudes towards genetic technology	-0.007	0.012	0.589	0.556	Rejected

Significant at: $p < 0.001$. Source: Estimated by the author.

6. Discussion and Conclusion

This study's findings demonstrate that genomic knowledge positively affects Egyptian women entrepreneurs' attitudes toward genetic technology. These findings are consistent with previous studies by scholars such as [43-47, 50]. This study's findings show that Egyptian women entrepreneurs recognize the importance of genomic technology, the risks associated with the pre-clinical phase of diseases, and the consequences of diseases related to genes. They learned these from educational backgrounds, training, and experiences. A thorough investigation into whether these entrepreneurs have backgrounds in life sciences or genetics, specific training in relevant fields, or work experience in genomics-related industries would shed light on the foundation of their knowledge.

In addition, this study's findings confirm that the feasibility of the evaluation process has a positive impact on Egyptian women entrepreneurs' attitudes toward genomic technology. These findings are consistent with previous studies [1, 42, 53-56]. These findings reflect that Egyptian women entrepreneurs develop attitudes towards genomic technology because they know the importance of the screening process. In addition, this study's findings show a strong belief and satisfaction among Egyptian women entrepreneurs about the availability of appropriate tests regarding genes. These findings reflect the relationship between the Egyptian women entrepreneurs and the review process. The findings also clarify that the screening process is not an event but an ongoing, dynamic process. This theory emphasizes continuous evaluation and analysis modification to ensure that it remains relevant and effective over time.

Contrary to the researcher's expectation, the results appeared to have a negative and not statistically significant effect on societal and health issues and attitudes towards genetic technologies. These results are accorded with studies of [61-63], who confirmed the negative association between societal and health problems and attitudes towards genetic technologies, and in contradiction with the results of [65-67], who claimed the positive relationship between societal and health issues on attitudes towards genetic technologies. This study's findings highlight the adverse effects and emphasize health and wellness as key influences. In this context, social issues include culture and public opinion. Conversely, health problems may exist through clinical care or technology-related policies.

Regarding Egyptian women entrepreneurs achieving their goals, the social and health fields play a negative role since, as shown by this study's findings, societal and health issues are significant barriers that must be overcome to change their attitudes toward adopting genetic technology. Therefore, creating or developing a conducive environment where Egyptian women entrepreneurs can quickly and conveniently develop attitudes toward gene advancement is essential. In summary, this study's findings show that, on the one hand, both genomic knowledge and the feasibility of screening procedures have positive effects on Egyptian women entrepreneurs' attitudes toward

genetic technology. On the other hand, societal and health system issues have a negative and not statistically significant impact on their attitudes toward genetic technology.

7. Implications, Limitations, and Future Research Arena

Regarding this study's practical implications, its findings encourage attaining more genomic knowledge and perceived risk associated with this technology. This study's findings are helpful when taking initiatives to improve genomic literacy through educational programs and associations with genetic experts. Accordingly, the researcher recommends that efforts be taken to cultivate the convenience of screening procedures by addressing financial and logistical obstacles and launching awareness campaigns to underline their standing in preventive healthcare. To counter the adverse effects of societal and health system issues, there is a need for public awareness campaigns to change misconceptions and to advocate health system reforms. Moreover, fostering community assignation and open discourse will generate a knowledgeable and supportive environment and ensure that genetic technology policies and practices align with Egyptian women entrepreneurs' unique needs and concerns.

Turning to the theoretical implications, this study's findings contribute to health communication and education by highlighting knowledge broadcasting and tailored educational interventions to develop positive attitudes. In the context of adopting technology theories, this study's findings underscore the significance of perceived feasibility as a determinant of attitudes about genetic technology/In this regard, improved access to and the practical use of genetic screening procedures can positively influence their acceptance. Social theory frameworks, such as those addressing cultural perceptions and societal attitudes, are essential to understanding the nuanced influences on individual attitudes toward genetic technology. Moreover, by highlighting the need for gender-sensitive policies in the intersection of genetics and entrepreneurial endeavors, this study's findings contribute to the existing literature on gender and entrepreneurship. Theoretical public health and policy development models can draw upon these findings to refine strategies that foster positive attitudes and mitigate negative societal and systemic influences on Egyptian women entrepreneurs' adoption of genetic technology.

