Spring 5-2017

Is Human Capital Development the Missing Element of the Aerotropolis Model?

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IS HUMAN CAPITAL DEVELOPMENT THE MISSING COMPONENT OF THE AEROTROPOLIS MODEL?

by

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A Dissertation
Submitted to the Graduate School
and the Department of Human Capital Development
at The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

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May 2017

Published by the Graduate School

THE UNIVERSITY OF SOUTHERN MISSISSIPPI®

ABSTRACT

IS HUMAN CAPITAL DEVELOPMENT THE MISSING COMPONENT

OF THE AEROTROPOLIS MODEL?

by John Roosevelt Hubbard

May 2017

Until the early 20th century, transportation by land or water served as the primary methods of trade. As competition in the global marketplace increased in the 21st-century air transportation emerged as a new and faster method of trade. Convinced of the economic benefits of air transportation, many policymakers of airport communities were quick to make plans for growth such as building infrastructure around the airport. This aerotropolis model often ignored the human capital development required for success.

Central to this study is this question: Is human capital development the missing component of the aerotropolis model economic development strategy? The researcher examined all 35 U.S. airports based on the aerotropolis model to determine the relationship between human capital development on aerotropolis model success. The purpose of this quantitative, explanatory, quasi-experimental study was to determine the relationship between human capital development and the aerotropolis model airport performance and success.

This study validated previous research that airports are important drivers of economic development. However, the study findings revealed that training (the nine Classification of Instructional Programs used to identify aerotropolis model education and training program categories in the study) had no effect on the success (measured as gross regional product, employment, and per capita income) of the airport community.

Additionally, there was not relationship between human capital development and passenger and cargo activity.

The study indicated the primary driver of economic success in the airport community is passenger activity. The inter-connectivity of the airport with other airports drives passenger activity and cargo activity, not talent pipeline. Cargo activity at the aerotropolis model airport is less vital to the economic success of the airport community than passenger activity. This finding is contrary to John Kasarda's opinion that cargo activity is equally important to the aerotropolis model as cargo activity.

ACKNOWLEDGMENTS

There is an old African proverb, later made popular by former first lady Hillary Clinton, which stated, “It takes a village to raise a child.” In my case, “the child” is this dissertation, and the “village” is the many family, friends, and advisors who offered their encouragement, patience, knowledge, and time to help me complete this journey. I will be forever grateful that this journey brought people into my life who I now consider my friends.

I will always be indebted to Dr. Barbara Kee who spent countless hours keeping me focused and offering me words of wisdom. Many thanks to Dr. Chris Nelson, Dr. John Davis, and Dr. Subhro Mitra for their advice and assistance as well. I am so appreciative to Dr. Flint Brent, Clark Magee, and Teresa Hanger, who besides my bride, have probably read this dissertation more times than anyone else but me.

Lynda Thornton from ACU: Thank you for believing in me and giving me hope. To my USM cohorts Stephen Ellis, Charles Childress, Will Burge, Tonya Moore, Deano Harrison, and Courtney Taylor: Thanks for allowing me to email, text and call you at all hours. Stephen, I especially appreciate your advice and friendship and allowing me to bounce ideas off you. You took me under your wing (or perhaps, I grabbed it) during my first class in the HCD program.

The HCD faculty and staff is AWESOME. I certainly appreciated the encouragement from Dr. Heather Annulis, Dr. Patti Phillips, and Dr. David Vance. Robin Johnson, thanks for keeping me on track. Suzy Robinson, I love you! Thank you for being you!

To my dissertation committee members, Dr. Cyndi Gaudet, Dr. Quincy Brown, and Dr. Dale Lunsford: Thank you for reviewing and commenting on my dissertation. It has been such an honor to work with you. I am so grateful to each of you!

Dr. Chad R. Miller: Thank you for agreeing to be my committee chair. I appreciate all the long hours and time you spent reviewing this dissertation when you could have been doing other things. I valued your guidance through this lengthy process. I appreciated all of your comments and suggestions. This dissertation is better than it could have ever been because of your input.

DEDICATION

Dedicated to my bride Marian, children Mariah, Alex, and Darah, son in law Jaime, grandchildren Jonah and Judah, in-laws Matthew and Takako, and to the memory of my Mom, Jessie Mae Mariah Worde and Dad, Dolphus Albert Hubbard.

In his book, The Myth of Sisyphus and Other Essays, Albert Camus states, "The meaning of life is the most urgent of questions." Assuming our life expectancy is 80 years, 3/4ths of my life on earth is gone. Like Qoheleth, I too can look back at my life and say everything I have experienced has been meaningless: I have endured the death of my parents, lost several jobs, been unemployed for over a year and been through a divorce. I have been blessed with many worthwhile things as well: I found my awesome bride, I have three beautiful children, a great son in law, and two amazing grandchildren. I have paid off the mortgage to my house; I have a fantastic job and, live a debt free life and after years of work, completed this dissertation.

However, through it all, I have realized that the only possession God wants me to have is the one that is permanent, that is, a relationship with Him. What matters most is that I put my trust in Him. My parents had it right – they understood what Jesus was talking about all along: Live a life not focused on earthly things which are fleeting, but rather focus on things above because in heaven is where real treasures lasting an eternity are stored.

Marian, Mariah and Jamie, Alex and Darah, and Jonah and Judah: Always remember that is never too late to accomplish your goals. My prayer for you, "Trust God in every decision you make, give more to others; strive for excellence but be content with what you have, always treat people fairly, embrace the good times and the bad times, remembering that God is in control." Learn how to die and you will learn how to live.

To my dear bride, Marian: This is OUR achievement. Thank you for your sacrifice, support, and encouragement as we completed another step in our journey together. I love you with all my heart, and I am so thankful that you are beside me. I look forward to the next chapter in our life. Ready to turn the page?

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TABLE OF CONTENTS

ABSTRACT ii

ACKNOWLEDGMENTS iv

DEDICATION vi

LIST OF TABLES xv

LIST OF ILLUSTRATIONS xvii

LIST OF ABBREVIATIONS xviii

CHAPTER I – INTRODUCTION 1

Background of the Study 3

Statement of the Problem 8

Purpose of the Study 9

Research Objectives 10

Conceptual Framework 11

Significance of the Study 14

Delimitations of the Study 15

Definition of Terms 16

Chapter Summary 19

CHAPTER II – LITERATURE REVIEW 21

Literature Search and Research Tools used in the Literature Review 21

The Role of Community Leaders and Policymakers in Economic Growth 22

The Role of Transportation and Trade in Urbanization 25

Human Capital Development, Transportation, and Urban Development 26

The First Wave of Transportation Development 27

The Second Wave of Transportation Development 28

The Third Wave of Transportation Development 29

The Fourth Wave of Transportation Development 30

The Fifth Wave of Transportation Development 31

Airport-Based Economic Development: The Aerotropolis Model 33

The Influence of Passenger Traffic and Cargo on Economic Development 34

The Airport City and Aerotropolis 36

Characteristics of Successful Aerotropolis Model Airports 37

Critique of the Aerotropolis Model. 40

How Human Capital Development Fits in with Aerotropolis Model 44

Human Capital Development 44

Measuring Human Capital Development 46

The Cost-Based Approach 47

The Income-Based approach 48

The Education-Based approach 49

Alternative Methods to Measure Human Capital Development 50

Talent Pipeline 51

Measuring Talent Pipeline and Regional Growth 52
Theories Guiding this Study 53
Theory of Transportation 53
Human Capital Theory 54
Key Attributes Identified in this Study 55
Aerotropolis Model Airport Performance Construct 55
Passenger Activity 56
Cargo Activity 56
Human Capital Development Construct 56
Regional Economy and Aerotropolis Model Success Constructs 57
Gross Regional Product 58
Employment 59
Per Capita Income 59
Weighting Variables 60
Chapter Summary 61
CHAPTER III – RESEARCH DESIGN AND METHODOLOGY 63
Research Objectives 63
Research Design 64
Population and Sample 65
Data Collection 66

Approval to Use Databases ... 67
Institutional Review Board ... 68
Dataset Name Conversion to IBM SPSS ... 68
Reliability and Validity ... 71
Variables and Latent Constructs ... 72
Data Analysis ... 74
Research Objective One ... 75
Research Objective Two ... 77
Research Objective Three ... 79
Research Objective Four ... 81
About Regression Analysis ... 82
Chapter Summary ... 85
CHAPTER IV – RESULTS ... 86
Data Collection Results ... 87
Organization of Data Analysis ... 88
Research Objective One ... 88
Results for Research Objective One. ... 89
Passenger Activity ... 89
Cargo Activity ... 90
Total Activity ... 90

Research Objective Two 92

Results for Research Objective Two 94

Descriptive Statistics for Research Objectives Three and Four 96

Research Objective Three 97

Results for Research Objective Three 98

Linearity 103

Normality 104

Multicollinearity 105

Control Variables 106

Research Objective Four 107

Results for Research Objective Four 107

CHAPTER V – FINDINGS, CONCLUSIONS & RECOMMENDATIONS 110

Summary of the Study 110

Limitations 111

Aerotropolis Model Performance and Airport Community Success 112

Findings 112

Conclusions 114

Recommendations 114

Talent Pipeline and Airport Community Success 115

Findings 116

Conclusions 116

Recommendations 116

Talent Pipeline and Aerotropolis Model Performance 117

Findings 117

Conclusions 118

Recommendations 118

Implications of Study Limitations 120

Suggestions for Future Research 120

Summary 122

APPENDIX A – Aerotropolis Model Statistics 124

APPENDIX B – Aerotropolis Model Statistics 126

APPENDIX C – Aerotropolis Model Statistics 127

APPENDIX D – Aerotropolis Model Statistics 128

APPENDIX E – Aerotropolis Model Statistics 135

APPENDIX F – Airport Model Statistics 137

APPENDIX G – Airport Model Statistics 139

APPENDIX H – Airport Model Statistics 141

APPENDIX I – U.S. Public Domain & Copyright Notice 143

APPENDIX J – Approval to use Illustration by John Kasarda 144

APPENDIX K – Approvals to use Illustration by Oliver Wyman 145

APPENDIX L – Approval to use Illustration by Jean-Paul Rodrigue............................ 146

APPENDIX M – Approval to use Illustration by other Georgia Institute of Technology 147

APPENDIX N – Approval to use Illustration by Kung-Jeng Wang & Wan-Chung Hong 148

APPENDIX O – Approval to use DKShifflet Data.. 149

REFERENCES.. 150

LIST OF TABLES

Table 1 Summary of the Economic Impact of Air Transportation, 2000-2012 4

Table 2 Airports Based on the Aerotropolis Model in the United States 6

Table 3 Commercial Service Airport Governance Distribution 23

Table 4 Some Human Capital Development Efforts and the Five Waves of Transportation 32

Table 5 Description of Variables.. 69

Table 6 Synopsis of Variables... 70

Table 7 Observed Variables and Source of Database(s).. 74

Table 8 Community College and University Programs Evaluated by CIP Code and Industry Type. 78

Table 9 Aerotropolis Model Airports by Airport Activity- 2014, n = 35 91

Table 10 Descriptive Statistics for Talent Pipeline, n=34 93

Table 11 Talent Pipeline by Airport MSA, n = 34 93

Table 12 Descriptive Statistics of Multiple Regression Models, n = 35............................ 97

Table 13 Model Summary and ANOVA Table: Airport Community Gross Regional Product (DV), n = 35.. 99

Table 14 Model Summary and ANOVA Table: Airport Community Employment (DV), n = 35 100

Table 15 Model Summary and ANOVA Table: Airport Community Per Capital Income, n=35 101

Table 16 Regression Output: Airport Community Gross Regional Product (DV), n = 35 102

Table 17 Regression Output: Airport Community Employment (DV), n = 35 102

Table 18 Regression Output: Airport Community Per Capita Income (DV), n = 35 102

Table 19 Pearson's Correlation Matrix, n = 35 106

Table 20 Model Summary and ANOVA Table: Human Capital Development (DV), n = 35 108

Table 21 Regression Output: Human Capital Development (DV), n = 35...................... 108

Table A1. Aerotropolis Model Airport Activity Influences 124

Table A2. Top Twenty U.S. Tourist Destinations in 2014.. 126

Table A3. Sorting Hubs of DHL, FedEx, and UPS at U.S. Airports............................... 127

Table A4. Airports Classified by the FAA as Qualifying Cargo Airports in 2014.......... 128

Table A5. Airport Communities by Population, Working age population, and Jobs 135

Table A6. Addresses of Aerotropolis Model Airports... 137

Table A7. Aerotropolis Model Airports by Passenger Activity - 2014 139

Table A8. Aerotropolis Model Airports by Cargo Activity- 2014 141

LIST OF ILLUSTRATIONS

Figure 1. Aerotropolis Conceptual Model with Theoretical Framework 12

Figure 2. Spatial illustration of the aerotropolis model and study area. 16

Figure 3. Illustration of the progression of airports.. 25

Figure 4. Cumulative Waves of Transportation Development... 26

Figure 5. Employment Sectors of the Airport City and Aerotropolis. 37

Figure 6. Spatial zoning of aerotropolis model industries.. 39

Figure 7. Worldwide Locations of Airports based on the Aerotropolis Model. 66

Figure 8. Aerotropolis Conceptual Model 73

Figure 9. Illustration of Multiple Regression Equation Model with Control Variables. ... 81

Figure 10. Illustration of the Multiple Regression Equation Model for RO4. 82

Figure 11. Scatter Plot of Dependent Variable Airport Community Gross Regional Product 103

Figure 12. Scatter Plot of Dependent Variable Airport Community Employment 104

Figure 13. Scatter Plot of Dependent Variable Airport Community Per Capita Income 104

Figure 14. P-Plots of Dependent Variables Airport Community Gross Regional Product, Airport Community Employment, and Airport Community Per Capita Income............. 105

Figure 15. Scatter Plot and P-Plot for Dependent variable HCD (DV)........................... 109

APPENDIX B 126

LIST OF ABBREVIATIONS

AC	Airport Community
CIP	Classification of Instructional Programs
EMSI	Economic Modeling Specialists, Inc.
HCD	Human Capital Development
IATA Code	International Air Transport Association Airport Code
IRB	The University of Southern Mississippi Institutional Review Board
MLR	Multiple linear regression
MS	Mean Square
MSA	Metropolitan or Micropolitan Statistical Area
SD	Standard Deviation
SIG	Significance
SPSS	Statistical Package for the Social Sciences
SS	Sum of Squares
USM	The University of Southern Mississippi

CHAPTER I – INTRODUCTION

The economic success and viability of any community depends on trade and transportation as the economic catalyst to stimulate the local marketplace (Ellis, 2011). As the world moves toward a global economy, competition for trade is fierce among communities (Porter, 2000). Community leaders struggle to find innovative approaches to attract new industry to maintain viable communities (Engel, 2015; Porter & Kramer, 2011). Engel (2015) suggests community leaders can stimulate economic growth by developing place-making policies that leverage a community's assets. In separate studies, Hyer (2013), Kasarda (2000, 2006, 2011), and Wyman (2013) agreed with Engel's research and determined place-making policies in the airport community encouraged the development of the aerotropolis model as an important economic development catalyst.

The aerotropolis model centers on the airport as the economic catalyst to stimulate the local economy (Kasarda & Appold, 2014). The successful aerotropolis model provides an array of non-air-related services to the community by generating more revenue for the airport community than with just air-related services (Hazel, 2013; Reiss, 2007). Seeing the economic benefits of the aerotropolis model, policymakers of many airport communities are adapting the concept in anticipation that airports will be the new catalyst for economic growth (Freestone, 2009; Kasarda, 2000).

Although the aerotropolis concept is relatively new, first coined by Kasarda (2000) in the latter part of the 20th century, the root word "polis" originated during the Archaic Period of Greek history (Pozzi &Wickersham, 1991). The aerotropolis is an urban region in which the airport is the focal point of the economy (Kasarda & Appold, 2014). The word aerotropolis originates from the Greek words "aero" meaning "air" and "polis" meaning city (Robertson, 1991). In Ancient Greece, most residents of a polis lived in the city instead of scattered in small farming communities (Nielsen, 2004). As the center of trade, the heart of the polis often meant the location of impressive buildings and other structures (Nielsen, 2004). The polis was often a place for sharing information for many of the residents (Nielsen, 2004). For Greek philosophers Plato and Aristotle, the polis held more significance: the polis represented a community where all residents experienced happiness and gratification (Nielsen, 2004). In this sense, Kasarda and Appold's vision for the aerotropolis parallel that of Plato and Aristotle. Kasarda and Appold (2014) describe the aerotropolis as "a new kind of city, one native to our era of instant gratification - call it the Instant Age" (p. 6).

As airport communities implement the aerotropolis model, it is common for policymakers to focus on physical capital improvements to the area in and around the airport property (Gillen, 2015; Hyer, 2013; Kasarda, 2011). Many airport development projects such as runway extensions, new terminals, and other infrastructure projects related to airport expansion are either presently planned or under construction (Addie, 2014). Policymakers, however, often ignore the human capital assets required to contribute to the success of airport activity (Florida, Mellander, & Holgersson, 2015). In much the same manner policymakers overlooked the significance of the human capital assets to the aerotropolis, a majority of the existing research on aerotropolis model airport performance focuses on physical capital improvements and not human capital development (Kaplan & Rauh, 2013). This study is an expansion of earlier research on the impact of the aerotropolis model by examining the relationship of airport commercial activities on the human capital assets of 35 airport communities classified as either an operating or developing aerotropolis or airport city in the United States (Kasarda & Appold, 2014). Chapter I of this study begins with the challenge that policymakers must consider to increase a competitive advantage in the global marketplace in the form of the problem statement. Chapter I also includes the purpose of the study, the significance of the study, and the conceptual framework, which serves as the research guide for this quantitative study.

