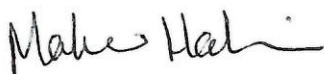


20<sup>th</sup> April 2015

To whom it may concern:

This is to certify that on 20<sup>th</sup> April 2015, Nihal Fathima submitted an honors thesis entitled Analyzing Innovation Entrepreneurship in the Arab world to the Dietrich College. This thesis has been judged to be acceptable for purposes of fulfilling the requirements to graduate with Dietrich College Honors.

Sincerely,



Maher Hakim  
Thesis Advisor

Randy Weinberg  
Department Head

Richard Scheines  
Dean, Dietrich College of Humanities and Social Sciences

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Analyzing Innovation Entrepreneurship in the Arab World, Spring 2015  
\_\_\_\_\_  
Thesis Title and Semester Completed

Carnegie Mellon University in Qatar

# Analysis of Innovation Entrepreneurship in the Arab World

Advised by : Maher Hakim

Nihal Fathima  
Carnegie Mellon University in Qatar  
P.Box :24866 Doha,Qatar  
nihalf@qatar.cmu.edu

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## ABSTRACT

The need to survive in this competitive world made Arab governments realize the importance and need for innovation and entrepreneurship for economic stability and development. They implemented various initiatives such as developments in technology and the education sector. However, there is still a dearth of an innovation driven entrepreneurship hub in the region. Previous research conducted in this realm found that culture affects or rather defines innovation initiation. However, no research has been conducted on how cultural factors affect the behavioral and cognitive skills required for innovation entrepreneurship. This paper intends to study if and what relation exists between the two. In addition this paper seeks to answer the impact of Arab culture on entrepreneurship. The research uses Clayton's Innovator's DNA model and Hofstede's 5 dimensional cultural theories on a sample of people from different cultures. The results showed that culture does indeed affect the skills required for entrepreneurship. The power distance culture factor negatively affects questioning, observation and networking behavioral skills. On the other hand Uncertainty Avoidance Culture factor negatively affects Questioning Behavioral skill. In addition Uncertainty Avoidance negatively affects a person's courage to take risks. Governments need to develop and monitor educational programs to encourage individuals on innovation entrepreneurship.

## Keywords

Innovation Entrepreneurship, Innovation and Culture, Innovation Behavior in Individuals, Innovation in Arab world, Information Technology

## INTRODUCTION

The purpose of the study is to understand the effect, if any, of cultural factors on Innovation entrepreneurship in the Arab world. The research will be based upon Clayton's Innovator's DNA model (Dyer, Gregersen and Christensen, 2011) as well as the Hofstede's 5 Cultural Dimensions theory (Geerthofstede.com, 2015). The former will help in identifying and testing the behavioral and cognitive skills of people in terms of Innovation whereas the latter would help analyze a person's relative culture index.

This empirical study will primarily focus on finding if there is any significant correlation between the cultural factors such as Power Distance, Uncertainty Avoidance and Individualism prevalent in a culture and the behavioral and associational skills in an Individual.

This study will involve surveying individuals about their individual behavioral skills leading to innovation on one hand and cultural factors affecting their behaviors on the other hand. The sample of this research will consist of individuals from Qatar and United States, more specifically students from Carnegie Mellon University Pittsburgh and Carnegie Mellon University Qatar. This will ensure that the sample consist of students representing diverse cultures and ethnicities.

## LITERATURE REVIEW

To explore and conduct this research, we need to understand the concepts of culture, innovation and the relationship between them.

### 3.1 Culture

Paul Herbig defines culture as an “Inclusive system of communications which incorporates the biological and technical behavior of human beings with their verbal and nonverbal systems of expressive behavior” (Herbig, Dunphy 1998). In simpler terms, it is the way of living life. Culture forces people to view and value social interactions differently. (Herbig, Dunphy 1998). For ex; Indians may prefer removing their shoes before entering any house, Americans may not.

### 3.2 Culture Models

There are various cultural models in use today; For ex: - The seven dimensions of culture (Trompenaars and Hampden-Turner, 1998), Patterns of cross cultural business behavior (Gesteland,1999) and Hall’s cultural compass (Hall,1998). However, for the purpose of this research, we will be using the Hofstede’s 5 Cultural Dimensions and Theory (Geerthofstede.com, 2015). Although Hofstede’s cultural model (Hofstede, 1980) has attracted much criticism, it is still one of the most widely used models and research works (Yoo, Donthu and Lenartowicz, 2011).



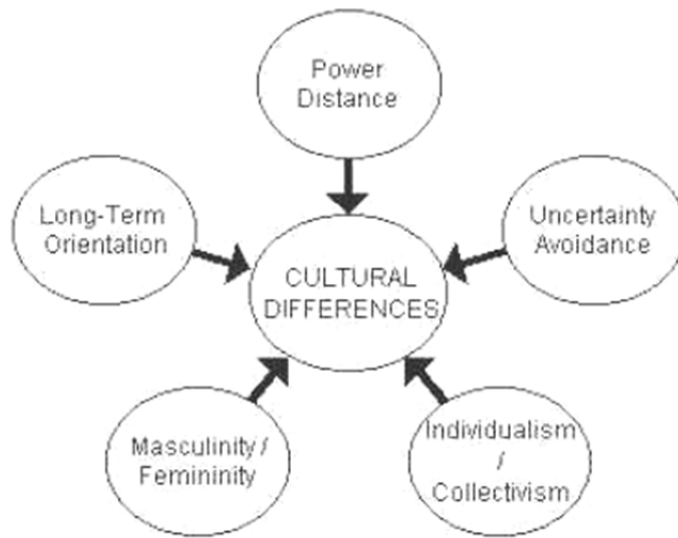


Figure 1: *Diagram depicting Hofstede's 5 cultural dimension theory* (Geerthofstede.com, 2015).