The researcher applied only quantitative methods in this study, limited to cross-sectional data collected using a questionnaire. The researcher did not choose any specific theory to underpin this study's conceptual framework. The researcher based this study on a few constructs: genomic knowledge, attitudes towards genetic technology, feasibility of screening procedures, and societal and health system issues. The study's respondents are restricted to Egyptian women entrepreneurs. Finally, this study's findings are based on 318 correctly completed questionnaires.

The researcher recommends that future studies use a qualitative approach, longitudinal data, and diverse data collection methods, such as questionnaires and interviews. Also, the researcher recommends applying the relevant theories to underpin each study's conceptual framework. Further, the researcher recommends that future studies include male participants and that a much larger sample be used to validate the findings.

Appendix

Genomic Knowledge [13]

- I know about the importance of genomic knowledge.

- I know about the persistent risks associated with genomic knowledge.
- Pre-clinical phase of the existing disease.
- Natural course (from susceptibility to precursor, early disease, and advanced disease) understood.

Feasibility of Screening Procedures [13]

- Entire screening procedure is acceptable to screened population.
- Suitable test or examination available.
- Screening continuing process that encompasses all elements of screening procedures.

Societal and Health System Issues [13]

- Balanced societal costs.
- Balanced economic and medical costs.
- Balance psychological costs.

Attitudes towards Genetic Technology [66]

- Using genetic technology in the health sector is a good idea.
- Using genetic technology is a pleasant experience.
- Like the idea of using genetic technology.

Acknowledgments

The researcher sincerely thankful to the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia for providing the funds. The researcher also appreciate the study respondents who gave their precious time for providing their valuable responses.

Author Contributions

Abdelwahed NAA developed all the sections.

Funding

This work was supported by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [Project No. GRANTA515].

Competing Interests

The author declares no competing interests exist.

References

1. Mitchell PB, Meiser B, Wilde A, Fullerton J, Donald J, Wilhelm K, et al. Predictive and diagnostic genetic testing in psychiatry. Clin Lab Med. 2010; 30: 829-846.
2. Abdo N, Ibraheem N, Obeidat N, Graboski-Bauer A, Batieha A, Altamimi N, et al. Knowledge, attitudes, and practices of women toward prenatal genetic testing. Epigenet Insights. 2018; 11. doi: 10.1177/2516865718813122.
3. Rogowski W. Genetic screening by DNA technology: A systematic review of health economic evidence. Int J Technol Assess Health Care. 2006; 22: 327-337.