Background of the Study

Airports are one of the largest investments any municipality or region can pursue and are a vital component in connecting that municipality or region to the global marketplace (Florida et al., 2015). Research underscores the importance of air transportation to the national economy (Gillen, 2015). In the same manner railroads and highways transformed the economy in the 19th and 20th centuries, Kasarda (2006, 2011) believes air transportation will be a major method of transportation in the 21st century. The literature identifies the economic benefit of air transportation (Gillen, 2015; Kasarda & Green, 2005). Increased economic output, measured in job creation and gross domestic product, are a direct result of increased airport activity (Brueckner, 2003; Gillen, 2015; Green, 2007). Airport activity added approximately $638 billion in economic output to the U.S. economy and $236 billion in value to the gross national product in 2012 (Gillen, 2015). Indirect airport activities contributed to the U.S. economy as well (Gillen, 2015). Indirect airport activities produced 2.1 million jobs and generated $145 billion in salary and wages to employees in 2012 (Gillen, 2015). The air transportation sector accounted for 5.4% of the gross domestic product in 2012 (U.S. Department of Transportation, 2014b). In 2012, the total economic value of goods and services created by the air transportation sector was over $1.5 billion (Gillen, 2015). Research reveals the importance of air transportation and the aerotropolis model (Kasarda & Green, 2005). Other measurements of the economic impact of the air transportation sector are displayed in Table 1.

Table 1

Summary of the Economic Impact of Air Transportation, 2000-2012

Year	Output ($Billions)	Earnings ($Billions)	Jobs (Thousands)	Percent of GDP
2012	1,533.8	459.4	11,790	5.4
2011	1,455.0	437.2	11,238	5.3
2010	1,354.8	407.8	10,496	5.2
2009	1,309.4	393.2	10,118	5.2
2008	1,453.5	436.9	11,237	5.6
2007	1,421.6	426.7	10,960	5.6
2006	1,315.2	39.45	10,185	5.4
2005	1,204.6	362.9	9,405	5.2
2004	1,107.6	334.0	8,653	5.1
2003	1,013.9	305.4	7,881	5.0
2002	1,002.1	300.8	7,735	4.6
2001	1,077.8	323.6	9,383	4.7
2000	1,131.0	339.5	9,891	5.1

Note: Adapted from The Economic Impact of Civil Aviation on the U.S. Economy Report. Published by the U.S. Department of Transportation, Federal Aviation Administration, June 2014. The data used on this document is in the public domain and did not require permission for reproduction. See U.S. Public Domain & Copyright Notice in Appendix B for more information. GDP does not include research and development and is in 2012 dollars. Earnings as a measure of wages, salaries, and other income paid to all employees who deliver output and services. Jobs indicate the number of people either directly or indirectly employed in the air transportation sector.

Grover (2013) and Kasarda (2006, 2011) observed as commercial activities at the airport grow, the community surrounding the airport become more important and satisfying the needs of the airport community becomes a greater challenge for community leaders. First, airport managers must compete globally to attract more passengers and cargo traffic (Everett, 2014). Second, policymakers must pursue economic drivers such as cargo distribution centers, corporate headquarters, and high-tech firms to support the airport community (Morin & Hanley, 2004; Porter, 2000). Third, as traditional manufacturing sectors give way to a post-industrial knowledge-based economy brought on by globalization, policymakers must develop new methods either to retrain current residents or to attract new talent to the airport community who will meet the human capital demands necessary to stay competitive (Morin & Hanley, 2004). Finally, both airport managers and policymakers of the airport community must prepare for the potential transformation of the airport property and the area surrounding the airport into an airport city or aerotropolis (Kasarda, 2006, 2011).

While community leaders may face many challenges in developing a successful airport city or aerotropolis, the aerotropolis model shows significant potential for creating economic success in the airport community (Grover, 2013; Kasarda, 2006, 2011, Peneda, Reis, & Macário, 2011). This economic success (named aerotropolis model performance in this study) is measured by evaluating the gross regional product, employment, and per capital income of the airport community (Brueckner, 1985, 2003; Green, 2007). The aerotropolis model provides the catalyst for economic activity primarily through passenger activity and cargo activity (named aerotropolis model airport performance in this study) and supporting airport-related activities (Kasarda, 2006, 2011). Kasarda and Appold (2014) identify 35 airports located in the United States that rely on the aerotropolis model. Kasarda and Appold classify these airports as either (a) an operating aerotropolis, (b) an operating airport city, (c) a developing aerotropolis, or (d) a developing airport city. Table 2 provides a listing of these airports.

Table 2

Airports Based on the Aerotropolis Model in the United States

	Airport	Aerotropolis Model Type
1	Chicago O'Hare International Airport	Aerotropolis Operational
2	Dallas-Ft. Worth International Airport	Aerotropolis Operational
3	Fort Worth Alliance Airport	Aerotropolis Operational
4	LA/Ontario International Airport	Aerotropolis Operational
5	Louisville International Airport	Aerotropolis Operational
6	McCarran International Airport	Aerotropolis Operational
7	Memphis International Airport	Aerotropolis Operational
8	Miami International Airport	Aerotropolis Operational
9	Orlando International Airport	Aerotropolis Operational
.10	Piedmont Triad International Airport	Aerotropolis Operational
11	Raleigh-Durham International Airport	Aerotropolis Operational
12	Washington Dulles International Airport	Aerotropolis Operational
13	Huntsville International Airport	Airport City Operational
14	John F. Kennedy International Airport	Airport City Operational
15	Los Angeles International Airport	Airport City Operational
16	Minneapolis-Saint Paul International Airport	Airport City Operational
17	Philadelphia International Airport	Airport City Operational
18	Phoenix Sky Harbor International Airport	Airport City Operational
19	Pittsburgh International Airport	Airport City Operational
20	Rickenbacker International Airport	Airport City Operational
21	Ted Stevens Anchorage International Airport	Airport City Operational
22	Baltimore-Washington International Airport	Aerotropolis Developing
24	Denver International Airport	Aerotropolis Developing
25	Detroit Metropolitan Wayne County Airport	Aerotropolis Developing
26	Indianapolis International Airport	Aerotropolis Developing
27	Jackson-Evers International Airport	Aerotropolis Developing
28	Hartfield-Jackson Atlanta International Airport	Aerotropolis Developing
29	Lambert-St. Louis International Airport	Aerotropolis Developing
30	Milwaukee General Mitchell International	Aerotropolis Developing
31	Northwest Florida Beaches International Airport	Aerotropolis Developing
32	Phoenix-Mesa Gateway Airport	Aerotropolis Developing
33	Charlotte Douglas International Airport	Airport City Developing
34	Kansas City International Airport	Airport City Developing
35	Newark Liberty International Airport	Airport City Developing

Note: Adapted from "Airport cities: The evolution," by J. D. Kasarda, 2013, April 21, *Airport World*. Copyright 2013 by Airport World. See Appendix C for a statement of permission from the author. o

There are numerous critiques of the aerotropolis model, but none address the impact of human capital development (Johnson, 2002; Mosbah & Ryerson, 2016). Proponents of airport-based economic development predict the airport will transform from a regional gateway to a functional airport city and aerotropolis (Kasarda, 2006). Kasarda and Lindsay (2011) believe the goal of every city leader should be to increase the viability of a city through competitiveness, job creation, and quality of life. Kasarda (2006) predicts airport-based economic development, and subsequent airport development based on the aerotropolis model will significantly help to achieve this goal. Ultimately, proponents of airport-based economic development envision the transformation of the airport into centers of trade based on the aerotropolis model.

In contrast to Kasarda and Lindsay (2011), there are many critics of the aerotropolis model. Charles, Barnes, Ryan, and Clayton (2007), Cidell (2015), Mukkala and Tervo (2013), and Neal (2012) dispute the value of the impact of the aerotropolis on economic development and local employment. These researchers identify several weaknesses in the aerotropolis model as an economic development strategy, but the lack of human capital development efforts was not identified as a potential weakness. Despite these concerns, Kasarda and Lindsay believe a well-designed and active aerotropolis is key to the economic success of the airport community. Two examples of the success of the aerotropolis model (measured by high employment, gross regional product, and per capita income) are revealed by observing the communities around Dallas-Fort Worth and Washington Dulles International Airports (Charles et al., 2007).

An examination of Dallas-Fort Worth and Dulles International Airports revealed the economic impact of these airports on their communities. An economic impact study of

Dallas-Fort Worth International Airport showed airport activity generated over 143,000 permanent jobs to Dallas area residents including 60,000 full-time employees on the airport property (Cook, 2013). The total economic impact from Dallas-Fort Worth International Airport attributed to the Dallas-Fort Worth Metropolitan Statistical Area (MSA) is over $37 billion which is almost 10% of the gross regional product of the Dallas-Fort Worth MSA (Ahles, 2015). Dulles International Airport in the Washington, DC area reported similar results (Fuller, 2013). The economic impact of the Washington–Arlington–Alexandria, DC–VA–MD–WV MSA was almost $10 billion, which was 4.5% of the gross regional product of the Washington DC area (Metropolitan Washington Airports Authority, 2014). Administrators at large metropolitan airports across the U.S. reported similar economic impact results (Fuller, 2013).

The planned development of Las Colinas in Irving, Texas and the city of Reston, Virginia are examples of communities building on the success of the aerotropolis model. Las Colinas, located adjacent to Dallas-Fort Worth International Airport and Reston, which is near Dulles International Airport, are incorporating the aerotropolis model into their long-term strategic plans (Antipova & Ozdenerol, 2013; Zhou, 2011). As a result, policymakers in Las Colinas and Reston have watched these communities evolve into an economic development nexus, attracting new industry and economic growth (Antipova & Ozdenerol, 2013; Kasarda, 2011; Zhou, 2011).

Statement of the Problem

Airports are a major source of local economic growth and produce substantial revenues to the airport community. However, the literature identifies potential causes of unsuccessful attempts to develop airports into the aerotropolis model by policymakers

(Appold, 2013, Ryerson, 2016). Often cited by researchers is the lack of investment in physical capital such as infrastructure, land acquisition, and buildings (Simmonds & Hack, 2000; Van Wijk, 2011). Overlooked, however, is how human capital development contributes to aerotropolis model economic development success (Freestone & Baker, 2011; Storper, 2010). If airport activity is to play a larger role in the airport community, the policymakers and community leaders should incorporate the concept of the quality of human capital as a key strategy in planning the success of the aerotropolis (Porter & Kramer, 2011). Hanushek and Woessmann, (2015), Zak and Getzner (2014) stress the importance of human capital development to the success of the aerotropolis model. The researchers explain the success of the aerotropolis model may depend on human capital development factors such as the availability of a well-trained labor supply (Hanushek & Woessmann, 2015; Zak & Getzner, 2014). Failure to acknowledge and understand the importance of human capital development in the aerotropolis model could lead policymakers to ignore strategies designed to increase human capital development (Appold, 2013). Ignoring the human capital development requirements of the aerotropolis model could result in the failure of the airport community to (a) remain competitive in the global economy, (b) maintain economic success and growth, and (c) attract new businesses and industry.

Purpose of the Study

The purpose of this quantitative, explanatory, quasi-experimental study was to determine the relationship between human capital development and the aerotropolis model airport performance and the relationship between human capital development (measured by talent pipeline in the airport MSA), and aerotropolis model success (measured as gross regional product, employment, and per capita income in the airport community). The study does not attempt to determine if a causal relationship exists between human capital development in the airport community and aerotropolis model success. The researcher reports the level of human capital development, measured as talent pipeline, located in the aerotropolis model airport region and compares it with the success of the aerotropolis model.

Research Objectives

Four research objectives were central to this study. The researcher determined if a relationship existed between human capital development efforts in the airport MSA and the success of the airport communities adjacent to aerotropolis model airports in the United States. Based on the review of the literature, Kasarda and Appold (2014) classified aerotropolis model airports as either an operating aerotropolis, an operating airport city, a developing aerotropolis, or a developing airport city. Kasarda and Appold identified 35 aerotropolis model airports that operate in 33 MSAs in the United States. The four research objectives of the study are:

RO 1: Rank aerotropolis model performance at each aerotropolis model airport, per population of the airport MSA.

RO 2: Determine the airport-skills workforce training concentration or "completion ratio" of the airport MSA.

RO 3: Determine the relationship between aerotropolis model performance and aerotropolis community success, and talent pipeline.

RO 4: Determine the relationship between talent pipeline and aerotropolis model performance.

Conceptual Framework

The conceptual framework focuses on theories, concepts, and variables that supported the four research objectives (Roberts, 2010). Schultz's (1961, 1975) human capital theory and Cooley's (1894) theory of transportation provided the foundation for understanding the importance of human capital development in the aerotropolis model. When describing the influence of human capital development on the wealth and success of a community, Schultz stated, "Economists have long known people are an important part of the wealth of nations. Measured by what labor contributes to output, the productive capacity of human beings is now vastly larger than all other forms of wealth taken together" (p. 1). Likewise, Cooley concluded transportation was the most important factor in determining the development and wealth of a community. In the theory of transportation, Cooley explained whenever an interruption or break in the logistics transportation chain occurred (e.g., the aerotropolis model airport), increased wealth also occurred. A discussion of each theory takes place in Chapter II.

A visual representation of the conceptual framework can simplify the understanding of the research by identifying the theoretical constructs and variables of interest in the study (Roberts, 2010; Yin, 2014). The visual representation of the conceptual framework, or conceptual model of this study, is presented in Figure 1. The conceptual model indicates that aerotropolis model airport success, human capital development, regional economy and aerotropolis model success are all interrelated. However, the conceptual model treats the constructs independently to investigate if human capital development is related to aerotropolis model airport performance and if human capital development is related to aerotropolis model success.

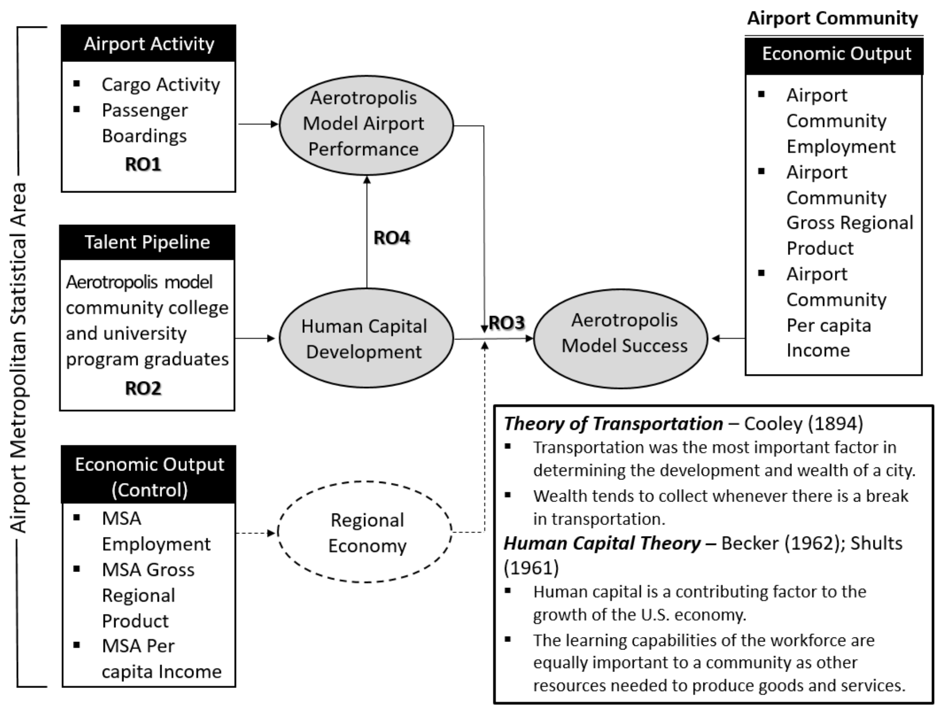

Figure 1. Aerotropolis Conceptual Model with Theoretical Framework

Note: MSA means Metropolitan Statistical Area.

The conceptual model of this study is designed to evaluate the influence of workforce educational programs on the economic output of aerotropolis model growth strategies. This conceptual model relied on three indicators most often cited in the literature as indicators of economic growth: employment, gross regional product, and per capita income (Glaeser & Gottlieb, 2008, 2009). These economic growth indicators were collected from the airport community to demonstrate the economic output spillover from airport activity. Collectively, these economic growth indicators were identified as airport community success. The zip codes within a 5-mile radius of the airport comprise the airport community (Appold, 2013). To control for economic growth outside the airport community, the conceptual model included the same economic growth indicators for the airport MSA (Spector & Brannick, 2011). This process allowed for better isolation of the economic output from the Airport (Spector & Brannick, 2011).

Educational programs specific to the airport workforce requirements in the airport MSA (Wang & Hong, 2011) are identified using data from Economic Modeling Specialists, International (EMSI). EMSI provided data on the number of completions of programs by graduates trained to work at airport-related businesses in the airport MSA. The classification of these industry-specific businesses was designated either a core industry or dependent industry (Wang & Hong, 2011). The talent pipeline identified the residents who completed airport specific industry training programs in the airport MSA. Based on the review of prior research, it was assumed that if communities possessed a greater pipeline of workers specifically trained in the target industry, it would result in improved economic output (Hanushek & Woessmann 2007, 2008, 2015; Sweetland, 1996; Woessmann, 2003). Testing to determine if airport specific industry training programs improved economic output is at the heart of this conceptual model. The researcher expected to find a relationship between increased airport activity and greater economic output in the airport community.

Passenger boardings and cargo activity comprised airport activity. Collectively, the model identified the composite of passenger boardings and cargo activity as aerotropolis model airport performance. Including airport activity in the model can provide a better understanding of the relationship between airport specific industry training programs and business activity (Chatterjee & Hadi, 2015). The model did not determine a causal relationship but merely determined if a relationship existed. Second, the model determined the relationship between airport activity and economic development. Additionally, the model used the combination of passenger boardings and cargo activity to rank the 35 airports classified as aerotropolis model airports by Kasarda and Appold (2014). Kasarda and Appold admitted that the criteria for the classification of the aerotropolis model airports are subjective. Kasarda and Appold's based the classification of aerotropolis-model airports on their research of airports and knowledge of industry clusters that correspond to the aerotropolis model. Using a composite Z-score of passenger boardings and cargo activity to rank the aerotropolis model airports introduces a new quantitative method to evaluate the impact of the aerotropolis model.

Significance of the Study

Communities that invest in people are more successful (Sweetland, 1996). Research from this study may identify the importance of human capital development efforts in contributing to the success of the aerotropolis model. The results may assist in determining if a gap exists between the educational and training requirements of businesses in the airport community and the human capital assets of the airport community.