The Hofstede's 5 cultural dimension theory is a framework used for analyzing and studying the effects of culture on the values of the individuals and consequentially their behavior. The theory states that there are essentially 5 factors which differentiates one culture from the other.

**Power Distance:** "Power distance is the extent to which the less powerful members of organizations and institutions (like family) accept and expect that power is distributed unequally. This represents inequality (more versus less), but defined from below, not from above." (Geerthofstede.com, 2015)

GCC Countries such as UAE, and Kingdom of Saudi Arabia have high power distance in the range of 90-95 which is relatively high (Geert-hofstede.com, 2015). Countries such as the United States and the United Kingdom whose power distance index is 35-40 (geert-hofstede.com, 2015). Countries such as Iran, Lebanon, Syria, Iraq have power distance indexes ranging from above average (58-Iran) to high (75-Lebanon), (80- Syria), (95 -Iraq) This indicates that there is more disparity in

power distribution, in the Arab culture and this reflects the hierarchical structure as well as the strong and rigid rules and beliefs.

**Long-Term Orientation:** “Long-term oriented societies foster pragmatic virtues oriented towards future rewards, in particular saving, persistence, and adapting to changing circumstances. Short-term oriented societies foster virtues related to the past and present such as national pride, respect for tradition, preservation of "face", and fulfilling social obligations.” (Geert Hofstede.com, 2015)

There is not much data available for long-term orientation for the Arab countries (geert-hofstede.com, 2015). This factor will not be analyzed in detail for the scope of this research.

**Masculinity/Femininity:** A society reflecting high on masculinity reflects its need to be driven by individuals who are aggressive, assertive and competitive rather than its opposite which reflects individuals with qualities such as peace, care, empathy and such are preferred.

GCC Countries such as Jordan, UAE, KSA lean just a bit towards femininity, with scores ranging from 40-50 on the masculinity scale. However, this trend doesn't apply to all countries such as Iraq and Lebanon which have scores ranging from 65-70, putting them towards the masculine side. Countries such as the United States and the United Kingdom rank higher on the masculinity scale i.e. 60-65 (geert-hofstede.com, 2015)

**Individualism/Collectivism:** Cultures either give a preference to Individualism or Collectivism. Cultures encouraging individualism emphasize on an individual's need of personal achievement and taking care of their immediate family. However, cultures emphasizing on collectivism encourage community bonding and take into consideration community interests. Individuals in the former culture do not generally see themselves affiliated with a community or a group

whereas individuals in the latter take decisions by taking community interest into consideration. Arab world countries rank more on collectivism (scores ranging from 25-40 for individualism) compared to countries such as the United States, Australia and the United Kingdom (89-91) (Geerthofstede.com, 2015)

**Uncertainty Avoidance:** Uncertainty avoidance is the degree to which uncertainty and ambiguity is tolerated by the members of society.

Arab countries have higher uncertainty avoidance (80-85), more so than that of the west (35-50) (Geerthofstede.com, 2015). Exceptions are Lebanon and Syria whose uncertainty avoidance is 50 and 60 respectively.

### 3.3 Culture scales for Individuals

Although Hofstede's model has been reliable for studying and identifying cultures through the years, it is very inefficient to measure individuals (Yoo, Donthu and Lenartowicz, 2011). This was reflected in the disappointing results of psychometric scales (Triandis, 1982). In fact, when Hofstede (Hofstede cited in Yoo, Donthu and Lenartowicz, 2011) tried to do it on an individual level it was found to be inconsistent. However it worked on a country level. Furthermore, several psychometric scales have been devised which measure a single dimension of Hofstede's 5 Dimensional cultural theory (Hofstede, 1980). ex: Collectivism (Triandis, 1995) and long-term orientation (Bearden, Money et al 2006). But, these are inefficient since they measure each of Hofstede's cultural dimensions (Hofstede, 1980) independently. However, the recently developed CVSCALE (Yoo, Donthu and Lenartowicz, 2011) provides a holistic approach in measuring Hofstede's dimensions (Hofstede, 1980) at an individual level. It analyses Hofstede's survey

questionnaires which are focused on national level culture and accordingly relevant questionnaire were developed reflecting Hofstede's cultural dimension theory (Geerthofstede.com, 2015).

The survey questions used for the purpose of this research have been inspired from but not reliant on the CVSCALE (Yoo, Donthu and Lenartowicz, 2011).

### **3.4 Innovation**

There is no set definition for Innovation and its definition varies from person to person. People generally think creativity and innovation are the same, but they are not. Creativity is about generating ideas which are abstract and may or may not be usable. Innovation on the other hand, is a continuously evolving process or change which leads to value creation. In other words, it is the process of channeling creativity or idea generation to fulfill unmet customer demands which leads to value creation. Innovation is both a process and an outcome. It is basically action producing whereas creativity is idea generation. In relative terms, creativity leads to innovation. Creativity is the back-end and Innovation is the front end (Venkat, 2010). Innovation can be either successful or a failure. The chances of success and failure depends on several factors such as time, competition, complexities etc (More, 2011). Successful innovation is determined by its (Return on Index ) ROI, positive cash flows etc. In other words its ability to generate income (More, 2011) (Anon,2014). Successful innovation is what contributes to the country's economy in a meaningful way thereby pushing governments to invest in it. This definition of successful innovation is what we will be using in our research. Innovative entrepreneurs create and sustain successful innovations.

### **3.5 Innovation Models in Individuals**

For the basis of this research, we will be using Clayton's Innovator's DNA Model (figure 2).