4. Gee M, Piercy H, Machaczek K. Family planning decisions for parents of children with a rare genetic condition: A scoping review. Sex Reprod Healthc. 2017; 14: 1-6.
5. Sharkey CM. Direct-to-consumer genetic testing: The FDA's dual role as safety and health information regulator. DePaul Law Rev. 2019; 68: 22-27.
6. Ma CC, Wang ZL, Xu T, He ZY, Wei YQ. The approved gene therapy drugs worldwide: From 1998 to 2019. Biotechnol Adv. 2020; 40: 107502.
7. Rajabi F, Picker JD. New innovations: Therapies for genetic conditions. Curr Genet Med Rep. 2014; 2: 113-123.
8. Siegrist M. The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. Risk Anal. 2000; 20: 195-204.
9. Regan M, Engler MB, Coleman B, Daack-Hirsch S, Calzone KA. Establishing the genomic knowledge matrix for nursing science. J Nurs Scholarsh. 2019; 51: 50-57.
10. Chen LS, Goodson P. Public health genomics knowledge and attitudes: A survey of public health educators in the United States. Genet Med. 2007; 9: 496-503.
11. Zhong A, Darren B, Loiseau B, He LQ, Chang T, Hill J, et al. Ethical, social, and cultural issues related to clinical genetic testing and counseling in low-and middle-income countries: A systematic review. Genet Med. 2021; 23: 2270-2280.
12. Maftei A, Dănilă O. The good, the bad, and the utilitarian: Attitudes towards genetic testing and implications for disability. Curr Psychol. 2023; 42: 13589-13610.
13. Van Langen IM, Hofman N, Tan HL, Wilde AA. Family and population strategies for screening and counselling of inherited cardiac arrhythmias. Ann Med. 2004; 36: 116-124.
14. El-Attar EA, Helmy Elkaffas RM, Aglan SA, Naga IS, Nabil A, Abdallah HY. Genomics in Egypt: Current status and future aspects. Front Genet. 2022; 13: 797465.
15. Abdelwahed NA. Examining the relationship between attitudes towards genomic technology and genetic entrepreneurial intention among Egyptian healthcare professionals. OBM Genet. 2023; 7: 199.
16. Elbardisy H, Abedalthagafi M. The history and challenges of women in genetics: A focus on non-western women. Front Genet. 2021; 12: 759662.
17. Hyman J. How knowledge works. Philos Q. 1999; 49: 433-451.
18. Huser V, Sincan M, Cimino JJ. Developing genomic knowledge bases and databases to support clinical management: Current perspectives. Pharmgenomics Pers Med. 2014; 7: 275-283.
19. Poon H, Quirk C, DeZiel C, Heckerman D. Literome: PubMed-scale genomic knowledge base in the cloud. Bioinformatics. 2014; 30: 2840-2842.
20. Blanchette PS, Spreafico A, Miller FA, Chan K, Bytautas J, Kang S, et al. Genomic testing in cancer: Patient knowledge, attitudes, and expectations. Cancer. 2014; 120: 3066-3073.
21. Chow-White P, Ha D, Laskin J. Knowledge, attitudes, and values among physicians working with clinical genomics: A survey of medical oncologists. Hum Resour Health. 2017; 15: 42.
22. Widayanti CG, Ediati A, Tamam M, Faradz SM, Sistermans EA, Plass AM. Feasibility of preconception screening for thalassaemia in Indonesia: Exploring the opinion of Javanese mothers. Ethn Health. 2011; 16: 483-499.
23. Nichol BA, Hurlbert AC, Read JC. Predicting attitudes towards screening for neurodegenerative diseases using OCT and artificial intelligence: Findings from a literature review. J Public Health Res. 2022; 11. doi: 10.1177/22799036221127627.

24. Kasem A, Razeq NM, Abuhammad S, Alkhazali H. Mothers' knowledge and attitudes about newborn screening in Jordan. J Community Genet. 2022; 13: 215-225.
25. Douma KF, Aalfs CM, Dekker E, Tanis PJ, Smets EM. An e-learning module to improve nongenetic health professionals' assessment of colorectal cancer genetic risk: Feasibility study. JMIR Med Educ. 2017; 3: e7173.
26. Frewer L. 10. Societal issues and public attitudes towards genetically modified foods. Trends Food Sci Technol. 2003; 14: 319-332.
27. Mulvihill JJ, Capps B, Joly Y, Lysaght T, Zwart HA, Chadwick R, et al. Ethical issues of CRISPR technology and gene editing through the lens of solidarity. Br Med Bull. 2017; 122: 17-29.
28. Wirz CD, Scheufele DA, Brossard D. Societal debates about emerging genetic technologies: Toward a science of public engagement. Environ Commun. 2020; 14: 859-864.
29. Sandler R. The ethics of genetic engineering and gene drives in conservation. Conserv Biol. 2020; 34: 378-385.
30. Potter BK, Avard D, Graham ID, Entwistle VA, Caulfield TA, Chakraborty P, et al. Guidance for considering ethical, legal, and social issues in health technology assessment: Application to genetic screening. Int J Technol Assess Health Care. 2008; 24: 412-422.
31. Chapman E. The social and ethical implications of changing medical technologies: The views of people living with genetic conditions. J Health Psychol. 2002; 7: 195-206.
32. Gaydarska H, Takashima K, Shahrier S, Raz A, Minari J. The interplay of ethics and genetic technologies in balancing the social valuation of the human genome in UNESCO declarations. Eur J Hum Genet. 2024. doi: 10.1038/s41431-024-01549-3.
33. Buchanan J, Wordsworth S, Schuh A. Issues surrounding the health economic evaluation of genomic technologies. Pharmacogenomics. 2013; 14: 1833-1847.
34. Farrell RM. The acceptance of genetic technologies by individuals, societies, and health-care systems. In: The impact of health care. Berlin, Germany: Evangelische Verlagsanstalt; 2023. pp. 65-76.
35. Koralesky KE, Sirovica LV, Hendricks J, Mills KE, von Keyserlingk MA, Weary DM. Social acceptance of genetic engineering technology. PLoS One. 2023; 18: e0290070.
36. Minear MA, Alessi S, Allyse M, Michie M, Chandrasekharan S. Noninvasive prenatal genetic testing: Current and emerging ethical, legal, and social issues. Annu Rev Genomics Hum Genet. 2015; 16: 369-398.
37. Barnett J, Cooper H, Senior V. Belief in public efficacy, trust, and attitudes toward modern genetic science. Risk Anal. 2007; 27: 921-933.
38. Jedwab A, Vears DF, Tse C, Gyngell C. Genetics experience impacts attitudes towards germline gene editing: A survey of over 1500 members of the public. J Hum Genet. 2020; 65: 1055-1065.
39. Olofsson A, Öhman S, Rashid S. Attitudes to gene technology: The significance of trust in institutions. Eur Soc. 2006; 8: 601-624.
40. Saastamoinen A, Hyttinen V, Kortelainen M, Aaltio J, Auranen M, Ylikallio E, et al. Attitudes towards genetic testing and information: Does parenthood shape the views? J Community Genet. 2020; 11: 461-473.
41. Gardner GE, Troelstrup A. Students' attitudes toward gene technology: Deconstructing a construct. J Sci Educ Technol. 2015; 24: 519-531.
42. Haga SB, Barry WT, Mills R, Ginsburg GS, Svetkey L, Sullivan J, et al. Public knowledge of and attitudes toward genetics and genetic testing. Genet Test Mol Biomarkers. 2013; 17: 327-335.