This information will allow policymakers to bridge potential gaps by developing policies to increase human capital development education and training programs that meet the needs of airport-based employees. According to Phillips (2012), better training programs result when there are assessment and reporting on the impact of the training programs. This information could also prevent airport-based employers from outsourcing jobs. Airport administrators, community leaders, and city planners outside these locations might be able to use information from this study to determine what factors could influence the success of the aerotropolis model in their communities.

Community leaders need information on the impact of human capital development to make informed decisions (Lee, 2017). The lack of research to demonstrate the significance of human capital development might result in community leaders only focusing on policies designed to enhance tangible forms of the aerotropolis model and ignoring the human capital requirements that are necessary for aerotropolis model success (Hanushek & Woessmann, 2015). Jorgenson and Fraumeni (1992) and Mellander and Florida (2007) emphasize the investment in human capital is just as beneficial to the success of a community as tangible forms of capital.

Delimitations of the Study

According to Roberts (2010), "delimitations are the boundaries of the study" (p. 138). In this case, the population is restricted to the 35 airports located in the United States identified as adopting the aerotropolis model by Kasarda and Appold (2014). The scope of this study is limited to airport commercial activity in 2014. The measurement of human capital development present in the airport community is limited to participants who completed community college and university programs in the airport MSA whose purpose is to develop talent for aerotropolis model occupations. Although identified by the literature as a sector related to the aerotropolis model (Wang & Hong, 2011), culinary and catering programs offered by universities and community colleges are excluded to allow for examination of education and training programs explicitly related to transportation and logistics. The university and community college programs selected in this study focused on airport-related businesses such as airlines, ground handling service, logistics companies, and freight forwarders. Program completions offered at these community colleges and universities range from certifications at community colleges to university doctoral degrees but were counted and weighed equally. The measurement of the economic output of human capital development is restricted to the airport MSA and airport community. Regional economic outcome factors are limited to gross regional product, employment, and per capita income. The age of the workforce is 15-64 years. Furthermore, the productivity of the airports is limited to the number of passenger boardings and cargo activity (in metric tons) of the airport MSA. The study area of the aerotropolis model is restricted to the region of the aerotropolis within a five-mile radius of the center of the airport. Figure 2 displays the spatial illustration of the aerotropolis model and study area.

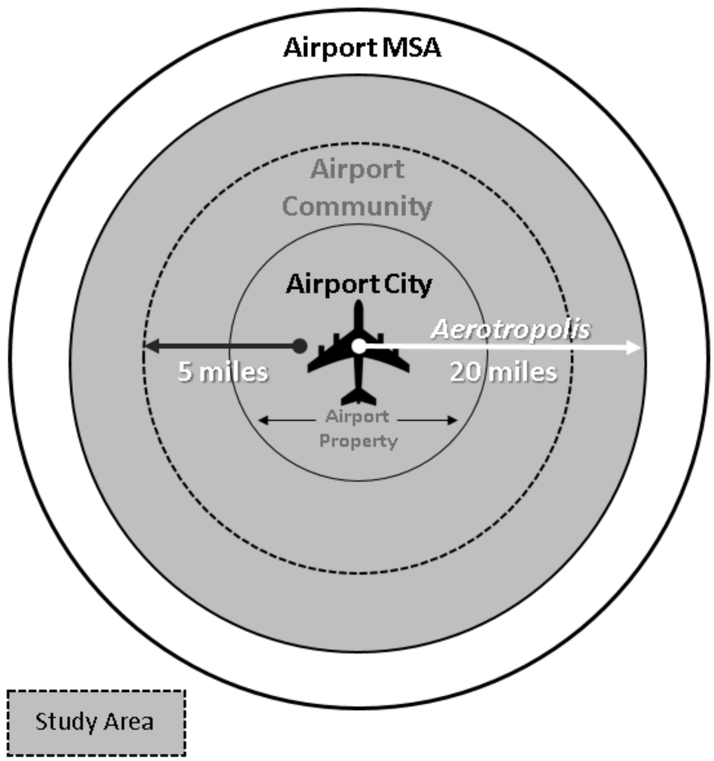

Figure 2. Spatial illustration of the aerotropolis model and study area.

Definition of Terms

To help the reader understand this study it is necessary to define terms that are used in this study. These terms are either unique to airport development or defined especially for this study. The following definitions relate to this research:

1. *Aerotropolis* – An area, region, or cluster in which the economic activity is

centered around the airport. Distribution centers, light manufacturing firms, office buildings, convention centers, entertainment centers, and hotels comprise the aerotropolis and are connected to the airport with a network of roads and rail (Kasarda, 2011).

2. *Aerotropolis model performance* – The number of passenger take-offs and landings and amount of cargo processed at the airport. Also referred to as airport commercial activity in this study. (Green, 2007).
3. *Aerotropolis model success* – The aggregate of gross regional product, employment, and per capita income of the airport community.
4. *Airport cargo activity* – Determined by the total amount of cargo processed in metric tons annually at an airport divided by the MSA population of the airport (Green, 2007).
5. *Airport City* – Refers to the area inside the airport property (e.g., terminals, runways) and any on-premise businesses that may be located on the airport property such as air cargo, logistics, offices, retail, and hotels (Kasarda, 2011).
6. *Airport Community* – For the purpose of this study, the Airport Community shall refer to the airport city plus communities inside the aerotropolis whose zip codes are within a five-mile radius of the center of the airport.
7. *Airport MSA* – Metropolitan and micropolitan statistical areas (also known as metro and micro areas or MSA) are geographic regions described by "the U.S. Office of Management and Budget for use by Federal statistical agencies in collecting, tabulating, and publishing Federal statistics" (U.S. Census Bureau,

2013, para. 1). For purposes of this study, the Airport MSA is the metropolitan or micropolitan statistical area in which the airport is located.

8. *Airport passenger activity* – Determined by the total number of annual boardings at an airport divided by the MSA population of the airport (Green, 2007).
9. *Cluster* – A concentration of companies, organizations, and institutions interconnected by similar goals and objectives in the same region, state, or nation (Porter, 1990).
10. *Completion Rate* – The total number of graduates completing specified level of education programs divided by the population of the typical graduation age of the educational program participants (Luca, Verdyck, & Coppens, 2014).
11. *Economic Geography* – A branch of geography that studies the global disbursement and placement of economic activities (Moretti, 2013).
12. *Employment to population ratio* – The portion of the total working age population (15-64) that is employed in a region, municipality or country compared to the total population in a region, municipality or country (Employment to population ratio, 2016).
13. *Latent Variable* – A variable that cannot be directly observed but inferred through other observable variables or statistical tests (Field, 2014).
14. *Working age population* – The number of residents of a community ages 15-64 (OCED, 2017).
15. *Z-score* – Also known as the Standard Score, is the value of observed deviations in a data set that is above or below the mean (Davis, 2011).

Chapter Summary

Cities have always revolved around trade (Ellis, 2011). In today's era of globalization, city leaders and policymakers are depending more on air transportation as a key component for economic growth and development (Addie, 2014). Kasarda (2006) suggests the rise in importance of air transportation is a result of a global economy driven by speed. Proponents of airport-based economic development predict the airport will transform from a regional gateway into a functional airport city and aerotropolis (Kasarda, 2006). Opponents of the aerotropolis model dispute the impact of the aerotropolis on economic development and local employment (Charles et al., 2007; Clayton, 2007; Cidell, 2015; Mukkala & Tervo, 2013; Neal (2012). Cidell (2015) and Neal (2012) identify several weaknesses in the aerotropolis model as an economic development strategy. Despite these concerns, Kasarda and Lindsay(2011) believe a well-designed and active aerotropolis is key to the economic success of the airport community. Seeking to attract new industry and economic growth, policymakers in airport communities consider adopting the aerotropolis model (Antipova & Ozdenerol, 2013; Kasarda, 2011; Zhou, 2011). Focusing mainly on infrastructure and other physical improvements to improve the economic well-being of the airport community, policymakers have ignored the importance of human capital development on a community's success (Kaplan & Rauh, 2013).

The balance of this study is composed of four chapters, a reference section, and appendixes in the following manner: In Chapter II, the literature review includes a brief history of the development of transportation and growth of cities. Additionally, an examination of the literature related to airport-based economic development and human capital development originates in this chapter. In Chapter III, the study focuses on the research methods used, and the introduction of the data. Chapter IV contains an analysis of the data and a discussion of the findings. Chapter V concludes the study with a discussion of the results and findings of the research objectives. Additionally, the researcher offers suggestions for future study in Chapter V.

CHAPTER II – LITERATURE REVIEW

The literature review is a summary of collected works that support the conceptual framework of the research (Roberts, 2010). In this study, particular focus was on literature concerning the aerotropolis model. As community leaders transitioned from business models that focused primarily on air transportation, interest in the aerotropolis model increased (Everett, 2014; Zhou, 2011). Supporting literature included in this review consists of concepts and theories that influence the success (or failure) of the aerotropolis model. Since transportation is an integral part of the development of the aerotropolis model, this chapter also includes a review of the literature on the growth and expansion of transportation methods (Ellis, 2011). Literature on the development of human capital, particularly the impact of human capital as the workforce transitioned from an industrial-based economy to a global one is also reviewed. Chapter II examines literature regarding new training methods brought on by the introduction of new transportation methods in the logistics chain. Human capital development theory and the theory of transportation are the foundation theories of this study. This researcher investigated how these theories may shape the aerotropolis. Overall, this literature review provides support for the conceptual framework and research objectives of this study.

Literature Search and Research Tools used in the Literature Review

A literature search is a systematic approach to finding all available sources for information relating to a scientific or scholarly subject (Foneseca, 2013). The literature search is not limited to a single search but comprises multiple searches and various resources (Avni et al., 2015). Resources used in this study include Google and Google

Scholar Internet search engines, the University of Southern Mississippi's electronic library card catalog, and the Online Computer Library Center's search engine named WorldCat.

The Role of Community Leaders and Policymakers in Economic Growth

The decisions of community leaders and policymakers can affect the economic well-being of their communities (Furth, 2013). Many times the economic quality of life of the residents and the success of the businesses in the community hinge on the policies and leadership goals of community leaders and policymakers to create a climate conducive to economic growth (Furth, 2013). For communities to remain competitive in the global economy, it is key that policymakers improve community assets and adopt policies that attract new companies to the area and encourage existing businesses to expand (Furth, 2013).

One asset available to many communities is the airport (Mosbah & Ryerson, 2016). The Federal Aviation Administration reported 5,171 airports designated for public use in 2013. Of these public use airports, the Federal Aviation Administration recognized 565 as commercial service airports operating in the United States (U.S. Department of Transportation, 2014a). In the United States, governmental or quasi-governmental agencies own all commercial service airports (Green, 2014). Commercial service airport ownership includes cities, counties, joint ownership by cities and counties, airport authorities, port authorities, and states (USA Airports and Airlines, 2015).

Because local, county, and state governments own all commercial airports, community leaders and policymakers can control the success of the local airport, to some extent, by developing policies that encourage economic growth (Freestone, 2009; Green, 2014; Mosbah & Ryerson, 2016). Community leaders and policymakers are seeking new revenue streams beyond traditional airport-related sources. (Freestone, 2009; Kasarda, 2000; Kramer, 2010; Mosbah & Ryerson, 2016). Table 3 lists the distribution of commercial service airports by governance type.

Table 3

Commercial Service Airport Governance Distribution

Ownership Type	Number	Percent
City--	225	40%
County	90	16%
City & County	15	3%
Airport Authority	150	27%
Port Authority	40	7%
State	45	8%
TOTAL	**565**	**100%**

Note: Data from Major USA Airport. USA Airports and Airlines. Nationwide Directory of U.S. Airports and Airlines. Published by USA Airports and Airlines. Retrieved from www.officialusa.com/travel/airlines.

Mosbah and Ryerson (2016) cautioned airport officials and policymakers to consider fundamental changes in the air transportation system when planning for growth. The deregulation of airlines in 1978 caused airport managers and policymakers to rethink the airport business plan (Everett, 2014; Kramer, 2010). Under airline regulation, the airport business model provided infrastructure and facilities for airlines and general aviation services as their primary objective (Basso, 2008, Kramer, 2010, Mosbah & Ryerson, 2016). This business model was established when airport operations, planning, and capital projects were based on airport revenue that was predictable and not subject to market forces (Basso, 2008; Everett, 2014). After deregulation, airlines increased service in some markets and eliminated service in unprofitable markets (Basso, 2008; de

Neufville, 1991). Airlines established hubs to reduce costs and increase revenue (Kramer, 2010). In the new competitive environment, the airport business model changed from one that assumed a certain level of airport-related activity to a model with unpredictable growth (Kramer, 2010).

Airport managers and policymakers soon realized reduced passenger revenues would require them to engage actively in the recruitment and retention of airlines and pursue other forms of income (Basso, 2008; de Neufville, 1991; Kramer, 2010). Figure 3 illustrates the progression of this trend as airports transform from those centered exclusively on air-related services to airport cities that provide an array of non-air-related services (Hazel, 2013). In the 1970s, the airport business model focused on passengers and providing airport facilities that ensured safe take-offs and landings (Everett, 2014; Hazel, 2013). Less than 5% of airport managers considered promoting non -aviation revenue. After deregulation of the airlines, airport managers looked to increase revenue through expanding retail sales at the airport. By 1990, Hazel (2013) reported more than 30% of airport managers considered ways to increase non-aviation revenue. Airports Council International reported in 2014 non-aviation revenue accounted for 44% of the total operating revenue, or $7.56 billion compared with $9.31 billion, or 55.2% of regular airport-related revenues (Airport Council International, 2015). Now 70% of airports place emphasis on increasing non-aviation revenue in order to manage the volatility of the airlines business cycle (Airport Council International, 2015; Hazel, 2013).

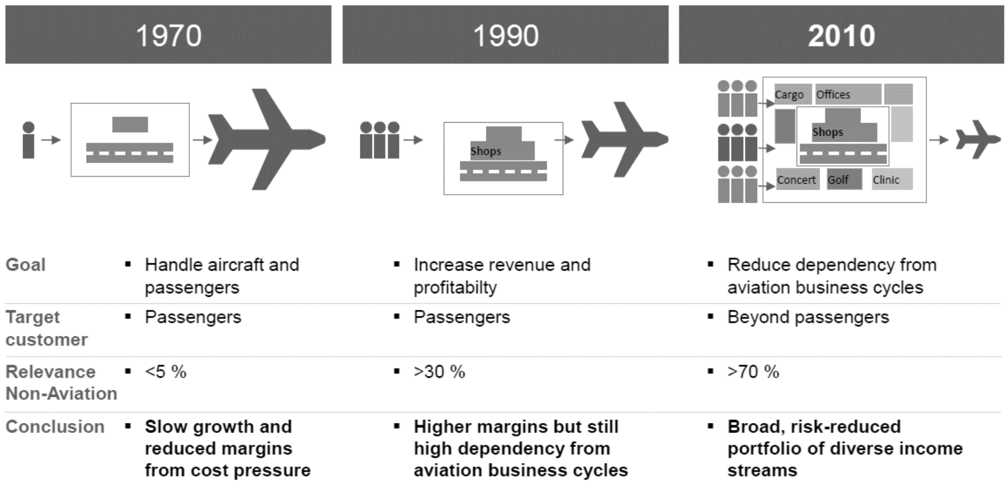

Figure 3. Illustration of the progression of airports.

Note: From "Airport Management for a World of Lower Demand and Greater Risk," by B. Hazel, 2008, *Airport Management*, p. 5. Copyright (2008) by Oliver Wyman. Reprinted with permission. See Appendix D for a statement of permission from the author.

The Role of Transportation and Trade in Urbanization

Today more than half the world's population lives in cities (Livi-Bacci, 2012). The percentage of city dwellers is higher when considering industrialized countries. For example, almost 60% of Canadians and 80% of U.S. residents live in cities (Cullingworth, 2015; Livi-Bacci, 2012). Researchers anticipate by 2050 that 66% of the world's population will live in cities (Livi-Bacci, 2012). With this trend towards global urbanization, many scholars believe air transportation and global trade will shape the future of society (Gleeson, 2012).

Kasarda (2006) suggested this rise in importance of air transportation is a result of a global economy driven by speed. Furthermore, Kasarda added that air transportation is the only practical method to transport goods globally with speed and efficiency. The advancement of air transportation is a result of the progression of five overlapping waves of transportation development (Kasarda, 2000). The five waves of transportation development are (a) seaports, (b) rivers and canals, (c) railroads, (d) vehicular transportation, and (e) airports as drivers of urban development. Prosperi (2007) explained that each wave influenced the transportation method of products and the morphological development or shape of the city. Figure 4 illustrates the waves of transportation development. Just as transportation shaped cities, human capital development efforts influenced the shape of cities (Crook, Todd, Combs, Woehr, & Ketchen, 2011).

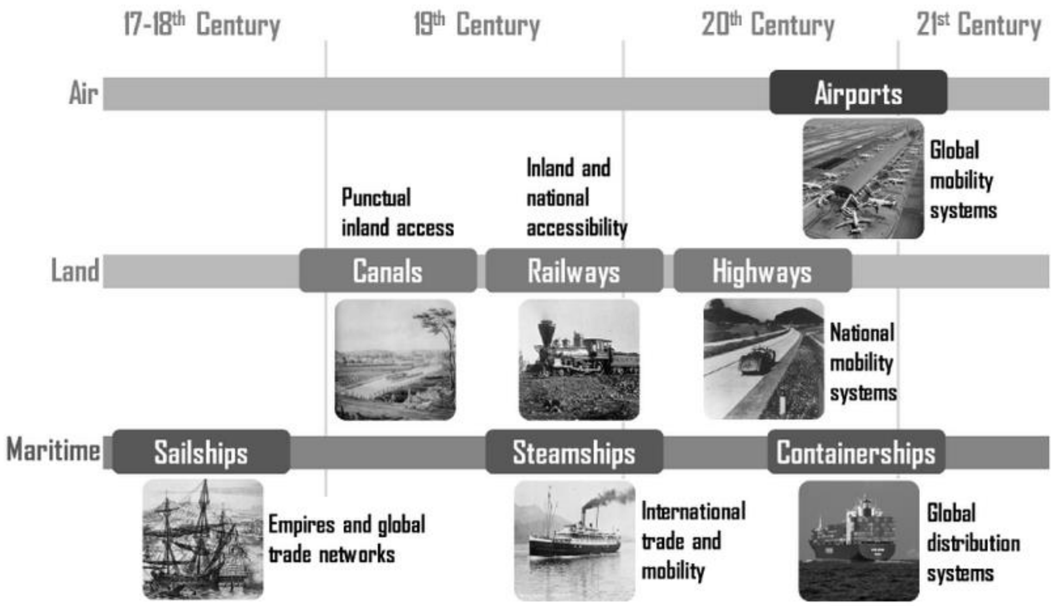

Figure 4. Cumulative Waves of Transportation Development.