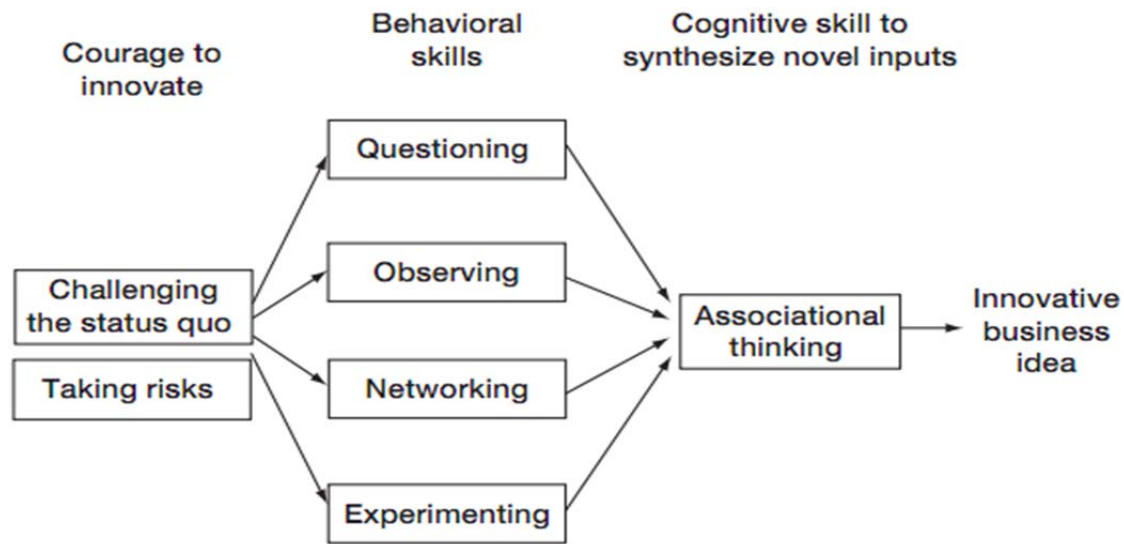


Figure 2: Diagram depicting Clayton's Innovator's DNA model(Dyer, Gregersen and Christensen, 2011)

Clayton Christensen analyzes the behaviors of entrepreneurs to see what sets them apart from the rest.

**Courage to Innovate:** A successful innovator possesses the ability and courage to challenge the status quo and take risks. Innovation requires one to deal with ambiguity, take huge risks and question the authority and the hierarchical nature of society.

**Behavioral skills:** Clayton identifies 5 core skills an innovator possesses: Questioning, Observing, Networking and Experimenting. These are crucial for innovators as these allow them to identify innovative ideas by challenging the natural order of things. Questioning and Observing allows them to identify the environment around them and the needs of individuals. Networking allows them to gather more information and knowledge from sources outside their own whereas Experimenting allows test out their theories.

**Cognitive skills:** Having just the courage to innovate along with behavioral skills is not enough to become an innovator. One needs to be able to synthesize the information and knowledge gathered to be able to become a successful innovator. Clayton has identified this to be Associational thinking.

### 3.6 Innovation and Culture

Various research conducted in this field has proved that there is a strong relationship between Innovation and Culture. “Culture has a profound influence on the innovative capacity of a society. A society’s values provide social direction to the process of technological development”. (Williams and McGuire, 2008). In addition to this, Kaasa suggested in his 2008 work, that although culture unifies people, it may also act as a barrier for innovation development since people’s belief can “contribute or block the process of developing and implementing new ideas” (Kaasa, Vadi, 2008).

Although previous research works such as (Williams and McGuire, 2008), (Ahmad,2012), (Herbig, Dunphy 1998),(Kaasa, Vadi, 2008), agree on the effect of culture on innovation, there have been different approaches for studying the relation . Several authors (Herbig & Dunphy cited in (Ahmad,2012)), (Kaasa & Vadi, cited in (Ahmad, 2012)) have used the direct application of Hofstede’s Dimensional theory (Hofstede, 1980) to countries to study the nation-wide effects on Innovation Initiation. (Ahmed, 2012). Williams considers that culture affects economic creativity which in turn affects innovation initiation (Williams and McGuire, 2008) whereas Kaasa considers that culture affects Innovation specifically measured through patent application (Kaasa, Vadi, 2008).

However as mentioned in the previous section, we will be considering successful innovators and their innovation as the basis for conducting research rather than relying on other values of

innovation, such as, patents. Patents are one dimensional statistic measures for innovation. Although, patents are unique and different, they might not be tangible or cater to user's needs. Moreover, the number of patent applications by a country may not directly correlate to its economic development and therefore this measure was not considered for this research.

### 3.7 Innovation and Culture in MENA region

Traditionally, entrepreneurs or Arab private owners in the Oil producing states such as the UAE and Saudi Arabia preferred investing in zero risk and non-innovative activities. They refrained from investing in industrial activities which involved high risk and vast technical knowledge and innovation (Oukil, M, 2011). However this has changed. Internal and External groups have been pressuring these countries to allow for more liberalization and diversification (Oukil,M, 2011). Arab countries realized the importance of technology development and innovation as part of economic development as well as to strengthen competitiveness. However, even though there is a lot of investment given in entrepreneurship training, there is still a weakness in creating Saudi entrepreneurs (Ahmad Z, 2012). Some believe that the reason may be because of lack of research on Innovation and Entrepreneurship (Oukil M 2011) while others believes the Middle Eastern Culture is a hindrance in this cause as all cultural factors are opposite to an ideal entrepreneurship culture (Ahmad Z, 2012).

## RESEARCH QUESTION

Individual's behaviors and thinking are constantly affected or determined by the culture they live in, but to what extent? And how does it affect the initiation of "Innovation Entrepreneurship"? This research aims to understand individual behavior with regards to innovation entrepreneurship and culture. It will answer the leading question of what is the impact of Arab culture on innovation

entrepreneurship by incorporating Clayton's Innovator's DNA model (Dyer, Gregersen and Christensen, 2011) and Hofstede's 5 dimensional cultural theory (Geerthofstede.com, 2015).