43. Jallinjoa P, Aro AR. Does knowledge make a difference? The association between knowledge about genes and attitudes toward gene tests. J Health Commun. 2000; 5: 29-39.
44. Bal Ş, Samancı NK, Bozkurt O. University students' knowledge and attitude about genetic engineering. Eurasia J Math Sci Technol Educ. 2007; 3: 119-126.
45. Etchegary H, Cappelli M, Potter B, Vloet M, Graham I, Walker M, et al. Attitude and knowledge about genetics and genetic testing. Public Health Genomics. 2009; 13: 80-88.
46. Alotaibi A, Alkhaldi NK, AlNassir AM, AlAyoubi LA, AlMalki NA, Almughyiri RA, et al. Exploring people's knowledge of genetics and attitude towards genetic testing: A cross-sectional study in a population with a high prevalence of consanguinity. Healthcare. 2022; 10: 2227.
47. Zhao H, Geng WJ, Wu RH, Li ZZ. Exploring female relatives of patients with hemophilia' awareness, attitudes, and understanding towards genetic testing. J Multidiscip Healthc. 2024; 17: 711-721.
48. Wagner W, Kronberger N, Seifert F. Collective symbolic coping with new technology: Knowledge, images and public discourse. Br J Soc Psychol. 2002; 41: 323-343.
49. Sturgis P, Cooper H, Fife-Schaw C. Attitudes to biotechnology: Estimating the opinions of a better-informed public. New Genet Soc. 2005; 24: 31-56.
50. Pearce A, Mitchell LA, Best S, Young MA, Terrill B. Publics' knowledge of, attitude to and motivation towards health-related genomics: A scoping review. Eur J Hum Genet. 2024. doi: 10.1038/s41431-024-01547-5.
51. Carver RB, Castéra J, Gericke N, Evangelista NA, El-Hani CN. Young adults' belief in genetic determinism, and knowledge and attitudes towards modern genetics and genomics: The PUGGS questionnaire. PLoS One. 2017; 12: e0169808.
52. Barns I, Schibeci R, Davison A, Shaw R. "What do you think about genetic medicine?" Facilitating sociable public discourse on developments in the new genetics. Sci Technol Hum Values. 2000; 25: 283-308.
53. Harris AR, Walker MJ, Gilbert F, McGivern P. Investigating the feasibility and ethical implications of phenotypic screening using stem cell-derived tissue models to detect and manage disease. Stem Cell Rep. 2022; 17: 1023-1032.
54. Schuurmans J, Birnie E, van den Heuvel LM, Plantinga M, Lucassen A, van der Kolk DM, et al. Feasibility of couple-based expanded carrier screening offered by general practitioners. Eur J Hum Genet. 2019; 27: 691-700.
55. Stark Z, Scott RH. Genomic newborn screening for rare diseases. Nat Rev Genet. 2023; 24: 755-766.
56. Boardman FK, Young PJ, Griffiths FE. Population screening for spinal muscular atrophy: A mixed methods study of the views of affected families. Am J Med Genet A. 2017; 173: 421-434.
57. Manchanda R, Gaba F. Population based testing for primary prevention: A systematic review. Cancers. 2018; 10: 424.
58. Shiroff JJ, Gregoski MJ. The measurement of patient attitudes regarding prenatal and preconception genetic carrier screening and translational behavioral medicine: An integrative review. Transl Behav Med. 2017; 7: 364-370.
59. Andermann A, Blancquaert I, Déry V. Genetic screening: A conceptual framework for programmes and policy-making. J Health Serv Res Policy. 2010; 15: 90-97.
60. Chu AT, Chung CC, Hue SP, Chung BH. The growing needs of genetic counselling-feasibility in utilization of tele-genetic counselling in Asia and Hong Kong. Front Genet. 2023; 14: 1239817.