Note: Adapted from "The Geography of Transport Systems." 2013, p. 62. Copyright 2013 by Dr. Jean-Paul Rodrigue, Hofstra University, New York, NY. Reprinted with permission (Appendix E).

Human Capital Development, Transportation, and Urban Development

The nature of work is under constant change (Swanson & Holton, 2009). Driven by society's need to survive, human capital development passed through many stages of growth (Swanson & Holton, 2009). Initially, education was informal and limited to families or tribes. Soon after society gained the ability to control fire and make simple tools, people began specializing in different types of trades (Swanson & Holton, 2009). To ensure these skills continued in the society, people shared what they learned with each other. Human capital development efforts eventually evolved to formal training to meet the new workforce requirements of the society (Swanson & Holton, 2009). As a result, human capital development efforts influenced urbanization with the introduction of new waves of transportation into the logistics supply chain (Crook et al., 2011).

The First Wave of Transportation Development

During the first wave of transportation development in the 17th and 18th centuries, seaports such as Rome and Constantinople (known today as Istanbul) became centers of international trade (Grover, 2013; Kasarda, 2000). These cities' strategic location along the Mediterranean and Marmora Seas provided excellent access to other trading partners (Grover, 2013; Kasarda, 2000). In the United States, New York, NY, Savannah, GA, and Norfolk, VA are examples of cities that developed around seaports (Grover, 2013). From seaports, development continued upstream along rivers (Kasarda, 2000).

At the same time, the Renaissance era brought a time of scientific and philosophical thinking (Swanson & Holton, 2009). The influences of Martin Luther, John Locke, Johan Pestalozzi, and other scholars contributed to the development of technical training and education for children that emphasized mathematics, logic, music, history, and science (Swanson & Holton, 2009). The first wave saw the formation of merchant and craft guilds. Soon after organization, the guilds provided apprentice programs. These human capital development efforts ensured the workforce would be competitive during the first wave (Mahan, 2004).

The Second Wave of Transportation Development

The second wave of transportation development occurred as a product of river and canal development (Grover, 2013). These waterways provided cities with networks of connectivity between goods and the marketplace (Grover, 2013; Kasarda, 2000). Throughout the early 19th century, it was common for factories to locate close to rivers in order to access water to power equipment (Ellis, 2011; Grover, 2013). Similarly, canal systems in Western Europe and North America emerged to transport heavy goods developed in the 19th century. The development of these canals also made possible the development of domestic distribution networks (Rodrigue, Comtois, & Slack, 2013). Where the canals created clusters of industry, rail terminals formed.

The United States transitioned from an agricultural society to an industrial one during the second wave of transportation. According to Finegold, Gatta, Salzman, and Schurman, (2010), during this era, the United States faced challenges to prepare the workforce for the best methods to compete in every decade since becoming a nation. Not until the early 19th century, with the founding of West Point Military Academy in 1802, and Rensellaer Polytechnic in 1824 was there any interest to use colleges and universities for vocational training (Grubb & Lazerson, 2012). The U.S. Congress formally acknowledged the role of higher education in workforce training with the passage of the Morrill Act in 1862 (Grubb & Lazerson, 2012). Under the Morrill Act, the federal government ceded land and cash to every state to build at a minimum, one college to teach agriculture and mechanical arts (Grubb & Lazerson, 2012).

The Third Wave of Transportation Development

The development of rail, which comprised the third wave of transportation development, allowed more flexible and high capacity inland transportation systems (Rodrigue et al., 2013). Rail made it possible for more inland areas to become accessible for manufacturing and trade (Grover, 2013). Distribution centers and processing centers emerged at rail hubs and terminal points (Grover, 2013). The availability of rail allowed manufacturing firms the flexibility to locate within the city near port facilities, rail lines, and the labor force. (Ellis, 2011; Lindsay & Kasarda, 2011). Increased surface traffic resulted in the construction of new and improved roads (Ellis, 2011). Improved roads made interstate trucking possible (Ellis, 2011).

During the development of rail, the third wave of transportation, human capital development efforts solidified in vocational education with the approval of the Vocational Education Act of 1917, (Grubb & Lazerson, 2012). The Vocational Education Act provided federal matching funds to States for training in vocational agriculture, transportation, home economics, and trades and industry in public secondary schools (Grubb & Lazerson, 2012). In 1933, Franklin D. Roosevelt signed the Wagner-Peyser Act (O'Leary & Eberts, 2008). The Wagner-Peyser Act created a national network of employment offices by consolidating local and state employment offices into one system. The new employment services improved job market operations by offering free job-matching assistance to those out of work and employers (O'Leary & Eberts, 2008). Initially, the employment offices functioned as a placement agency, mainly referring applicants to public-sector jobs (O'Leary & Eberts, 2008). Later, the scope of services under the Wagner-Peyser Act expanded to provide other job-related services such as career counseling, skill assessment, training workshops, and fulfilling various state and local unemployment compensation systems' work test requirements (O'Leary & Eberts, 2008).

Human capital development efforts continued during the third wave (Gordon, 2014). Brought on by widespread protests by workers on issues of health and job safety, President Franklin D. Roosevelt signed the National Apprenticeship Act into law in 1937 (Gordon, 2014). Known as the Fitzgerald Act, the act created a national advisory committee to research and draft regulations and set minimum standards for apprenticeship programs (Gordon, 2014). As a result, registered apprenticeship programs included mainly manufacturing, construction, and utility sectors after the passage of the Fitzgerald Act. Registered apprenticeship programs expanded, however, after World War II to include the training of public safety officers and other health and safety workers, (Gordon, 2014).

The Fourth Wave of Transportation Development

The development of comprehensive road transportation systems, such as the national interstate highway system, and the production of affordable automobiles facilitated the fourth wave of urban development (Rodrigue et al., 2013). The movement of merchandise and goods shifted to vehicular transportation. Cities expanded out to suburbs, and central business districts grew (Ellis, 2011; Kasarda, 2000). The developed road network connected working and living areas and offered workers flexibility. Automobiles and trucks broadened the footprint of the daily movement of urban workers (Appold & Kasarda, 2013). The availability of cars, such as the Model T by Henry Ford, in the early 20th century, drove down prices allowing more Americans to purchase cars

(Alizon, Shooter, & Simpson, 2009). Once limited to jobs on farms, many rural residents were suddenly able to buy cars and travel to the city to work in new factories (Ellis, 2011). Americans in the early 20th century were traveling more as part of daily life.

With the advent of a highway transportation system, the focus on education and training in the United States continued into the late 1960s (Mirengoff & Rindle, 1976). In 1962, the Federal government passed the Manpower Demonstration Training Act (Gatta, & Peprez, 2010). The goal of the Manpower Demonstration Training Act was to reduce unemployment by providing short-term training to the poor (Gatta, & Peprez, 2010). In 1973, President Richard M. Nixon signed into law the Comprehensive Employment and Training Act (CETA) (Gatta, & Peprez, 2010). This Act transferred the control of the Department of Labor Manpower programs to state and local officials. The Comprehensive Employment and Training Act allowed cities and counties of 100,000 people or more to receive funding to develop and run Manpower programs suitable for their needs (Mirengoff & Rindle, 1976). By the 1980s, politicians criticized the Manpower Demonstration Training Act and CETA programs because of the focus on job creation. This criticism, along with a general lack of support for public job creation, led to the creation of the Job Training Partnership Act enacted in 1982 (Finegold et al., 2010).

The Fifth Wave of Transportation Development

The 21st century brought a new wave: air transportation. Flight was in its infancy and emerged as the fifth wave of urban development by the 21st century (Kasarda, 2000). When describing the development of the fifth wave, Montgomery (2008) and Prosperi (2007) suggested the impact of trade now shapes cities through air transportation. Montgomery and Prosperi claim the change is occurring in the same manner as seaports, rivers and canals, rail, and vehicular transportation shaped yesterday's cities. Airports offer a similar potential to influence the shape of a city today as railroads did in the previous century (Montgomery, 2008; Prosperi, 2007). As the fifth wave of urban development, air transportation will be as essential to urban development in the 21st century as automobiles, railroads, and sea vessels were in previous centuries. Air transportation is now the catalyst for the fifth wave of urban development. Table 4 compares human capital development efforts with the five waves of transportation.

Table 4

Some Human Capital Development Efforts and the Five Waves of Transportation

Waves of Transportation Development	Focus	Human Capital Development Efforts
1. Sea ports	▪ Human-centric ▪ Infrastructure-centric	▪ Engineering and technical training ▪ Secular education for boys and girls ▪ Manual training
2. Rivers and Canals	▪ Human-centric ▪ Infrastructure-centric	▪ Apprenticeship training ▪ Role of government in technical training
3. Rail & Railroads	▪ Human-centric ▪ Infrastructure-centric	▪ The Vocational Education Act ▪ National Apprenticeship Act into law
4. Highways & Interstate	▪ Human-centric ▪ Infrastructure-centric	▪ Manpower Demonstration Training Act ▪ Comprehensive Employment and Training Act
5. Airports & the Aerotropolis	▪ Infrastructure-centric	▪ Talent Pipeline ▪ Economic measures

The literature offered little research on human capital development efforts to assist air transportation development. Nor did the literature address the importance of human capital in the training of the workforce required to operate the airport successfully. The focus of air transportation literature was adding infrastructure to the airport and airport planning (Kasarda, 2009; Kasarda & Appold. 2014).

Airport-Based Economic Development: The Aerotropolis Model

As the fifth wave of urban development, air transportation influences the quality of life and shapes or molds a community (Appold & Kasarda, 2013). In much the same manner that human capital development efforts contributed to the growth of the four previous waves, it is anticipated human capital development should help the growth of the communities through air transportation (Sweetland, 1996; Tomer, 2016). Until recently the literature on the significance of airport-based economic development has been ignored by scholars despite the greater role air transportation now plays in shaping cities (Freestone & Baker, 2011). Research on the effectiveness of airports as unique generators of regional economic development is still emerging (Cronin et al., 2016; Mosbah & Ryerson, 2016). However, as the influence of air transportation and the accompanying airport-based economic development increases, researchers and scholars are examining the importance of airport-based economic development on the national and local economy (Freestone & Baker, 2011). Green (2007) and Kasarda and Appold (2014) explained airport-based economic development tended to attract high-tech companies seeking to hire highly skilled workers. Besides benefiting the high-tech firms that attracted them, workers hired at these businesses helped create jobs for the entire community (Basterretxea & Albizu, 2011). In fact, Moretti (2013) suggested the most efficient way for a city to create jobs for less skilled workers is to attract high-tech companies that hire highly qualified workers.

The Influence of Passenger Traffic and Cargo on Economic Development

The connectivity of scheduled air transport service to other markets drives the demand for passenger and cargo activity (Allroggen, Wittman, & Malina, 2015; Lakew, 2015). Mayer (2016) reported that airports that are classified by the FAA as large passenger hubs or located in an airport MSA that is a tourist destination experienced higher passenger traffic. When examining cargo activity, Mayer also discovered that airports containing air cargo sorting facilities for DHL, FedEx, or UPS outperform airports that do not possess these facilities. Tables A1, A2, and A3 in Appendix A provide detailed information on airport hubs, tourist destinations, and the location of air cargo sorting facilities.

Passenger traffic is also a powerful predictor of population growth and employment growth (Green, 2007). Researchers can determine the influence of economic activity generated by the airport by measuring the number of people transported to an airport community (Green, 2007). Studies by Brueckner (2003) and Sheard (2014) indicated a positive correlation exists between increased airport passenger traffic and increased employment. Button and Yuan (2013) stressed that there is less economic impact to a community from air cargo compared to passenger traffic, but benefits from air cargo activity exist.

Chang and Chang, (2009) examined the relationship between air cargo expansion and economic growth. The results of the study revealed an equal integration between air cargo expansion and economic growth. That is, there is a symbiotic relationship between air cargo expansion and economic growth. Chang and Chang observed there is also a bi-directional causality between air cargo expansion and economic growth. Chang and Chang concluded that air cargo expansion plays a crucial role in promoting economic growth in the airport community. Appold and Kasarda (2013) reported the movement of people and cargo is of equal importance in the fifth wave of transportation development. However, Mayer (2016) observed that passenger activity may be up to 10 times more valuable than cargo activity. Regardless of location, businesses located in the airport community can efficiently transport products to distant markets and global supply chains using air cargo (Mayer, 2016). Goods shipped by air tend to have a high value-to-weight ratio, are highly perishable, or are time-critical components of the complex supply and distribution chains (Appold & Kasarda, 2013). For that reason, many cities are expanding outward, away from traditional urban centers and adopting the aerotropolis model (Appold & Kasarda, 2013).

Airports classified by the FAA as large passenger hubs or located in an airport MSA that is a tourist destination experienced the highest passenger and cargo activity (Dobruszkes, Givoni, & Vowles, 2017). When examining cargo activity, Dobruszkes, Givoni, and Vowles noted that aerotropolis model airports containing air cargo sorting facilities for DHL, FedEx, or UPS outperformed aerotropolis model airports that did not possess these facilities (Mayer, 2016). Cargo activity is driven primarily by integrators (e.g., DHL, FedEx, and UPS) using the airports as sorting facilities for air cargo (Alkaabi & Debbage 2011; Mayer, 2016).

The Airport City and Aerotropolis

A fundamental principle of the aerotropolis model is that the aerotropolis and airport city are specialized regions (Kasarda, 2011). Kasarda and Lindsay (2011) envisioned life in the 21st century revolving around the aerotropolis model. In the aerotropolis and airport city, the airport is the central component of the city and key to its economic vibrancy as the world's population becomes more urbanized.

Freestone (2009) expressed an expectation that communities based on the aerotropolis model would grow. Many of today's airports are designed or being redesigned to conform to the aerotropolis model (Charles et al., 2007). Airport communities are constructing a supporting infrastructure network of roads and rail to accommodate the clusters of logistics centers for freight, business centers, shopping centers, hotels and entertainment facilities that are locating in the aerotropolis (Charles et al., 2007). With the rise in airport activity, some researchers and policymakers assume airports are regional and local job generators. They promote the aerotropolis as a new type of urban place or airport sub-region based on the number of jobs located in the airport community (Kasarda & Lindsay, 2011). Business owners seek to gain a competitive advantage by locating near air transportation; and by doing so, are transforming airport communities into clusters of commercial activity and economic development (Kasarda, 2000). Figure 5 illustrates the employment sectors inside the fence of the airport, called the airport city, and employment sectors outside the fence in the aerotropolis (Kasarda, 2008).

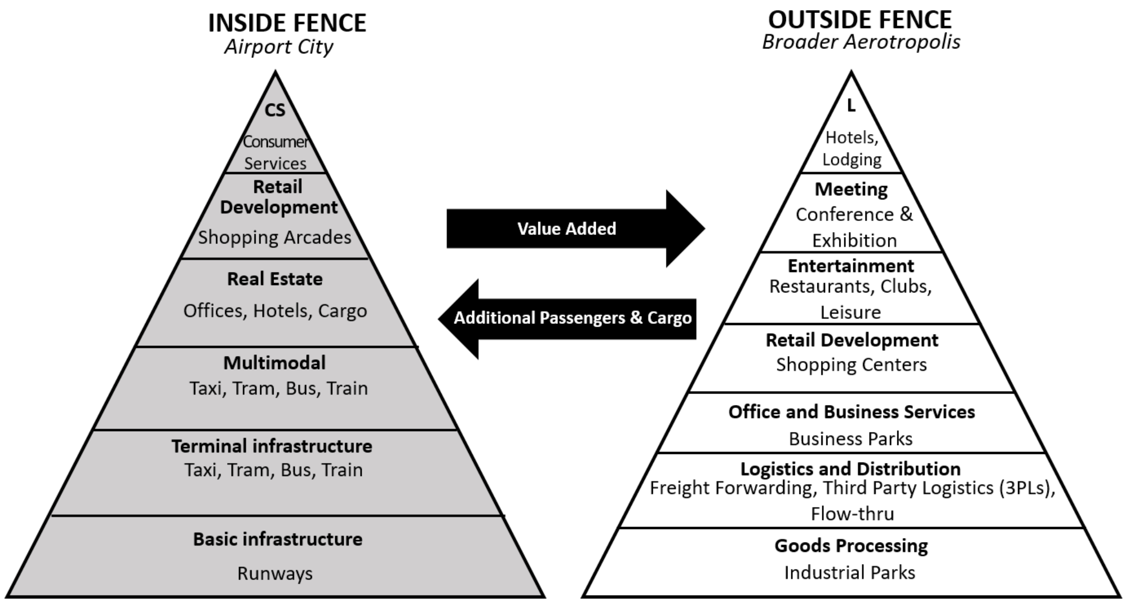

Figure 5. Employment Sectors of the Airport City and Aerotropolis.

Note: Adapted from "Developing the City of Hapeville into the Future Airport City", by Y. Zhou, 2011, School of City and Regional Planning, Georgia Institute of Technology, Georgia Institute of Technology, Atlanta, GA., p.8. Copyright 2011 by Georgia Institute of Technology. Adapted with permission. See Appendix F for a statement of permission from the author.