## RESEARCH MODEL AND HYPOTHESIS

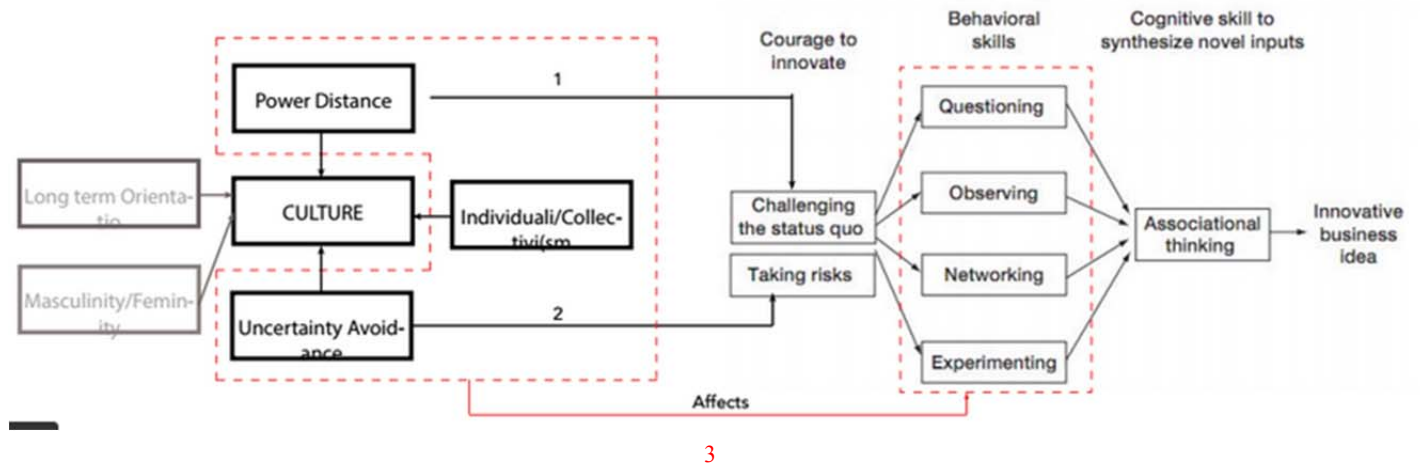


Figure 3: Hypothesis testing research model comprising Hofstede's cultural theory (Geerthofstede.com, 2015) and Clayton's Innovator's DNA model (Dyer, Gregersen and Christensen, 2011)

Figure 3 demonstrates the hypothesis which will be tested below.

1. Power distance **negatively affects** courage to challenge the status Quo

*High power distance → Low Courage to Innovate*

2. Uncertainty avoidance **negatively affects** courage of people making risky decisions.

*High Uncertainty avoidance → Low chance of taking risks*



3. Cultural factors (power distance, uncertainty avoidance and individualism/collectivism) **affect** behavioral skills (Questioning, Observing, Networking and Experimenting) and associational cognitive skills.

To test the above hypotheses, we conducted a study which took students from Carnegie Mellon University Pittsburgh and Qatar. This allowed us to study students of varied cultures aged between 18 and 24, thereby giving us a diverse sample population while reducing any skewed error.

## METHODOLOGY

### 4.1 Survey and Survey scale

A survey was administered to participants. The first part of the survey had questions based on cultural dimensions or cultural factors which assessed the individual's understanding of the norms prevalent in their culture. The second part of the survey was adapted from the innovator (Dyer, Gregersen and Christensen, 2011) who had questions based on the individual's behaviors. This section assessed the individual's motivational, behavioral and cognitive skills. It contained 36 questions. The first section consisted of 17 questions related to cultural factors and the second section consisted of 19 questions related to individual behavior. As mentioned earlier, the first section of the survey is inspired from the CVSCALE (Yoo, Donthu and Lenartowicz, 2011) and the second section is inspired from the questions used in the innovator's DNA (Dyer, Gregersen and Christensen, 2011). The survey questions were developed by considering the student samples from CMUQ and CMUP.

A popular and trusted survey tool (SurveyMonkey®) was used for survey building and data collection. This allowed users to take the survey at their own convenience. The duration of the survey was around 5 minutes.

## 4.2 Participants

As mentioned before the survey targeted towards students at Carnegie Mellon University in Qatar as well as Students at Carnegie Mellon University Pittsburgh. The survey will target only undergraduate students of majors in Information systems, Computer Science and Business Administration. Both the groups share similar interests of technology and innovation. However, even though their interests and education are the same, both the groups contain students with different cultures, backgrounds and ethnicities. This will therefore determine whether a culture influences an individual's spirit of innovation entrepreneurship

## 4.3 Participant recruitment

Students from CMUQ and CMUP were recruited through their respective mailing list. This was done only after receiving permission for using the mailing lists from the respective department heads.

Furthermore, only people of 18 years and above of the target population were recruited to take the survey. The study was conducted during the spring semester of 2015.

## 4.4 Data Analysis

The data, taken through survey monkey, was organized in an excel sheet. As shown in the appendix, each survey question has options ranging from 1- 5, 1 being the lowest to 5 being the highest. Some questions were positive while others were negative. This was done to ensure

consistency of answers through the survey. The scales of the negative questions had to be reverted back to ensure uniformity.

Data analysis was done with the help of regression tools. For example, to study Hypothesis 2, the average values for 'courage to Innovate' was taken as the dependent value and was plotted against average values for 'power distance index'. The coefficient value 'b' thus obtained implied whether there was a positive or negative relation and the correlation between the t-value and the p-value determined if the study conducted was significant and reliable. This method of data analysis was repeated likewise for Hypothesis 1 and 3.

## RESULTS

### 5.1 Participants characteristics

There were around 120 responses from CMUQ and CMUP students. After cleaning out the data, it was found that there were 89 complete responses. Below were the general characteristics of the participants.