61. Nelson JP, Tomblin DC, Barbera A, Smallwood M. The divide so wide: Public perspectives on the role of human genome editing in the US healthcare system. Public Underst Sci. 2024; 33: 189-209.
62. De Paor A, Blanck P. Precision medicine and advancing genetic technologies-disability and human rights perspectives. Laws. 2016; 5: 36.
63. Medani KR, Neill A, Garrod G, Ojo M, Hubbard C. Societal perceptions and attitudes towards genetically modified (GM) crops, feed, and food products in the Middle East, North Africa, and Turkey (MENAT) region: A systematic literature review. Food Qual Prefer. 2024; 117: 105148.
64. Collins FS. Medical and societal consequences of the human genome project. N Engl J Med. 1999; 341: 28-37.
65. Koralesky KE, Tworek HJ, von Keyserlingk MA, Weary DM. "Frequently asked questions" about genetic engineering in farm animals: A frame analysis. Food Ethics. 2024; 9: 7.
66. Schönmann M, Bodenschatz A, Uhl M, Walkowitz G. Contagious humans: A pandemic's positive effect on attitudes towards care robots. Technol Soc. 2024; 76: 102464.
67. Omotayo O, Maduka CP, Muonde M, Olorunsogo TO, Ogugua JO. The rise of non-communicable diseases: A global health review of challenges and prevention strategies. Int Med Sci Res J. 2024; 4: 74-88.
68. Yamaguchi T, Ezaki K, Ito K. Exploring the landscape of public attitudes towards gene-edited foods in Japan. Breed Sci. 2024; 74: 11-21.
69. Raspa M, Moultrie R, Toth D, Haque SN. Barriers and facilitators to genetic service delivery models: Scoping review. Interact J Med Res. 2021; 10: e23523.
70. Karlen Y, McNair A, Perseguers S, Mazza C, Mermod N. Statistical significance of quantitative PCR. BMC Bioinf. 2007; 8: 131.
71. Golafshani N. Understanding reliability and validity in qualitative research. Qual Rep. 2003; 8: 597-607.
72. Lee MC. Predicting and explaining the adoption of online trading: An empirical study in Taiwan. Decis Support Syst. 2009; 47: 133-142.
73. Hair JF, Risher JJ, Sarstedt M, Ringle CM. When to use and how to report the results of PLS-SEM. Eur Bus Rev. 2019; 31: 2-24.
74. Purwanto A. Education management research data analysis: Comparison of results between Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS for small samples. Nidhomul Haq. 2021; 6: 382-399.
75. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. J Mark Res. 1981; 18: 39-50.
76. Carlson KD, Wu J. The illusion of statistical control: Control variable practice in management research. Organ Res Methods. 2012; 15: 413-435.
77. Mohamad B, Saad HS, Ismail SH. The role of integrity as a mediator between work satisfaction and work performance in the perspective of Islam: An empirical approach using SEM/AMOS model. Int J Res Appl Nat Social Sci. 2014; 2: 71-84.
78. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL. Multivariate data analysis. 6th ed. Upper Saddle River, NJ: Pearson Prentice Hall; 2006.