Characteristics of Successful Aerotropolis Model Airports

Kasarda and Appold (2014) stated that aerotropolis model airports possess features that distinguish them from airport-based economic development. Kasarda and Appold identified 84 airports worldwide based on the aerotropolis model including 35 airports in the United States. The airports include both aerotropoli and airport cities. Kasarda and Appold admitted the criteria for the classification of the aerotropolis model airports are subjective. Instead, the basis of the Kasarda and Appold's assessment relied on their qualitative and quantitative research of airports and their knowledge of industry clusters that correspond to the aerotropolis model. According to Kasarda and Appold, aerotropolis model airports share essential characteristics. For example, there is community support from city leaders and policymakers for the aerotropolis model (Kasarda & Appold, 2014). The establishment of aerotropolis steering committees, strategic planning, and development initiatives this support. Also, there is governmental and regulatory support of the aerotropolis model through tax incentives and policies that support the aerotropolis model. There are also marketing initiatives by community leaders to promote the aerotropolis model. The airport itself serves as a catalyst to attract non-airport related commercial development (Kasarda & Appold. 2014). The most popular non-airport related developments are restaurants and specialty retail, hotels, and other accommodations, convention and exhibition centers, logistics and distribution hubs, free trade zones, and custom free zones (Kasarda & Appold. 2014).

The researcher of this study observed that all 35 aerotropolis model airports are cargo service airports. The Federal Aviation Administration classifies cargo service airports as airports that process aircraft cargo with a total annual landed weight of more than 100 million pounds (U.S. Department of Transportation, 2014a). Wang and Hong (2011) suggest airports based on the aerotropolis model provide enhanced cargo operations that offer not only connectivity to the airport but also access to global regions. In addition to processing more than 100 million pounds of cargo, Xia and Li (2006) noted six common characteristics of the aerotropolis model:

- the airport is at the core of the aerotropolis model;
- industries related to airport operations and air transportation tend to cluster within the aerotropolis model;
- industries with different air transit utilization rates are located at various distances from the airport;
- the airport offers market efficiency for businesses requiring quick access to business flow and transit;

- the airport has access to global networks; and
- the airport makes use of technology and provides technical support.

With economic activity revolving around the airport, the aerotropolis model attracts business and recreational purposes (Wang & Hong, 2011). Classification of the business activity at the aerotropolis takes place in three groups. Figure 6 lists the spatial zoning of the aerotropolis model. At the core of the aerotropolis model are the core industries. These industries include airport-related businesses such as airlines, ground handling service, and catering services. The next category contains dependent industries (Wang & Hong, 2011). Dependent industries include logistics companies, freight forwarders, aircraft maintenance firms, and air cargo facilities. The third group of the aerotropolis model consists of related industry. Wang and Hong place value added manufacturing, hospitality, tourism, and business and exhibition in this category.

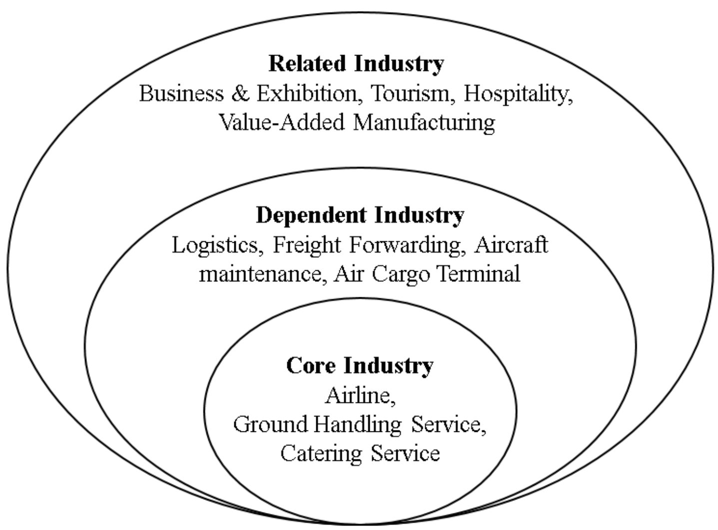

Figure 6. Spatial zoning of aerotropolis model industries.

Note: From "Competitive advantage analysis and strategy formulation of airport city development: The case of Taiwan", by K. Wang and W. Hong, 2011, *Transport Policy*, 18, p. 278. Copyright 2011 by Transport Policy. Adapted with permission. See Appendix G for a statement of permission from the author.

Critique of the Aerotropolis Model.

Despite the success and popularity of Dallas-Fort Worth International Airport, Dulles International Airport, and other airports based on the aerotropolis model, scholars disagreed on their practicality. Scholars questioned the theory behind the aerotropolis model. While Friedman's (2006) flat earth theory of urban globalization supported the aerotropolis model, Brugmann (2011) denounced urban globalization models like the aerotropolis. Instead, Brugmann promoted the strategic design of urban areas. Brugmann described strategic design as the process in which cities intentionally create new social, political, and economic structures within the context of their existing structure.

Research indicated economies based on services linked to the aerotropolis model contribute to the economic growth of the airport community. Brueckner (2003) and Sellner and Nagl (2010) believed increases in air traffic and air traffic capacity at an airport attract more firms to a region, which leads to more jobs. Other researchers, however, found job creation was not as simple as more air traffic. Instead of airport activity creating job growth, Neal (2012) suggested that the increase in jobs around the airport is what leads to increases in air traffic. Despite the enthusiasm over the potential number of jobs generated by the aerotropolis model proponents, Bel and Fageda (2008) reported major U.S. airports are the most important sub-regional job center of its metropolitan area only about 50% of the time. Bel and Fageda went on to report that in 25% of metropolitan areas, airports are insignificant as a local employment generator. Other researchers were also not as enthusiastic about the aerotropolis model.

Cidell (2015) agreed with the findings of Bel and Fageda (2008), and other researchers who minimized the importance of the aerotropolis. Cidell criticized Kasarda, Lindsey, and other proponents of the aerotropolis implying the researchers ignored sub-regional factors that may influence job growth. Cidell complained that proponents of the aerotropolis as economic engines either ignore the spatial distribution of the airport community and only focus on evaluating the total costs and benefits or discredit challengers of the aerotropolis as narrow-minded. Regarding the infrastructure of a major international airport, Cidell explained that the costs are clearly localized and easily identifiable. Cidell referred to increased noise, reduced property values, degradation of health, and lower quality of life as costs associated with airport infrastructure, but admits identifying localized benefits are not as clear in isolating the costs. Cidell argued a company's requirements for accessibility to air transportation, the ability to acquire enough land to operate the business, low taxes, and ease of access to roads and transportation, are the same business location concerns that are important regardless of location. The question remains whether businesses attracted to metropolitan areas by good air service are locating within airport communities or if they are locating away from the airport to communities that are already benefiting from growth (Bel and Fageda, 2008). Cox (2010) cited the lack of ability of many airport communities to obtain land needed to develop the aerotropolis. Cities such as Memphis, TN face difficulty in obtaining land for development because the land is occupied by other users (Cox, 2010). The lack of available land forces planners to compress corridors leading to the airport and land uses into smaller areas (Cox, 2010).

Another concern for the viability of the aerotropolis is the reliance on fossil fuel as an energy source for aircraft. Researchers cite potentially high fuel costs, the unavailability of alternate fuel sources, and pollution as factors that could limit airport activity at the aerotropolis (Charles et al., 2007). Charles et al. (2007) disputed Kasarda and Lindsay's (2011) claim the increase of airport activity stimulated by the aerotropolis will result in a dramatic shift from rail and sea transportation to air transportation. Charles et al. (2007) believed the growth of the aerotropolis is impractical because aircraft depend on fossil fuel.

Charles et al. (2007) cited potentially high fuel costs, peak oil, the unavailability of alternate fuel sources, and pollution as factors that could prevent the growth of aerotropolis. Peak oil occurs when the demand for oil exceeds supply (Charles et al., 2007). While today's aircraft are limited to fossil fuel, Charles et al. emphasized ships have the flexibility to operate by using alternate energy sources such as wind, coal, and nuclear power. Charles et al. predicted that ships could use solar energy as an eventual source of energy. Barring new technological advances in aviation engineering, no effective and economically efficient alternative energy system exists for aircraft. Because aircraft are limited to using fossil fuels as an energy source, researchers are also concerned about the environmental and health impact of the airport to the community (Charles et al., 2007).

Until recently, researchers and scientists ignored the environmental and health impact on airport emissions. Like other transportation sources that use fossil fuel, aircraft emit air pollutants (Marć, Tobiszewski, Zabiegała, de la Guardia, & Naiman, 2015). Aircraft emissions include carbon dioxide, nitrogen oxides, carbon monoxide, sulfur dioxides, volatile organic compounds, particulates, and other trace compounds (Marć et al., 2015). A study by Jacobson, Wilkerson, Naiman and Lele (2013) revealed airports are one of the largest contributors to ambient air pollution in the United States. The study disclosed that aircraft emissions were responsible for about 6% of Arctic surface global warming, roughly 1.3% of the total surface global warming, and about 4% of global warming in the upper troposphere (Jacobson et al., 2013). The troposphere is the lowest layer of the earth's atmosphere and is the origin of most of the earth's weather activity (Li et al., 2014). The Jacobson et al. (2013) study also reported increases in human mortality of approximately 620 deaths annually worldwide because of aircraft emissions.

Kasarda (2009) acknowledged the concerns about fossil fuel as legitimate, but disputes fossil fuel will hinder the growth and importance of the aerotropolis. First, Kasarda discounted allegations made by opponents of the aerotropolis regarding the long-term availability of fossil fuel. Kasarda explained that despite the fact that many scientific models existed which predict peak oil, scientists are unable to forecast the attainment of peak oil because the assumptions continuously change as the discovery of new sources of oil and innovative energy extraction methods emerge. Second, unlike many skeptics, Kasarda confirmed his belief that advances in aerospace energy will produce viable alternatives to fossil fuel. Last, Kasarda reminded his critics that it is human nature to predict crises and ignore innovation. Kasarda is confident innovation will find satisfactory solutions for the critical long-term challenges of environmental concerns and peak oil. Despite the differences of opinions by scholars on the development of the aerotropolis model, the overall view of growth is similar to other urban development. The growth of the airport community will be determined by inherent trends that will shape their development. Kasarda and Lindsay (2011) predict the aerotropolis will survive potential threats and be commonplace in the 21st century.

How Human Capital Development Fits in with Aerotropolis Model

How the airport community responds to managing its assets in response to airport activity is central to this study. In research on the enhancement of community competitiveness, Johnson (2000) stated the key to the well-being of any community, including the airport community, is the ability to manage its assets. As part of the research, Johnson introduced a conceptual model for improving community health and well-being. In the model, Johnson describes the elements needed for a healthy community. Consistent with the literature, Johnson emphasized the importance of community leaders and policymakers endorsing programs necessary to improve the financial, physical, cultural, and social capital of the community. Johnson also stressed the importance of human capital development to the well-being of the community. Johnson suggested communities make large-scale investments in the local education system. The involvement of primary and secondary institutions, community colleges, and universities ensures the availability of education and training programs that will allow citizens to compete for jobs (Johnson, 2000). These investments in human capital development enhance the communities' attractiveness for business retention and recruitment (Johnson, 2000).

Human Capital Development

According to Freestone and Baker (2011), airports shape or mold the community by attracting human capital to the community and influencing the human capital needs of the airport community. Human capital development is critical as technological changes and economic growth affect the community (Lucas, 1988). Human capital development is the process of understanding and learning new ideas from others (Jacobs, 1970). On the importance of human capital development, Schultz (1975) argued human capital development helps people identify the changing incentives that result from innovation and allows companies and individuals to react quickly to technological changes.

Economist Theodore William Schultz described human capital development as:

> A process that relates to training, education, and other professional initiatives to increase the levels of knowledge, skills, abilities, values, and social assets of an employee that will lead to the employee's satisfaction and performance, and eventually on a firm's performance (As cited in Marimuthu, Arokiasamy, & Ismail, 2009, p. 265).

As the world moves to a more global economy, human capital development becomes more important by providing new approaches for companies to gain a competitive advantage (Porter, 1990).

There are different categories of human capital. Herbert S. Parnes defined human capital as "the productive capabilities of human beings that are acquired at some cost and command a price in the labor market because they are useful in producing goods and services" (As cited in Swanson & Holton III, 2009, p. 87). Groysberg, McLean, and Nohria (2006) defined five types of human capital as (a) general human capital, (b) strategic human capital, (c) industrial human capital, (d) relationship human capital, and (e) company-specific human capital. General human capital incorporates skills in leadership, management, and functional expertise. Strategic human capital exemplifies itself through knowledge gained from experience in situations that require specific strategic skills such as cost cutting. Industrial human capital relates to technical, regulatory, or industry-specific knowledge. Relationship human capital involves relationships with colleagues. Company-specific human capital is knowledge specific to systems and processes unique to a particular company (Groysberg et al., 2006). Based on these definitions, human capital development is a process, constructed on human capital theory, to improve an employee's skills, education, and problem-solving abilities to make that employee a more productive worker (Groysberg et al., 2006; Swanson & Holton III, 2009). The aerotropolis model promotes human capital development by attracting businesses to the airport communities that share ideas through informal networks, short feedback loops, and knowledge transfer (Fontan, Hamel, Morin, & Shragge, 2009).

Measuring Human Capital Development

Economists and social scientists agree the driver of economic development in any community is highly skilled and educated people (Florida, Mellander, & Stolarick, 2008). Economists often refer to this group of talent as human capital (Florida et al., 2008). Measuring the development of human capital of a community is challenging (Baron, 2011). While there is agreement on the importance of human capital in a community, scholars disagree on the best method to measure it (Boarini, d'Ercole, & Liu, 2012). Consequently, the measures for human capital are fluid and are dependent on the strategy of the organization or researcher (Boarini et al., 2012; Christian, 2011). Baron (2011) explained some of the variation in measuring human capital stems from whether scholars treat people as costs or assets. For instance, some researchers advocate measuring human capital based on an indicators-based or educational attainment approach while other scholars promote monetary based measures (Boarini et al., 2012).

Folloni and Vittadini (2010) credit Sir William Petty as the first person to attempt to measure human capital in the late 17th century. Petty viewed human capital as an asset and valued human capital based on capitalizing national wages (Folloni & Vittadini, 2010). Conversely, Richard Cantillon, an entrepreneur, and economist in the early18th century dismissed the value created by human capital and instead treated human capital as a cost (Folloni & Vittadini, 2010; Murphy, 1986). For example, Cantillion focused on the cost to maintain his slaves rather than the value generated from them (Folloni & Vittadini, 2010). More recent work by Christian (2011), Jones and Chiripanhura (2010), and Li, Fraumeni, Liu, and Wang (2009) applied the income-based approach to measuring human capital. Other researchers, such as Barro and Lee (2013), and Portela, Alessie, and Teulings (2010), measured human capital based on the educational attainment of individuals. As a result, there is no single method to measure human capital (Baron, 2011; Boarini et al., 2012). Baron summarizes three main approaches to measuring human capital. These approaches are (a) the cost-based approach, (b) the income-based approach, and (c) the education-based approach. Additionally, scholars often use an integrated approach that employs elements of any or all three methods (Baron, 2011).

The Cost-Based Approach

The cost-based approach measures human capital based on the expenses to rear a child to age 26 (Le, Gibson, & Oxley, 2005). Similar to the method used by Cantillon to determine the cost of owning slaves (Folloni & Vittadini, 2010), this approach provides an estimate of the amount of resources spent on investment in education and other expenditures related to human capital development (Le et al., 2005). Boarini et al. (2012) recognized the work of John Kendrick as the most popular application of the cost-based approach. According to Boarini et al., Kendrick's estimate for measuring human capital is more comprehensive than other applications using the cost-based approach. Kendrick assumed all expenses associated with child rearing are human capital investments (Le et al., 2005). In addition to using the cost of child rearing and spending on education as factors, Kendrick included other expenditures thought to have educational value (Boarini et al., 2012). Kendrick included the opportunity cost of student time, the price of tuition and books, and government's costs for salaries and capital improvements such as schools and administrative buildings in his estimates (Boarini et al., 2012).

The cost-based approach of measuring human capital is useful because it offers a measurement of the allocation and pathway of resources invested by a community in human capital (Le et al., 2005). An additional advantage of the cost-based approach is that data on public and private spending is readily available (Le et al., 2005). Still, criticism of the cost-based approach exists. Folloni and Vittadini (2010) determined there is no relationship between the amount a community spends on education and training and the quality of the education and training. Secondly, Folloni and Vittadini warned that not all of the components invested in human capital development are identified. A third criticism of the cost-based approach is that the method ignores the value of social costs, such as public investments in health and education, in measuring human capital (Folloni & Vittadini, 2010).

The Income-Based approach

The second method discussed in the literature is the income-based approach. Unlike the cost-based approach, the income-based approach looks at the earnings of human capital investment over the lifetime of the individual (Boarini et al., 2012; Hamilton & Liu, 2014). Implementing the income-based approach generally requires three steps: (a) collecting data on individual earnings, school enrollment rates, employment rates and survival rates, (b) developing cross-classified groups by categorizing information such as age, gender, education, lifetime income, and other characteristics of individuals, and (c) aggregating across these groups to estimate the monetary value of human capital (Boarini et al., 2012).

An advantage of the income-based approach is that it focuses on individual earning power. It values human capital at market prices (Boarini et al., 2012). In other words, the income-based approach provides an accurate measurement of the value of human capital that results from supply and demand in the labor market (Boarini et al., 2012). However, the income-based approach is not without shortcomings. According to Boarini et al. (2012) and Le et al., (2005), researchers must predict future economic indicators such as real income growth rate and wages. This subjectivity can make it difficult for researchers to predict the costs of human capital accurately (Boarini et al., 2012).

The Education-Based approach

The third method is the education-based approach. As the name suggests, the education-based approach measures human capital by evaluating factors related to educational attainments such as literacy rates, average number of years in school, and test scores (Le et al., 2005). Christian (2011) described the education-based approach as the simplest of the three approaches to measuring human capital. The education-based approach to measuring human capital provides a relatively easy method for researchers to track the educational attainment of a community (Jones & Chiripanhura, 2010). Research by Barro and Lee (2013) and Portela, Alessie, and Teulings (2010) emphasized the importance of education to the economic well-being of a community. Bontis (2004), Mulligan and Sala-i-Martin (2000), and Shapiro (2006) used the education-based approach to study the growth, development, and wealth of countries, regions, and cities.