Distribution of participants by various factors		
Gender	Country of residence	Majors
Males : 45 %	United States : 55%	Business Administration : 40%
Females : 55%	Qatar : 43%	Information Systems 18%
	Other : 2%	Computer Science : 43%

Figure 4: *Distribution of participants*

As reflected in the figure above the male to female ratio was 9: 11. There were 48 female respondents compared to 40 male respondents. This suggests that the sample in terms of gender composition is balanced.

Furthermore, there were 40 respondents from Qatar and 48 respondents from United States. As for the people choosing the 'Other' option, it is assumed that the students were either from CMU-P or CMUQ but not currently spending the semester on campus. This is because the participants were only recruited through their respective degree specific mailing lists.

In terms of major distribution, we can see that there are student responses from all 3 targeted majors. There are 35 student responses from Business Administration students, 15 student responses from Information Systems students and 39 responses from Computer Science students.

## 5.2 Hypothesis Testing

To test the relations between the different variables, the research primarily used a regression analysis.

**Hypothesis 1: Power distance negatively affects the courage to challenge the status Quo**

SUMMARY OUTPUT									
Regression Statistics									
Multiple F	0.148094								
R Square	0.021932								
Adjusted	0.010425								
Standard Error	0.473182								
Observations	87								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	0.426755	0.426755206	1.906	0.171028				
Residual	85	19.03158	0.223900919						
Total	86	19.45833							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	3.204729	0.273756	11.70650943	2.06E-19	2.660429	3.749030148	2.660429	3.74903	
Power Inc	-0.14225	0.103038	-1.380579675	0.171028	-0.34712	0.062614789	-0.34712	0.062615	

Figure 5: Regression model of Power Distance and Challenging status quo

The average values from each question for both the variables were calculated. The dependent or the y variable in this regression analysis is 'Challenging the status Quo' and the independent variable is the 'Power Distance'. As seen in figure 5, there is an inverse relation between both the variables i.e. an increase in power distance of any culture leads to a 0.14 decrease in the individual's ability to challenge the status quo which in turn affects Innovation Initiation. This is synonymous with previous research work expressed by Williams (Williams & McQuire, 2005) who suggested that the greater the freedom of the individual to explore and express opinions, the greater the likelihood of new ideas coming into being. Therefore societies where freedom of expression is low, i.e. high power index, innovation tends to suffer. In addition to this, other research work also emphasized on how high power distance restricted creativity (Herbig & Dunphy cited in (Ahmad,2012)), (Kaasa & Vadi, cited in (Ahmad, 2012))

Furthermore, as reflected in the regression model since the t-stat value of  $|1.34|$  is lesser than the recommended ' $|2|$ ' and p-value being  $.17 > 0.05$ , the relation between both the variables is **weak and not significant**. Therefore, we can say that the Hypothesis is **rejected**.

**Hypothesis 2: Uncertainty avoidance negatively affects courage of people making risky decisions.**

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.303895							
R Square	0.092352	Relation between Uncertainty Avoidance and Taking Risks						
Adjusted R Square	0.081674							
Standard Error	0.688306	Final Inverse relation and significant						
Observations	87							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	4.097438	4.097438	8.648665	0.004216			
Residual	85	40.27006	0.473765					
Total	86	44.3675						
	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	3.868379	0.376199	10.28281	1.39E-16	3.120396	4.616363	3.120396	4.616363
Uncertain	-0.34196	0.116281	-2.94086	0.004216	-0.57316	-0.11077	-0.57316	-0.11077

Figure 6: Regression model of Uncertainty Avoidance and Taking risks

The average values from each question for both the variables were calculated. The dependent or the y variable in this regression analysis is 'Taking risks' and the independent variable is 'Uncertainty Avoidance'. As seen in figure 6, there is an inverse relation between the two. An increase in uncertainty avoidance leads to a 0.38 decrease in a person's choice to make risky decisions. This is synonymous with previous research work on the topic. Hofstede (Hofstede,

1980) cited in (Mohammed,Ahmed,2012)) found that since cultures with high uncertainty avoidance have fear of failure, they tend to have a low inclination to take risks. This research is supported by Shane (Shane, cited in (Mohammed, Ahmed, 2012)) who suggested that the cultural value of uncertainty avoidance has a strong relation with innovation rates.

Coming back to the regression model, the relation between Uncertainty avoidance and taking risks is further strengthened by the t-stat value  $|2.94| > |2|$  and p-value  $.004 < 0.005$  which suggests that the relation between both the variables is **very strong and significant**. Therefore, we can conclude by saying that Uncertainty Avoidance negatively affects courage of people making risky decisions. In other words, Hypothesis is **confirmed**.

**Hypothesis 3: Cultural factors (Power distance, uncertainty avoidance, and individualism/collectivism) affect behavioral and cognitive skills.**

The average values from each question for all the variables were calculated. This main hypothesis was broken down into several sub-hypotheses.

**Hypothesis 3.1: Power Distance affects questioning behavioral skill**

Multiple R	0.536449							
R Square	0.287778				Final	PI, UA inversely affects		
Adjusted R Square	0.262035							
Standard Error	0.595275							
Observations	87							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	3	11.88378	3.96126	11.17888	3.09E-06			
Residual	83	29.41124	0.354352					
Total	86	41.29502						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.763083	0.574971	10.02326	5.91E-16	4.619489	6.906676	4.619489	6.906676
Power Inc	-0.65093	0.130409	-4.99144	3.26E-06	-0.9103	-0.39155	-0.9103	-0.39155
Uncertainty	-0.24678	0.101752	-2.42533	0.017463	-0.44916	-0.0444	-0.44916	-0.0444
Collectivism	-0.01956	0.132353	-0.14781	0.882853	-0.28281	0.243681	-0.28281	0.243681

Figure 7: Regression model of uncertainty avoidance, power distance and collectivism and questioning

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Questioning behavioral skill' and the independent variable is 'Power distance'. As seen in Figure 7, there is an inverse relation between the two. An increase in power distance leads to a decrease in questioning behavioral skills. The significant t-value which is  $|4.99| > |2|$  and p-value  $3.26e-06 < 0.05$  suggests that the relation between the two is very strong. Therefore, we can conclude that Power Distance has a **strong negative influence** on a person's questioning behavioral skill. In other words, the hypothesis is **confirmed**.

### Hypothesis 3.2: Uncertainty avoidance affects questioning behavioral skills

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Questioning behavioral skills' and the independent



variable is 'Uncertainty avoidance'. As seen in Figure 7, there is an inverse relation between the two. An increase in uncertainty avoidance leads to a .24 decrease in questioning behavioral skill. Looking at the high t-value and low p-value suggests that the relation is **significant**. Therefore, we can conclude that uncertainty avoidance has a **strong negative influence** on a person's questioning behavioral skills. In other words, the hypothesis is **confirmed**.

### **Hypothesis 3.3: Individualism/Collectivism affects questioning behavioral skills**

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Questioning behavioral skills' and the independent variable is 'Collectivism'. As seen in the above Figure 7, there is an inverse relation between the two. An increase in collectivism leads to a decrease in questioning behavioral skill. However as suggested by the low t-value and high p-value, the relation is **not significant**. In other words, the hypothesis is **rejected**.

Regression Statistics		Relation between PI, UA, Collectivism and Networking behavior						
Multiple R	0.368358							
R Square	0.135687							
Adjusted R Square	0.104447	Final PI inversely affects						
Standard Error	0.796609							
Observations	87							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	3	8.268704	2.756235	4.343359	0.006808			
Residual	83	52.67063	0.634586					
Total	86	60.93934						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	4.9467	0.769438	6.428981	7.71E-09	3.416319	6.47708	3.416319	6.47708
Power Inc	-0.60234	0.174516	-3.45148	0.000879	-0.94944	-0.25523	-0.94944	-0.25523
Uncertainty	-0.08698	0.136167	-0.63879	0.52472	-0.35781	0.183849	-0.35781	0.183849
Collectivism	0.163398	0.177117	0.922544	0.358919	-0.18888	0.515677	-0.18888	0.515677

Figure 8: Regression model of uncertainty avoidance, power distance and collectivism and networking

### Hypothesis 3.4: Power distance affects networking behavioral skill

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Networking behavioral skills' and the independent variable is 'Power distance'. As seen in Figure 8, there is an inverse relation between the two. An increase in power distance leads to a 0.6 decrease in networking skills. The t-value of 3.45 and p-value of 0.0008 suggests that this relation is very strong and significant. Therefore, we can conclude that power distance has a **strong negative influence** on networking skill. In other words, the hypothesis is **confirmed**.

### Hypothesis 3.5: Uncertainty avoidance affects networking behavioral skills

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Networking behavioral skills' and the independent variable is 'Uncertainty avoidance'. As seen in Figure 8, there is an inverse relation between the two. An increase in uncertainty avoidance leads to a 0.086 decrease in networking skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

### **Hypothesis 3.6: Individualism/Collectivism affects networking behavioral skills**

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Networking behavioral skills' and the independent variable is 'Collectivism'. As seen in Figure 8, there is a direct relation between the two. An increase in collectivism leads to a 0.16 increase in networking skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

SUMMARY OUTPUT									
Regression Statistics					Relation between PI, UA, Collectivism and Observation				
Multiple R	0.396121								
R Square	0.156912				Final	PI inversely affects			
Adjusted R Square	0.126439								
Standard Error	0.805993								
Observations	87								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	3	10.03517	3.345055	5.149211	0.002583				
Residual	83	53.91886	0.649625						
Total	86	63.95402							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	4.274767	0.778502	5.49102	4.27E-07	2.726359	5.823176	2.726359	5.823176	
Power Inc	-0.61027	0.176571	-3.45621	0.000866	-0.96146	-0.25907	-0.96146	-0.25907	
Uncertainty	-0.12246	0.137771	-0.88884	0.37666	-0.39648	0.151565	-0.39648	0.151565	
Collectivism	0.333733	0.179203	1.862316	0.066097	-0.02269	0.690162	-0.02269	0.690162	

Figure 9: Regression model of uncertainty avoidance, power distance and collectivism and observation

### Hypothesis 3.7: Power distance affects observational behavioral skill

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Observational behavioral skills' and the independent variable is 'Power distance'. As seen in Figure 9, there is an inverse relation between the two. An increase in power distance leads to a 0.61 decrease in observational behavioral skill. Looking at the high t-value (|-3.45|) and low p-value (.00086) suggests that the relation is **significant**. Therefore, we can conclude that power distance has a **strong negative influence** on a person's observational behavioral skills. In other words, the hypothesis is **confirmed**.

### Hypothesis 3.8: Uncertainty avoidance affects observational behavioral skills

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Observation behavioral skills' and the independent

variable is 'Uncertainty avoidance'. As seen in Figure 9, there is an inverse relation between the two. An increase in uncertainty avoidance leads to a 0.12 decrease in observational skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

### **Hypothesis 3.9: Individualism/collectivism affects observational behavioral skills**

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Observational behavioral skills' and the independent variable is 'Collectivism'. As seen in Figure 9, there is a proportional relation between the two. An increase in collectivism leads to a 0.33 increase in networking skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

SUMMARY OUTPUT		Regression Statistics							
Multiple R	0.160236	Final							
R Square	0.025675	Not significant							
Adjusted R Square	-0.00954								
Standard Error	0.61723								
Observations	87								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	3	0.833273	0.277758	0.729074	0.537522				
Residual	83	31.62075	0.380973						
Total	86	32.45402							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	3.809309	0.596177	6.389561	9.17E-09	2.623537	4.995081	2.623537	4.995081	
Power Inc	-0.1434	0.135218	-1.06053	0.291979	-0.41235	0.125541	-0.41235	0.125541	
Uncertainty	-0.08518	0.105505	-0.80732	0.421792	-0.29502	0.124669	-0.29502	0.124669	
Collectivism	-0.04447	0.137234	-0.32408	0.746696	-0.31743	0.228479	-0.31743	0.228479	