Alternative Methods to Measure Human Capital Development

Even with its merits, scholars suggest there are better methods other than education-based approaches to measuring the human capital development of a community (Hanushek & Woessmann, 2015; Judson, 2002). Traditionally, many researchers use educational attainment, usually presented as the average number years of schooling, to measure human capital development (Baron, 2011). Jones and Chiripanhura (2010) concluded this approach does not account for the costs and returns of education that can differ at various education levels. In other words, Jones and Chiripanhura believe the education-based approach incorrectly assumes one year of schooling will raise human capital by one year. Jones and Chiripanhura stressed that the education-based approach also incorrectly assumes the quality of education is consistent between all communities and timeframes. Jones and Chiripanhura recognized that because the quality of education does vary between communities, there is a potential for bias and possible subsequent overlooking the quality of teaching with the education-based approach. Researchers often cite program completion rates, or talent pipeline, as a better method to quantify educational attainment in a community (Camilleri, 2016; Collings and Mellahi, 2009). Talent pipeline is defined as the number of students completing training and education programs that a community produces each year relative to the population of the education program group. (Hanushek & Woessmann, 2007, 2008, 2015).

Talent Pipeline

One of the biggest challenges communities and employers must address is creating and sustaining a strong talent pipeline (Stahl et al., 2012). E. Gordon (2009) credited the struggle for communities to provide an acceptable talent pipeline is the result of the combination of three economic and cultural forces. Gordon cites an evolving globalized economy, baby boomer retirements, falling birthrates, and a declining global education to employment system that has lagged behind 21st-century skill needs and employment requirements. Despite these challenges, Barlow (2006) and Gordon (2009) recommended communities provide a continual supply of highly skilled workers, or talent pipeline, to drive the economy. Tyszko, Sheets, and Fuller (2014) and Woods (2015) warned that the lack of a continual supply of trained workers in a community can result in (a) an increased skills gap, (b) a weakening of a community's competitive advantage, and (c) loss of productivity for local employers.

A skills gap is defined as the difference between the needs of employers for skilled talent in the community and the skills possessed by the available workforce (Woods, 2015). Benefits of reducing a community's skills gap include a better-prepared workforce for employers and improvements in job placement for education and workforce partners. Additionally, reducing a community's skills gap results in a higher return on workforce and education investments for policymakers (Woods, 2015). Researchers agree that technical and non-technical innovations enable companies to gain a competitive advantage in the global marketplace (Amarakoon, Weerawardena, & Verreynne, 2016; Cronin et al., 2016). Collings and Mellahi (2009) argued that a company's ability to maintain a competitive advantage is tied to the company's ability to access the community's talent pipeline. Woods (2015) suggested that there is a often a disconnect between the training programs the community offers and the training programs local businesses need. Ideally, communities will work in close collaboration with the private sector to provide the talent needed for local businesses to remain competitive (Woods, 2015). A community with a high talent pipeline is more productive because skilled workers produce more product than unskilled workers.

Recognizing a potential increase in the skills gap, a weakening competitive advantage and lower productivity resulting from a poor talent pipeline, policymakers, and educational institutions in proactive communities collaborate with companies to design training programs that are relevant to meeting the business requirements of the community (Tyszko, Sheets, & Fuller, 2014). Before beginning a new training program, local educational intuitions should first evaluate the local economy to identify the relevant private sector activities to determine how the potential program could add value to the community (Woods, 2015). Many companies located in areas with low talent pipeline have put in place stop-gap measures until the talent pipeline efforts to regain its effectiveness take place (Stahl et al., 2012). These actions include recruiting retirees to fill vacant positions, recruiting people from other companies or markets, using technology and machines to help perform the work, launching internal training programs, and leaving the position vacant (Stahl et al., 2012; Woods, 2015).

Measuring Talent Pipeline and Regional Growth

Research links talent pipeline and regional growth (Gundling, Caldwell, & Cvitkovich, 2016). A 2002 study by Simon and Nardinelli determined that cities that began with proportionally higher talent pipelines ultimately grew faster. Simon and

Nardinelli examined the talent pipeline or the completion rates for 400 cities from 1900-1990. Simon and Nardinelli determined the completion rates by comparing the number of college graduates of nine occupation groups with the calculated MSA of each city. In a similar study using completion rates per population, Glaeser, Ponzetto, and Tobio (2014) also discovered a positive correlation between the talent pipeline and economic growth. The researchers discovered that school completion rates increased the level of entrepreneurship and innovation of cities (Glaeser, Ponzetto, & Tobio, 2014).

Theories Guiding this Study

Two theories guide this study. These theories are central to the aerotropolis model and may help explain the reasons behind the growth and development of the airport community. The theories are the theory of transportation and the human capital development theory.

Theory of Transportation

The pioneering research of Cooley (1894) in the late 19th century concluded that transportation was the most important factor in determining the development and wealth of a city. Cooley explained whenever there is an interruption or break in the logistics transportation chain, increased population and wealth occurs. Although Cooley's work is over a century old, it demonstrates the importance of breaks in transportation on the spatial development of cities today. As new methods of transportation integrated into the framework of the logistics chain, the impact of these breaks in transportation on the economic development and growth of a city became apparent (Rodrigue et al., 2013).

Cooley's (1894) theory of transportation states whenever there is a break in transportation or goods change ownership, other people are needed to support the exchange. Shortly after the publication of Emerson's research in 1894, Weber (1899) used the theory of transportation to explain the population growth of cities during the 19th century. Weber reported cities required other skills and trades besides those directly associated with the transfer of goods at the break in the transportation chain. Weber explains, "Importers and exporters, merchants and money-changers accumulate vast wealth and require the presence of other classes to satisfy their wants, and the population will grow rapidly" (p 173). In much the same manner, the aerotropolis requires a trained and educated workforce to support economic growth (Florida et al., 2015).

Human Capital Theory

Human capital theory suggests communities obtain economic benefits by investing in people (Sweetland, 1996). Ideas about human capital started with the industrial revolution, but not until Gary S. Becker's research on human capital in the 1960s did these ideas translate to form a theory (Swanson & Holton, 2009). Beginning with the Post-World War II era, four traditional factors were attributed to the production of the United States economy (Becker, 1962, 1993). Schultz (1961, 1975) identified these four traditional factors as physical capital, labor, land, and management. By the early 1960s, however, it was difficult to explain the growth of the United States using only these four traditional factors of production (Schultz, 1961, 1975). Becker (1962, 1993) proposed a new form of capital, human capital, as a contributing factor to the growth of the United States economy. Becker (1962, 1993) determined the learning capacities of the workforce were equally important to a community as were the other resources needed to produce goods and services. Becker (1962, 1993) believed the most significant investment in human capital was education and training.

The central message to community leaders on the importance of investing in human capital is that education and training are essential for growth of the community (Becker, 1993; Gennaioli, Porta, Lopez-de-Silanes, & Shleifer, 2011). Educating and training an individual not only contributes to the success of an organization but also through knowledge spillover makes the entire community more successful (Becker, 1993; Moretti, 2013). Human capital theory also suggests there is a correlation between education and training and the wealth of a community (Hamilton & Liu, 2014). Sweetland summed up human capital theory by suggesting that communities obtain economic benefits by investing in people (Sweetland, 1996). The principles of human capital theory help this study by organizing concepts, ideas, and methodologies that support the importance and impact of training and education on the airport community.

Key Attributes Identified in this Study

This study used three constructs, also known as latent variables, and six variables. Bollen (2014) describes constructs as attributes that cannot be measured directly, but rather are determined by using indicator variables. According to Trochim (2006), variables are attributes, which when measured, can change value. A variable may vary from group to group and evolve over time (Trochim, 2006).

Aerotropolis Model Airport Performance Construct

Airports move two things: people and cargo or goods (Florida et al., 2015). This study uses two variables to measure aerotropolis model performance. The two variables are passenger activity and cargo activity. Research by Green (2007) on airport activity at U.S. metropolitan airports provided a basis for using these variables. Green used these variables to determine if an airport's commercial activity predicted employment and population growth in the metropolitan region of the airport.

Passenger Activity. The number of passenger boardings is essential to this study (Brueckner, 2003; Green, 2007). Research by Brueckner (2003) revealed for every 10% increase in passenger boardings in an airport's MSA, there was a corresponding 1% gain in service employment. Research of Canadian airports by Gillen (2015) indicated the importance of passenger boardings to the airport community as well. The study indicated a 1% increase in passenger boardings resulted in a 0.75% increase in direct employment and a 0.49% increase in direct revenue (Gillen, 2015). In this study, passenger activity is calculated using total boardings at the aerotropolis model airport tons per airport MSA (Green, 2007).

Cargo Activity. The volume of cargo processed at an airport is a major factor in airport development. According to Green (2007), the impact of an airport's expanding distribution is measured by cargo activity. In this study, cargo activity is measured using cargo volume in metric tons per airport MSA (Green, 2007).

Human Capital Development Construct

There is extensive literature that supports the development of human capital, or talent, as a reliable predictor of economic growth in a community (Moretti, 2014). Adam Smith (1937) first emphasized the importance of talent development when he identified it, along with land, labor, and capital, as contributing factors that are essential to a community's successful economic growth. The study will use the variable, talent pipeline, to measure the construct, or latent variable, human capital development. School completions, known in this study as "talent pipeline," measure the number of students graduating from a community college or university programs in the MSA (Gordon, 2009; Sulaiman, Bala, Tijani, Waziri, & Maji, 2015). This study defines talent pipeline as the number of students graduating from aerotropolis model programs in the airport MSA as identified by the literature (Wang & Hong, 2011).

Regional Economy and Aerotropolis Model Success Constructs

A community receives qualitative benefits from investing in people (Barro & Lee, 2001, 2013; Sweetland, 1996). Sweetland cited improvements in health, nutrition, and overall quality of life as some of the benefits when a community invests in people. As discussed earlier in the study, it is hard to measure these benefits quantitatively (Baron, 2011). Sweetland speculated that because of the difficulty measuring human capital, there is a trend amongst researchers to analyze economic growth as indicator of human capital development. Woodhall's (1987) definition of human capital supports Sweetland's premise that researchers are relying more on economic growth to measure human capital development. Woodhall defined human capital as the process in which people "invest in themselves, by means of education, training, or other activities, which raises their future income by increasing their lifetime earnings" (p. 21). The literature points to more use of quantitative measures to measure human capital development (Klomp, 2011).

The variables used to measure regional economy and aerotropolis model success are economic output variables that are often used to quantify human capital development. Gross regional product, employment, and per capita income were most often cited as reliable indicators of economic growth for human capital development. Manuelli and Seshadri (2014) and Qadri and Waheed (2014) focused on the economic output of efforts made by communities to measure human capital development. Instead of evaluating input (e.g., training programs and educational attainment) of communities, Manuelli and Seshadri (2014) and Qadri and Waheed (2014) measured gross regional product and employment to determine the development of human capital in communities. Studies by Barro and Lee (2001, 2013), Judson (2002), and Klomp (2011) also included economic growth indicators such as gross regional product, employment, and per capita income to determine the human capital development in communities. In this study, the researcher measured gross regional product, employment, and per capita income in both the airport MSA and airport community to determine economic growth of human capital development.

Gross Regional Product. Economists define gross regional product as the gross domestic product of a metropolitan area or region (U.S. Department of Commerce, 2015). Gross regional product measures the size or net wealth generated by all sources of the local economy (Lobo, Mellander, Stolarick, & Strumsky, 2014). Just as gross domestic product is an indicator that measures the value of goods and services produced in a country, gross regional product is an indicator that measures the value of goods and services in a region (U.S. Department of Commerce, 2015). The region can be a census tract, zip code, county, MSA, or other defined area (D'Alisa, Demaria, & Kallis, 2015; (U.S. Department of Commerce, 2015). For economists, gross domestic product (and likewise, gross regional product), is one of the most carefully examined indicators of economic activity (U.S. Department of Commerce, 2015). Economists often analyze Gross Domestic Product to isolate factors that influence the economy. A 2015 study by Lakštutienė identified relationships between the Central bank assets and Gross Domestic Product of the countries of the European Union. Lakštutienė (2015) discovered significant indicators that characterized the development of the financial sector including a strong correlation between gross domestic product and liquid liabilities of the bank. Bowen (2012) recognized a statistical relationship existed between the levels of air cargo volume and gross domestic product when examining cargo transit records of FedEx and UPS. Florida et al. (2015) state, "Human capital and employment are both significantly related to GRP (gross regional product) per capita." (p. 207). Florida et al. used gross regional product in a study to determine the impact of airports on economic development in MSAs.

Employment. Green (2007) identified a correlation between airport activity and job growth. In this study, the employment to population ratio in the airport MSA and the airport community will determine the employment of the airport MSA and airport community. The World Bank (2016) defines the employment to population ratio as the portion of the total working age population employed in a region, municipality or country. The World Bank considers people ages 15 to 64 as working age population. The employment to population ratio measures a regions' ability to provide jobs and is a useful indicator of the influence of airport activity (Green, 2007; Leon, 1981). According to the U.S. Department of Labor and Statistics, the employment to population ratio has averaged about 61% in the United States since January 2006. In November 2016, the employment to population ratio was 59.7%.

Per Capita Income. The Bureau of Economic Analysis defines per capita income as the total regional income (gross regional product) divided by the total population (U.S. Department of Commerce, 2015). Per capita income is not the same as average income because it includes non-working age population. Per capita income may apply to the average per-person income for a zip code, city, region or country (Markusen, 2013). In this study, per capita income is the measurement of the amount of money earned from all sources per person in the MSA and the airport community. Economists use per capita income as an indicator of an area's living standards. Per capita income was used to evaluate the quality of life of the airport MSA and airport community.

Weighting Variables

Weighting variables is often necessary when developing composite scores (Bobko, Roth, & Buster, 2007). It is important to weight the variables if the researcher suspects one or more variables has more value than another variable (Bobko et al.). There is more than one approach to weighting variables. Bobko et al. (2007) offered four methods to consider using when weighting variables: (a) regression weights, (b) archival expert information, (c) expert judgments, and (d) unit weights.

The regression weights method determines the weight by using a multiple regression model to determine the relationship between the predictors and criterion (Bobko et al., 2007). The sample size must be large, generally over 50, to ensure valid results. Archival expert information is another method to weight variables (Bobko et al., 2007). Adapting a weighting method from other studies to determine values is the archival expert information method. Experts making a statistical judgment on the weight of variables is the expert judgment method (Bobko et al., 2007). Usually, a Likert survey is the typical method to collect the data from the experts. The last method offered by Bobko et al. (2007) is the unit weights method. Bobko et al. refer to unit weights as the summation of standard scores to each variable that was converted to Z-scores before applying equal weights. The practice of using weighted variables is acceptable and encouraged when one or more variables have more value than other variables. The importance of gross regional product, employment, per capita income and airport productivity occurs throughout the literature, but none of the variables is weighted more than another variable (Green, 2007; Kasarda, 2009). In the study, the researcher treated all variables equally.

Chapter Summary

The decisions of community leaders and policymakers can affect the economic well-being of their communities (Furth, 2013). Many times the success of the businesses in the community and the quality of life of its residents depend on the decisions, policies, and leadership goals of community leaders and policymakers to create a climate conducive to economic growth (Furth, 2013). For communities to be competitive in the global economy, it is essential that policymakers improve community assets and adopt policies that attract new companies to the area and encourage existing businesses to expand (Furth, 2013). One asset available to many communities is the airport. Because all commercial airports are publically owned, community leaders and policymakers can control the success of the local airport by developing policies that encourage economic growth (Freestone, 2009; Green, 2014). The deregulation of the airline industry in 1978 has caused policymakers to rethink the airport business plan and seek other sources of revenue (Kramer, 2010). Airport managers soon realized the need to engage actively in the recruitment and retention of airlines and pursue other forms of income (Basso, 2008; de Neufville, 1991; Kramer, 2010).

The advancement of air transportation is a result of the progression of five overlapping waves of transportation development (Kasarda, 2000). The five waves of transportation development are (a) seaports, (b) rivers and canals, (c) railroads, (d) vehicular transportation, and (e) airports as drivers of urban development. Prosperi (2007) explains each wave influenced the transportation method of products and the morphological development or shape of the city. Just as transportation shaped cities, human capital development efforts also influenced the shape of cities (Crook et al., 2011). The literature offered little research on human capital development efforts to assist air transportation development. Moreover, the literature did not address the importance of human capital in the training of the workforce required to operate the airport successfully (Kasarda, 2009; Kasarda & Appold, 2014).

Chapter III contains a description of the research design and methodology used in the study. The chapter also defines how the variables of the study were measured and compared to the research design. The research methodology will compare these variables to airport passenger and cargo volume.

CHAPTER III – RESEARCH DESIGN AND METHODOLOGY

The purpose of this study was to determine the relationship between human capital development and the aerotropolis model airport performance and the relationship between the human capital development and aerotropolis model success. Chapter III includes a summary of the research design. Also included in Chapter III is a discussion of the population and sampling methods presented in the study. A discussion of the data collection methods, including databases used as well as authorization to use those databases, and variables follows. To conclude the chapter, a description of data methods are noted.

Research Objectives

The researcher determined if a relationship existed between human capital development efforts in the airport MSA and the success of the airport communities adjacent to aerotropolis model airports in the United States. Success of the airport communities was measured by evaluating employment, gross regional product, and per capita income, of each airport community. Kasarda and Appold (2014) classified aerotropolis model airports as either an operating aerotropolis, an operating airport city, a developing aerotropolis, or a developing airport city. Kasarda and Appold identified 35 aerotropolis model airports that operate in 33 MSAs in the United States. The four research objectives of the study are:

RO 1: Rank aerotropolis model performance at each aerotropolis model airport, per population of the airport MSA.

RO 2: Determine the airport-skills workforce training concentration or "completion ratio" of the airport MSA.

RO 3: Determine the relationship between aerotropolis model performance and aerotropolis community success, and talent pipeline.

RO 4: Determine the relationship between talent pipeline and aerotropolis model performance.

Research Design

This quantitative, quasi-experimental, explanatory study used archival and secondary data. Trochim (2006) identifies three types of research designs: (a) randomized or true experiments, (b) quasi-experiments, and (c) non-experiments. As the name implies, in randomized or true experiments, population samples are randomly assigned (Trochim, 2006). In true experiments, the population samples are divided into a treatment group and control group. The two groups are equivalent; however, the treatment group receives the intervention or treatment while the control group does not. According to Trochim (2006), a quasi-experimental design is one that mirrors a true experiment but lacks random assignment. This study is an explanatory study because the researcher is attempting to understand the relationships between variables by examining the relationship between the variables (Trochim, 2006). Secondary data are information that typically includes public records from governmental agencies, universities and research organizations (Church, 2002). Research information originally collected from other studies and researchers also comprises secondary data (Church, 2002).

Population and Sample

In statistical terms, population refers to the collection of all members or units of a defined group for data-driven decisions (Field, 2014). Besides people, a population can consist of animate and inanimate objects. A smaller, but representative collection of the larger unit of a population used to infer truths about the larger population is a sample (Field, 2014). In other words, the sample supplies the data for the study (Field, 2014).

Kasarda and Appold (2014) identified 84 airport communities worldwide that are based on the aerotropolis model. The airports in these airport communities include both aerotropoli and airport cities. The location of 38 of the airports identified as aerotropolis model airports are in North America, including 35 airports in the United States. Other aerotropolis model airports located worldwide include 20 in Europe, 17 in Asia, seven in Africa and the Middle East and one in both Central America and South America (Kasarda & Appold. 2014). Figure 7 displays the location of airports based on the aerotropolis model by continent. Because data for the aerotropolis airports outside the United States is not available, this study is limited to a census of all 35 aerotropolis model airport communities identified by Kasarda and Appold in the United States. The method is a census because the population and sample are the same (Field, 2014). In a census, the estimated value in the study is the parameter itself. This means there is no need for a confidence interval in the study (Trochim, 2006).

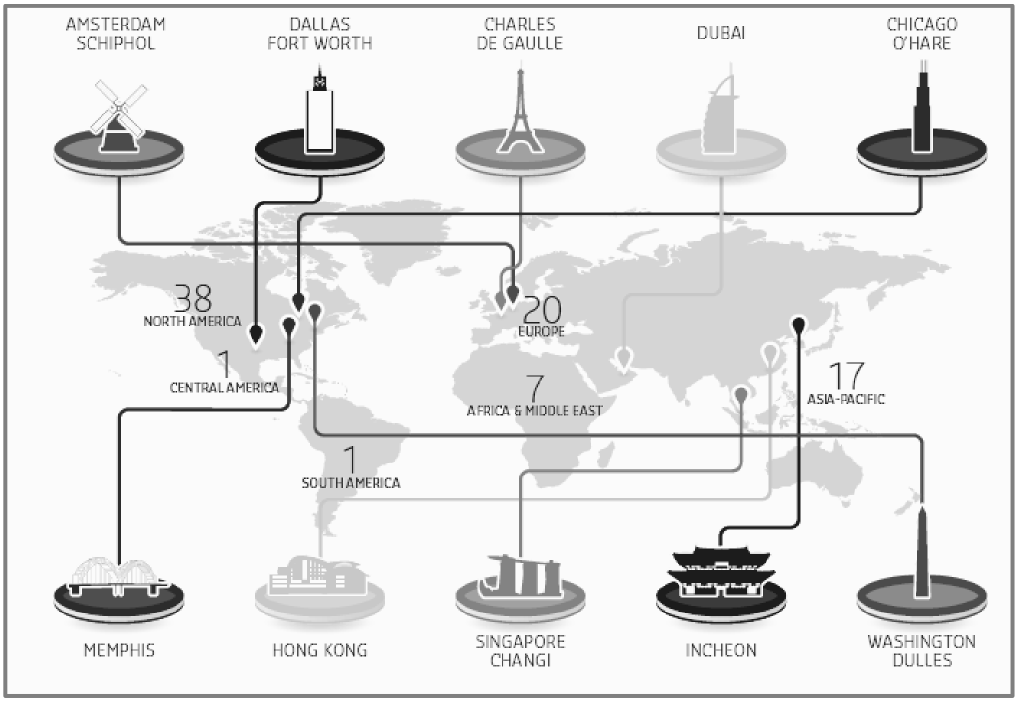

Figure 7. Worldwide Locations of Airports based on the Aerotropolis Model.

Note: From "Airport City and Aerotropolis Locations Worldwide." From Airport cities: The evolution, by J. D. Kasarda, 2013, Airport World. Copyright (2013) by Airport World. See Appendix C for a statement of permission from the author.

Data Collection

This study used secondary data as its exclusive source for data. Secondary data typically includes data from public records from governmental agencies, universities and research organizations (Church, 2002). Secondary data are research information originally collected from other studies and researchers (Church, 2002). Scholars often use secondary data to analyze and evaluate programs, build other databases, and conduct research (Sørensen, Sabroe, & Olsen, 1996). There are two sources of secondary data in this study. Information from the Federal Aviation Administration (FAA) provided data used on airplane passenger boardings and air cargo. Economic Modeling Systems, Inc. (EMSI) was the source of the remaining data. EMSI's database incorporates over 90 different data sources with the ability to drill down to individual zip code areas (Emsi, n.d.). EMSI collects data from federal agency databases of the United States federal government, state governments, and local governments. The U.S. databases include data from the Bureau of Economic Analysis, the U.S. Census Bureau, the Bureau of Labor Statistics, the Employment and Training Administration, and the National Center for Education Statistics (Emsi, n.d.).

Approval to Use Databases

The researcher used IBM Statistical Package for the Social Sciences (SPSS) to process the statistical testing required for this study (Field, 2014; Westland, 2015). All the data needed for this study was approved for collection by the database owners. The Public Domain and Copyright Notice provides that public documents can be assessed and represented without legal restrictions (U.S. Government Publishing Office, n.d.). Therefore, the FAA database is in the public domain and available for public use. The researcher accessed EMSI's online database using a licensing agreement between EMSI and the Department of Economic Development, Tourism, and Sports Management at The University of Southern Mississippi (USM). The licensing agreement allows USM faculty, staff, and students access to the database.

Institutional Review Board

The researcher submitted the research proposal to The University of Southern Mississippi Institutional Review Board (IRB) for approval. It is the responsibility of the IRB to ensure that all research proposals comply with applicable federal and institutional standards and guidelines (The University of Southern Mississippi, n.b.). Because all the data in the study was publically accessible and no human subjects were involved, no additional reviews were required by the IRB. A copy of the IRB approval for data collection is listed in Appendix I.

After approval from the IRB, the researcher collected the data from the EMSI and FAA databases. Only data specific to the study was collected and transferred to a Microsoft Excel spreadsheet. Next, the raw data was exported from the Microsoft Excel spreadsheet to IBM SPSS. Data collection and statistical analysis was completed after IRB approval.

Dataset Name Conversion to IBM SPSS

IBM SPSS prohibits naming data with hard spaces and certain symbols in dataset names, therefore, the researcher renamed the variables (Field, 2014). The new names are compatible with the approved nomenclature in IBM SPSS (Cohen, Cohen, West, & Aiken, 2003). A table with the description of variables, including the variable name, the corresponding IBM SPSS name, description, and dataset I.D. of each appear in Table 5.

Table 5

Description of Variables

Variable	IBM SPSS Name	Description	Dataset ID
Passengers Activity	Boardings	The number of passenger enplanements per Airport MSA	V1
Cargo Activity	Cargo	The amount of cargo in metric tons per Airport MSA	V2
Talent Pipeline	Talent	The number of graduates of aerotropolis related community college and university programs per working age population (ages 15-64) of the Airport MSA	V3
MSA Gross Regional Product	MSA_GRP	The gross regional product of the Airport MSA	V4
MSA Employment	MSA_EMP	The employment to population ratio in the Airport MSA	V5
MSA Per Capita Income	MSA_INC	Per capital income of the Airport MSA	V6
Airport Community Gross Regional Product	AC_GRP	The gross regional product of the airport community	V7
Airport Community Employment	AC_EMP	The employment to population ratio in the airport community	V8
Airport Community Per Capita Income	AC_INC	Per capital income of the airport community	V9
Aerotropolis Model Airport Performance	Performance	Latent variable representing Passenger Activity and Cargo Activity	A
Human Capital Development	HCD	Latent variable representing Talent Pipeline	B
Regional Economy	Regional	Latent variable representing MSA Per Capita Income, GRP, and Employment	C
Aerotropolis Model Success	Success	Latent variable representing Airport Community Per Capita Income, GRP, and Employment	D

Fink (2003) describes a survey as "a system for collecting information from or about people to describe, compare, or explain their knowledge, attitudes, and behavior" (p. 1). In this study, only secondary data were used. Nevertheless, a system to collect and evaluate the data was still required. This collection system, entitled synopsis of variables in this study, is presented in Table 6. Although not technically a survey, the synopsis of variables includes the same components: the research objectives, the variables used for each objective, the variable type, the scale of the variable, statistical tests used for each research objective, and literature related to the statistical test or variable. The synopsis of variable includes control variables. According to O'Neil et al., 2015, the popularity among research is attributed to the control values' unchanging state that allows for a better understanding of the relationship between the other variables tested.

Table 6

Synopsis of Variables

	Variable	Scale	Statistical Method	Literature Review
RO1	Boardings	Ratio	Z-score	R. Green (2007)
	Cargo	Ratio		R. Green (2007)
RO2	Talent	Ratio	Completion per capita	E. Gordon (2009)
RO3	Talent (IV)	Ratio	MLR	Hanushek and
	Boardings(IV)	Ratio		Woessman (2007)
	Cargo (IV)	Ratio		Klomp (2011)
	MSA Gross Regional Product (CV)	Ratio		Sweetland (1996)
	MSA Employment (CV)	Ratio		Barro and Lee
	MSA_ Per capita income (CV)	Ratio		(2001, 2013)
	Airport Community Gross Regional Product (DV)	Ratio		
	Airport Community Employment (DV)	Ratio		
	Airport Community Per capita income (DV)	Ratio		

Table 6 (continued).

	Variable	Scale	Statistical Method	Literature Review
RO4	Talent (DV) Boardings(IV) Cargo (IV)	Ratio Ratio Ratio	MLR	Hanushek and Woessman (2015) Kew and Lew R. Green (2007)

Note: Completions per capital is completions per 1 million working age population of the Airport MSA. MLR means multiple linear regression, or simply, multiple regression. DV means dependent variable, CV means control variable, and IV means independent variable. The MLR is performed three times with the Airport Community Gross Regional Product, Airport Community Employment, and Airport Community Per Capita Income serving as the dependent variable.

Reliability and Validity

The researcher must ensure the study is valid (Shadish, Cook, & Campbell, 2002). Reliability is a term that describes the degree to which an assessment tool measures consistently over time and populations (Shadish et al., 2002). Validity measures how well the results obtained in the study meet all of the requirements of the scientific research method (Shadish et al., 2002). The expectation is that the findings from the assessment tool are true (Shadish et al., 2002).

EMSI uses federal agency databases for the information in this study (Emsi, n.d.). All federal agency databases must comply with Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Office of Management and Budget, 2002). The Act provides policy and procedural guidelines for Federal agencies to guarantee that all data, including statistical information, provided by all Federal agencies is accurate, unbiased, and reliable (Office of Management and Budget, 2002). Additionally, other organizations including research universities and scholars confirm the reliability and the validity of the data collected from EMSI (Cummings & Epley, 2015; Dolan, Pierre, & Heckler, 2016).

Variables and Latent Constructs

This study uses four latent constructs and nine variables. Latent constructs are variables that cannot be directly measured (Bollen, 2014). The latent constructs are (a) aerotropolis model airport activity, (b) human capital development, (c) regional economy and (d) aerotropolis model success. The variables in the model are (a) passenger boardings, (b) cargo activity, (c) talent pipeline, (d) MSA employment, (e) MSA gross regional product, (f) MSA per capita income, (g) airport community employment, (h) airport community gross regional income, and (i) airport community per capita income. These constructs and variables are important to the study because the successful aerotropolis model is centered on the airport being the catalyst for a robust economy (Kasarda, 2013). An illustrative description of the aerotropolis conceptual model is displayed in Figure 8.

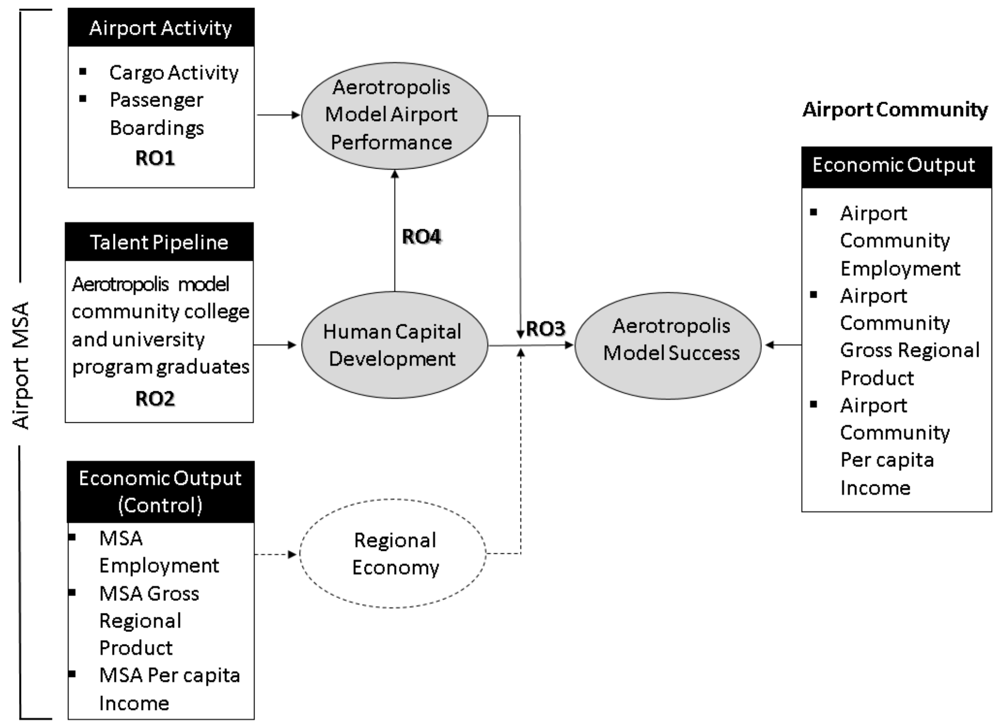

Figure 8. Aerotropolis Conceptual Model

The level of measurement, or scale of the variables, in this study is a ratio scale (Trochim, 2006). Knowing the level of measurement is important to selecting the appropriate statistical test and interpreting the data. (Trochim, 2006). Ordinal variables are similar to nominal variables, but there is an order to each group (Trochim, 2006). With interval variables, the distance between variables is equally spaced, but there is no true zero (Davis, 2011; Trochim, 2006). The designation of a zero is arbitrary (Davis, 2011). The attributes of ratio variables are similar to interval variables but contain an absolute zero where zero means nothing of the item is being measured (Davis, 2011; Trochim, 2006). The scale of the variables is important because the type of statistical test used in the study is contingent on the scale of the variable (Field, 2014). The source of the databases providing the data is in Table 7.

Table 7

Observed Variables and Source of Database(s)

Variable	Database/Source
Boardings	FAA/2014 Passenger Boarding and All-Cargo Data EMSI/2014 MSA Population Estimate
Cargo	FAA/2014 Passenger Boarding and All-Cargo Data, EMSI/2014 MSA Population Estimate
Talent	EMSI/2014 Occupation Programs Completions EMSI/2014 MSA Population Estimate
MSA Employment	EMSI/2014 Jobs in MSA EMSI/2014 MSA Population Estimate, Ages 15-64
MSA Gross Regional Product	EMSI/2014 Gross Regional Product by MSA
MSA Per Capita Income	EMSI/2014 Gross Regional Product by MSA EMSI/2014 MSA Population Estimate
Airport Community Employment	EMSI/2014 Jobs in Airport Community EMSI/2014 Airport Community Population Estimate, Ages 15-64
Airport Community Gross Regional Product	EMSI/2014 Gross Regional Product by Airport Community
Airport Community Per Capita Income	EMSI/2014 Gross Regional Product by Airport Community EMSI/2014 Airport Community Population Estimate, Ages 15-64

Data Analysis

After the collection of the data, statistical relationships were determined using the designated variables of the study. To accomplish this task, the researcher evaluated the success of the aerotropolis model based on economic activity at airports listed as either operating aerotropolis, operating airport city, developing aerotropolis, or developing airport city in the United States. See Table 2 in Chapter 1 for a list of the 35 aerotropolis model airports.