Figure 10: Regression model of uncertainty avoidance, power distance and collectivism and experimental behavior

### Hypothesis 3.10: Power distance affects experimental behavioral skill

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Experimental behavioral skills' and the independent variable is 'Power distance'. As seen in Figure 10, there is an inverse relation between the two. An increase in power distance leads to a 0.14 decrease in experimental skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

### Hypothesis 3.11: Uncertainty avoidance affects experimental behavioral skills

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Experimental behavioral skills' and the independent variable is 'Uncertainty avoidance'. As seen in Figure 10, there is an inverse relation between the

two. An increase in uncertainty avoidance leads to a 0.08 decrease in experimental skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

### **Hypothesis 3.12: Individualism affects experimental behavioral skills**

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Experimental behavioral skills' and the independent variable is 'Collectivism'. As seen in Figure 10, there is an inverse relation between the two. An increase in collectivism leads to a 0.04 decrease in experimental skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

Regression Statistics						Relation between PI, UA, Collectivism and Associational cognitive skill			
Multiple R	0.141168								
R Square	0.019928					Final		Not significant	
Adjusted R Square	-0.0155								
Standard Error	0.628843								
Observations	87								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	3	0.667382	0.222461	0.562561	0.641222				
Residual	83	32.82176	0.395443						
Total	86	33.48914							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	3.48317	0.607393	5.734619	1.54E-07	2.275088	4.691251	2.275088	4.691251	
Power Inc	-0.02939	0.137762	-0.21337	0.831558	-0.3034	0.244609	-0.3034	0.244609	
Uncertainty	-0.10704	0.10749	-0.99578	0.322249	-0.32083	0.106756	-0.32083	0.106756	
Collectivism	0.129329	0.139816	0.924993	0.357651	-0.14876	0.407417	-0.14876	0.407417	

Figure 11: Regression model of uncertainty avoidance, power distance and collectivism and associational cognitive skill

### Hypothesis 3.13: Power distance affects Associational cognitive skill

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Associational cognitive skills' and the independent variable is 'Power distance'. As seen in Figure 11, there is an inverse relation between the two. An increase in power distance leads to a 0.02 decrease in associational cognitive skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

### Hypothesis 3.14: Uncertainty avoidance affects associational cognitive skills



The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Associational cognitive skills' and the independent variable is 'Uncertainty avoidance'. As seen in Figure 11, there is an inverse relation between the two. An increase in uncertainty avoidance leads to a 0.1 decrease in associational skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

### **Hypothesis 3.15: Individualism affects associational cognitive skills**

The average values from each question for both the variables were calculated. The dependent or the y-variable in this regression analysis is 'Associational cognitive skills' and the independent variable is 'Collectivism'. As seen in Figure 11, there is a direct relation between the two. An increase in collectivism leads to a 0.1 increase in associational skills. However, the low t-value and high p-value suggests that this relation is **not significant**. Therefore, we can conclude that the hypothesis is **rejected**.

## **GRAPHICAL MODEL WITH ACCEPTED HYPOTHESIS**

The below figure shows the accepted hypothesis with relations reflected in the Hofstede's model and Clayton's Innovator DNA's model (Dyer, Gregersen and Christensen, 2011).

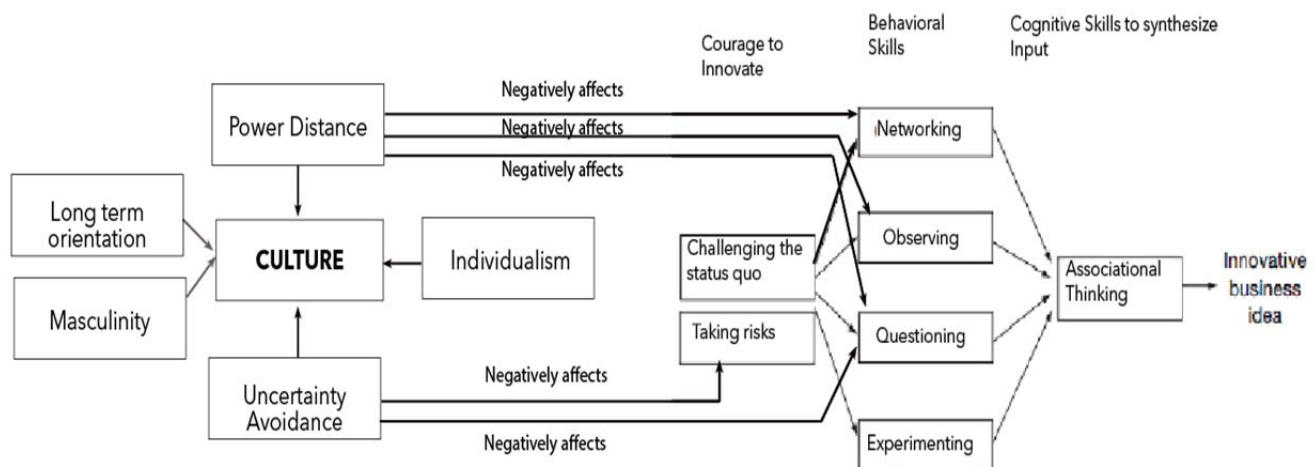


Figure 12: Revised research model comprising of Hofstede's cultural theory (Geerthofstede.com, 2015) and Clayton's Innovator's DNA model (Dyer, Gregersen and Christensen, 2011)

## CONCLUSION

The results from the thesis as well as findings from the literature review threw light on specific realities.

First, previous research work found that Arab Countries rank from above average to high (Geerthofstede.com, 2015) on the uncertainty avoidance scale. Combining this with the results of our research suggests that uncertainty avoidance has an inverse relation with taking risks; we can conclude that people who have an Arab culture have a high tendency to avoid taking risks. Furthermore, since results of the research also proved that uncertainty avoidance has an inverse relation with a person's questioning skills, we can successfully conclude that a high uncertainty avoidance factor in Arab culture restricts people's questioning skills which may hinder them to be a successful innovator.

Second, previous researches in this realm have suggested Arab Countries rank above average to high on the power distance scale (*Geerthofstede.com, 2015*). The results from research expounded on an inverse relation between power distance and questioning skills, observational skills and networking skill. We can therefore conclude that the power distance factor in the Arab culture negatively affects the development of behavioral skills required for Innovation.

### 7.1 Limitations

Few results from the survey show that there is a weak relation between low t-value and high p value. We think that this may be due to the small sample size. The size of the sample may have prevented us from obtaining higher data confidence. The accuracy and reliability of this research can be increased by targeting more students. Furthermore, since only university students were targeted for the research, the results might be different if population at all levels in terms of education level, age etc. would have been surveyed.

### 7.2 Future Work

All in all, Arab culture has detrimental effects on innovation entrepreneurship behavior in individuals. In order for the governments to develop an innovative entrepreneurship culture, they need to focus on development of behavioral skills to counter the negative effects of the culture. They can do this by creating educational programs both at university level and school level that specifically target on developing these behavioral skills in students. Furthermore, in order to determine the success of these programs at university level, governments can survey incoming freshmen and compare those responses with the responses they would have 4 years later as seniors. This will give governments a value they can base against future initiatives.

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\* Harvard citation used.

## APPENDIX

### SURVEY QUESTIONS \*\*

This research is part of Nihal Fathima's honors thesis. Nihal is supervised by Professor Maher Hakim. For any enquiries regarding the survey, please feel free to contact Nihal ([nihalf@qatar.cmu.edu](mailto:nihalf@qatar.cmu.edu)) or Professor Maher ([mhakim@cmu.edu](mailto:mhakim@cmu.edu))

Your participation in this survey is totally voluntary. You are free to end your participation at any point.

Are you 18 years or older? \* Yes ☐ No ☐

What is your major? \_\_\_\_\_

Select Your Gender \* Female ☐ Male ☐

Select your current age group \* 18 - 24 years ☐ 25- 35 years ☐ 36 years and above ☐

Select Your Current place of Residence \* Qatar ☐ United States ☐ Other :please specify [\_\_]

### CULTURAL FACTORS

Please Rate the following questions on a scale 1 – 5 (where 1 represents Strongly DISAGREE and 5 strongly AGREE). Please select the answer that BEST describes you AS YOU REALLY ARE.

#### Measuring Power distance

1. In a typical meeting with my upperclassmen I am able to give a contrary method/opinion
2. My advisors freely ask me for my input to help make decisions
3. In a task, my work culture encourages contrary behavioral skills
4. In a dinner table I am able to openly challenge my parents in a view extremely opposed to theirs.
5. In my society the accepted norm is to accept the status quo.
6. My parents are able to accept fully accept my view no matter how opposed it is.
7. In a team, my upperclassmen, TA's pay careful attention to my suggestions.

#### Measuring Uncertainty Avoidance

1. In this country/culture I am encouraged to invent new ways to do things
2. I believe it is important for higher ups to give me instructions for any tasks to be carried out
3. I believe following rules and regulations are good.
4. It is important to closely follow instructions and procedures.

## Measuring Individualism

1. There is a spirit of teamwork at your campus.
2. Individual initiative is encouraged in my culture
3. I am expected to sacrifice my self-interest based on the group's interest
4. I consider my success to be more important than group success.
5. Group loyalty should be encouraged even if Individual goals suffer\*\*

## INDIVIDUAL BEHAVIOUR

**Please Rate the following questions on a scale 1 – 5 (where 1 represents Strongly DISAGREE and 5 strongly AGREE). Please select the answer that BEST describes you AS YOU REALLY ARE.**

### Taking risks :

1. I constantly create detailed plans to get work done.
2. I pay careful attention to details at work.
3. I carefully think through all the issues before starting new projects and ventures.
4. I aim to learn from my failures even if it means failing.

### Challenging Status Quo:

1. I hold myself and others strictly accountable for getting results \*
2. I regularly ask questions to challenge the status quo
3. I must have everything finished 'just right' when completing a work assignment
4. I have to accept the status Quo even if I don't like it.

## Measuring Questioning skills

1. I attend conferences (on my areas of expertise as well as unrelated areas) to meet new people and understand their issues.
2. I frequently ask 'what if' questions so that I can explore new areas.
3. My ideas frequently diverge from others.

## Measuring Networking Skills

1. I generally talk to a diverse set of people (example: different organizations, geographies, different cultures etc.) to find and refine new ideas
2. I like to connect and listen to ideas of people who don't have the same background as me



3. My best friends have similar backgrounds (in terms of majors/nationality etc.) as me.

### **Measuring Observational Skills**

- 1 I actively seek to understand emerging trends by reading articles, magazines, blogs etc.

### **Measuring Experimental Skills**

1. Often I experiment to create new ways to do things.
2. I regularly observe the activities of customers, suppliers or other organization to get new ideas.
3. To accomplish a task, I start with detailed plan and clear milestones

### **Measuring Associational Skills**

1. I often find solutions to problems by drawing on solutions or ideas developed in other industries, fields or disciplines
2. My experiences/work are all related to the major I studied
3. I do work limited to only 1 scope of industry /major /discipline

*\* Retrieved from (cnbc.com,2011). Innovator's DNA model (Dyer, Gregersen and Christensen, 2011) Reference to CVScale (Yoo, Donthu and Lenartowicz, 2011)*