Research Objective One

The first research objective was to determine aerotropolis model performance at each aerotropolis model airport by measuring airport activity, measured as passenger activity (boardings) and cargo activity (measured in metric tons) per airport population MSA, to rank the 35 aerotropolis model airports. In this study, the researcher used the same methodology as Green (2007) to determine airport activity. For passenger activity, this number is determined by dividing the number of annual passenger boardings at each aerotropolis model airport by the population of the airport MSA (Green, 2007). Cargo activity is determined in the same manner. The annual amount of cargo processed (in metric tons) is divided by the population of the airport MSA (Green, 2007). Green evaluated these variables using passenger boardings per MSA and cargo processed per MSA because this methodology best demonstrated the scale or impact of the airport relative to the size of the airport MSA (R. Green, personal communication, July 21, 2016). Green (2007) believed this methodology provides a better assessment of the impact of airport activity than just considering the total amount of passenger and cargo traffic. The formulas for the passenger activity and cargo activity are listed below:

$$\text{Passenger Activity} = \frac{\text{Annual Passenger Boardings}}{\text{Population of Airport MSA}}$$

$$\text{Cargo Activity} = \frac{\text{Annual Cargo}}{\text{Population of Airport MSA}}$$

After determining passenger and cargo activity, the observations are combined to create a composite score to rank the aerotropolis model airports. Field (2014) states that a standardization method is required to combine the different observations. Because the observations representing passenger boardings and cargo activity are different, Z-scores for each observation of aerotropolis model airport activity are calculated. Field (2014) suggested a Z-score is an ideal method to combine different observations. A Z-score indicates the number of standard deviation units an observation is above or below the mean (Field, 2014). A Z-score of one indicates the observation is one standard deviation above the mean. A score of negative one indicates the observation is one standard deviation below the mean. A Z-score of zero indicates the observation is equal to the mean (Field, 2014). Many scholars use Z-scores to combine unlike variables in their research. For example, Kew and Lew (2013) used Z-scores to measure urban sprawl in rural Kentucky. Other examples of researchers adding Z-scores include the work of Fralicx and Raju (1982) and Colan (2013). Fralicx and Raju used Z-scores from five different weighting methods to evaluate bank tellers. Colan combined the Z-scores of height and weight to help determine cardiovascular heart health. The formula for calculating aerotropolis airport activity using Z-score is:

$$\text{Aerotropolis Airport Model Activity} = Z_{\text{Passenger Activity}} + Z_{\text{Cargo Activity}}$$

After the passenger boardings and cargo activities are determined, Z-scores for each observation of economic activity are calculated. Next, the observations are combined to create a ranking of aerotropolis model activity. Research from Bruencker (2003) and Green (2007) provide a precedent to rank airports based on airport activity. Bobko et al. (2007) offer four methods to consider when weighting variables: (a) regression weights, (b) archival expert information, (c) expert judgments, and (d) unit weights. The practice of using weighted variables is acceptable and encouraged when one or more variable(s) has more value than other variables. Since the literature is silent on the value of airport boardings and cargo activity, the researcher treated the variables equally (Bobko et al., 2007).

Research Objective Two

The purpose of research objective two was to determine the talent pipeline of the airport MSA. Talent pipeline was determined by calculating the number of the workforce age population completing aerotropolis model education and training programs offered by community colleges and universities per the population (per 1,000,000) of the airport MSA. Aerotropolis model education and training programs in the MSA (identified by the literature) were converted to the corresponding Classification of Instructional Programs (CIP) codes. First developed by the U.S. Department of Education's National Center for Education Statistics, CIP codes are a classification system that tracks and reports fields of study and program completions activity (NCES, 2014). The CIP codes are inputted to identify the number of the working-age population (ages 15-64) completing aerotropolis model education and training programs per population of the airport MSA in 2014. The industry type of occupations originating from aerotropolis related industry is classified as either core industry or dependent industry (Wang & Hong, 2011). Core industry jobs work directly with airport operations such as ground handling services and flight attendants. Jobs stemming from dependent industry are occupations closely associated with air transportation such as aircraft maintenance workers and freight forwarders (Wang & Hong, 2011). Table 12 displays the Community College and University programs evaluated in this study by CIP code and Industry Type.

Table 8

Community College and University Programs Evaluated by CIP Code and Industry Type.

CIP Code	Program Title	Industry Type
47.0607	Airframe Mechanics and Aircraft Maintenance Technology/Technician	Dependent
47.0608	Aircraft Power Plant Technology/Technician	Dependent
49.0101	Aeronautics/Aviation/Aerospace Science and Technology, General	Dependent
49.0102	Airline/Commercial/Professional Pilot and Flight Crew	Core
49.0104	Aviation/Airway Management and Operations	Core
49.0105	Air Traffic Controller	Core
49.0106	Airline Flight Attendant	Core
52.0203	Logistics, Materials, and Supply Chain Management	Dependent
52.0209	Transportation/Mobility Management	Dependent

Note: Classification of programs by industry type is based on "Competitive advantage analysis and strategy formulation of airport city development: The case of Taiwan", by K. Wang and W. Hong, 2011, *Transport Policy*, 18, p. 278. Copyright 2011 by Transport Policy.

The researcher replicated methodology similar to Simon and Nardinelli (2002) to identify the variable, talent pipeline, to quantify aerotropolis model education and training program completions. In an approach similar to Green (2007) to determine size and impact of the airport's impact on passenger boardings and cargo relative to the airport MSA, Simon and Nardinelli used program completion ratios to examine the completion rates for 400 cities from 1900-1990. In this study, they determined the school completion ratios of students completing community college and university aerotropolis model education and training programs in the MSA contribute to faster economic growth in cities from 1900 to 1986. The formula for talent pipeline is:

$$\text{Talent Pipeline} = \frac{E}{P} = \frac{\text{MSA Annual Completions of Training Programs}}{\text{Working Age Population of the Airport MSA}}$$

In the equation, Talent Pipeline represents the ratio of the working age population completing aerotropolis model education and training programs in the MSA, *E* is the number of annual completions of training programs in the MSA, and *P* is the working age population of the airport MSA. The working age population is defined as those residents of each MSA who are 15-64 years of age.

Research Objective Three

The third research objective was to determine if there was a relationship between aerotropolis model success, and aerotropolis model performance and talent pipeline. The statistical test for research objective three was multiple regression analysis. Field (2014) describes multiple regression as an extension of simple linear regression. Consequently, it is not possible to visualize the regression line in two-dimensional space, but it is easily identified (Field, 2014; Statsoft, 2016). The dependent variables are Airport Community Gross Regional Product, Airport Community Employment, and Airport Community Per Capita Income (*y*). The independent variables (*x*) in the study are Boardings, Cargo, and Talent. The control variables are MSA Per Capita Income, MSA Employment, and MSA Per Capita Income. Because analysis of only one dependent variable can be performed at a time in multiple linear regression, three separate regressions must be performed. The general multiple linear regression equation is: $y = a + b_1x_1 + b_2x_2 ... + b_px_p$, where *y* is the dependent variable and *x* is the control variable.

The diagram in Figure 9 depicts an illustrative multiple regression equation for this objective. The rectangles represent the equation's observed variables. Rectangles V1 through V3 represent the three observed input variables: (a) Passenger Boardings, (b) Cargo Activity, and (c) Talent Pipeline. Rectangles V4 through V6 represent the three control variables: (a) MSA Gross Regional Product, (b) MSA Employment, and (c) MSA Per capita income. Although the multiple linear regression model does not distinguish between the terms input variables and control variables (they are synonyms, mathematically), the use of the term control variable is popular among researchers using multiple linear regression (Davis, 2011; O'Neill et al., 2014). Also, another synonym for input variable and control variable is independent variable (Davis, 2011).

Rectangles V7 through V9 represent the three observed outcome variables: (a) Airport Community Gross Regional Income, (b) Airport Community Employment, and (c) Airport Community Per Capita Income (Huber-Carol et al., 2002). The outcome variables are dependent variables meaning a change in airport performance or human capital development could lead to a change in aerotropolis model success (Field, 2014). The four ovals represent the four unobserved or latent variables: (a) Aerotropolis Model Airport Performance, (b) Human Capital Development, (c) Regional Economy, and (d) Aerotropolis Model Success (Huber-Carol et al., 2002).

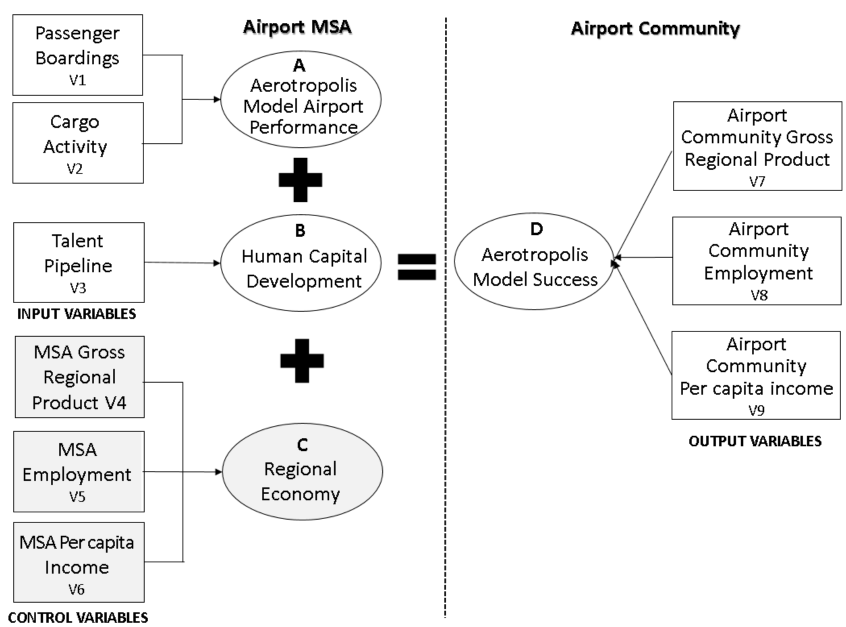

Figure 9. Illustration of Multiple Regression Equation Model with Control Variables.

Substituting the latent variables in the multiple regression formula produces the following equation: Success = a + b_1(Performance) + b_2(HCD) + b_3(Economy). The latent variables Performance and HCD are the independent variables, the latent variable Economy is the control variable, and the latent variable Success is the dependent variable. Replacing the latent variables with the observed independent variables, control variables, and dependent variables in the multiple regression formula results in three equations:

Airport Community Gross Regional Product = a + b_1(Boardings) + b_2(Cargo) + b_3(Talent) + b_4(MSA Gross Regional Product) + b_5(MSA Employment) + b_6(MSA Per Capita Income)

Airport Community Employment = a + b_1(Boardings) + b_2(Cargo) + b_3(Talent) + b_4(MSA Gross Regional Product) + b_5(MSA Employment) + b_6(MSA Per Capita Income)

Airport Community Per Capita Income = a + b_1(Boardings) + b_2(Cargo) + b_3(Talent) + b_4(MSA Gross Regional Product) + b_5(MSA Employment) + b_6(MSA Per Capita Income)

Research Objective Four

The purpose of research objective four was to determine if there was a relationship between aerotropolis model airport performance and human capital development. The multiple regression analysis for research objective four was performed by comparing Passenger Activity and Cargo Activity with Talent Pipeline. The diagram in Figure 13 depicts an illustrative regression equation for this objective. The two ovals represent the two unobserved or latent variables: (a) Aerotropolis Model Airport Performance, and (b) Human Capital Development (Huber-Carol et al., 2002). The rectangles represent the study's observed variables. Rectangles V1 and V2 represent the two observed input variables: (a) Passenger Boardings, and (b) Cargo Activity. The rectangle V3 represents the observed outcome variable, Talent Pipeline, which represents the latent variable, human capital development (HCD). Substituting the latent variables in the regression formula produces the following equation:

$$\text{Talent Pipeline} = a + b_1(\text{Passenger Boardings}). + b_2(\text{Cargo Activity})$$

The variable Talent Pipeline is the dependent variable and the variables, Passenger Activity, and Cargo Activity, are independent variables (Field, 2014).

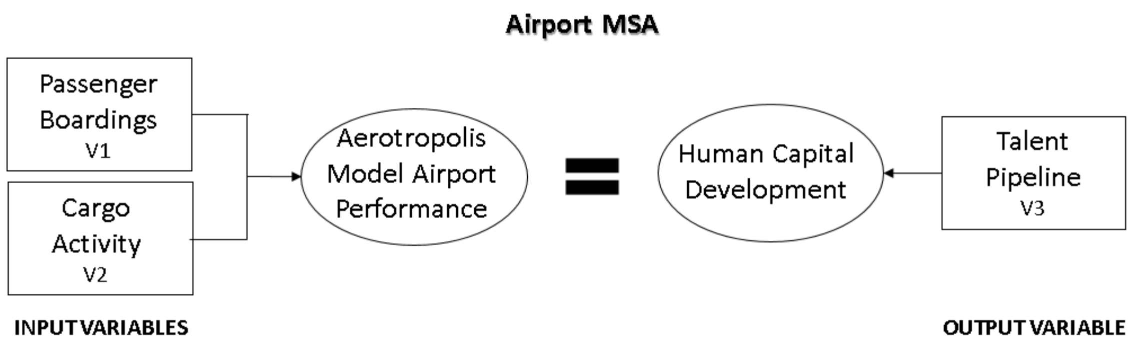

Figure 10. Illustration of the Multiple Regression Equation Model for RO4.

About Regression Analysis

The study used multiple regression analysis to predict outcome variables for Research Objective 3 and Research Objective 4. Field (2014) describes simple regression as a statistical method that studies relationships between two continuous variables. In simple regression, there is one outcome variable and one predictor variable. Field describes multiple regression as an extension of simple linear regression where the outcome variables are predicted by a combination of one or more predictor variables. As to the usefulness of this statistical tool, Field points out researchers often use multiple regression analysis to predict the value of outcome variables based on the value of two or more independent or predictor variables. Chatterjee and Hadi (2015) viewed multiple regression analysis as one of the most popular statistical tools among researchers. Chatterjee and Hadi attributed this popularity to the ease of which multiple regression analysis can identify functional relationships among variables.

There are many advantages to using multiple regression analysis (Keith, 2015). Cohen, Cohen, West, and Aiken (2003) point out that social scientists often use multiple regression analysis to test hypotheses regarding the presence of casual effects and then compare the strength of those effects across groups. Cohen et al. (2003) suggest two other benefits of multiple regression analysis are that the statistical tool provides a powerful methodology for distribution of variables and for estimating the distribution of these variables under hypothetical conditions. Additionally, Cohen et al. (2003) suggested a good use of multiple regression analysis is the ability to adjust observed differences for the effects of variables that correlate with both dependent and independent variables. Cohen et al. explained this capability is important because otherwise, meaningful comparisons of variables would be prohibited. Modest extensions of multiple regression can provide for analysis of cross-classified data. For example, Green (2007) used multiple regression analysis to determine if airport activity predicts population and employment growth. Green used several variables for airport activity, including passenger boardings per capita and cargo tonnage per capita. Green discovered passenger boardings per capita was a powerful predictor of population and job growth in metropolitan areas. In a more recent study, Florida et al. (2015) examined the likelihood of a region having an airport and the impact of the airport on the economic development of the metropolitan area. Using multiple regression analysis, Florida et al. (2015) determined the size and scale of the airport contribute to regional development. Florida et al. (2015) findings also support the aerotropolis model regarding economic development.

Because of its popularity, Woodside (2013) warned that multiple regression analysis can become more than a statistical tool. The overall acceptance of the theoretical concepts of multiple regression analysis by researchers "shapes thinking and theory crafting (p. 463)". Woodside suggests that researchers should take precautions to prevent bias when reporting results using multiple regression analysis. Additionally, researchers dispute the sample size required to produce reliable results in multiple regression analysis (Cohen et al., 2014; Keith, 2015; Knofczynski & Mundfrom, 2008; Schönbrodt & Perugini, 2013). Two distinct applications of multiple regression analysis prevail among researchers: prediction and explanation (Keith, 2015). Knofczynski and Mundfrom discovered that minimum sample size requirements were contingent on whether the application type was prediction or explanation. Knofczynski and Mundfrom's study focused on the implementation of multiple regression for prediction. In general, Knofczynski and Mundfrom realized when utilizing multiple regression for prediction applications, a relationship existed between the minimum recommended sample size and the sample size to predictor ratio and the squared multiple correlation, p^2.

Knofczynski and Mundfrom (2008) understood that minimum sample size can vary. However, sample size can be determined. Knofczynski and Mundfrom maintain researchers can estimate the minimum sample size by including the number of predictor variables in their regression model and determining a reliable estimate of the squared multiple correlation coefficients. It was anticipated that the sample size would have affected the results of this study. This study was a census of aerotropolis model airports as identified by Kasarda and Appold (2014) as located in the United States. As a result, the sample size was limited to 35. Keith (2015) discovered researchers disagree on the recommended minimum sample size but agree a minimum sample size of 100 is needed for reliable results in multiple regression analysis. Soper (2016) recommended a minimum sample size of 54 when using one independent or predictor variable. However, Knofczynsly and Mundfrom (2008) suggested much smaller sample sizes can be used with reliable results. Knofczynsly and Mundfrom suggested sample sizes as small as 20-21 can provide an excellent prediction level with six independent variables. Further commentary on sample size is reported in the delimitations of the study section in Chapter V.

Chapter Summary

The purpose of this quantitative explanatory, quasi-experimental study was to determine the relationship between the aerotropolis model and the human capital development efforts in the airport community. In Chapter III, the methodology of the study was described. The population of the study and sample of the study was the 35 aerotropolis model airports in the United States as classified by Kasarda and Appold (2014). The study used secondary data that is available to the public. Z-scores and IBM SPSS software were used to analyze the data. In Chapter IV, the results of the quantitative data are discussed, and analysis of the study is summarized.

CHAPTER IV – RESULTS

Investment in human capital should lead to greater economic success in a community (Becker 1962, 1993; Shultz, 1961, 1975). This quantitative study investigated the relationship between human capital development and the aerotropolis model airport performance and the relationship between the human capital development and aerotropolis model success. This chapter reports on the results of the study's four research objectives: (a) ranking aerotropolis model performance at each aerotropolis model airport, per population of the airport MSA, (b) determining the airport-skills workforce training concentration or "completion ratio" of the airport MSA, (c) determining if there is a relationship between aerotropolis model performance and aerotropolis community success, and talent pipeline, and lastly, (d) determining if there is a relationship between talent pipeline and aerotropolis model performance. These research objectives measured the benefits of human capital investment for economic success in the airport community.

The methodology for the research objectives included ratio, Z-scores, and multiple regression. The first research objective used Z-scores of passenger and cargo activity to rank performance at the 35 aerotropolis model airports. This measurement is important to the study because airport performance is positively related to the economic success of the airport community (Green, 2007). The second research objective identifies the level of talent pipeline in the airport MSA. Talent pipeline is measured as the number of people (15-64) completing aerotropolis related training and education programs per the number of working age population in the airport MSA. A lack of talent pipeline leads to an increased skills gap, a weakening of a competitive advantage, and lost productivity for local employers in the airport community (Gennaioli et al., 2011; Hamilton and Liu, 2014).

The third and fourth research objectives used multiple linear regression to determine the relationship between aerotropolis model performance and airport community success (RO3) and to determine the relationship between aerotropolis model performance and human capital development (RO4

Data Collection Results

The sample of this study consisted of 35 airport communities in the United States that were adjacent to aerotropolis model airports. A census of all airport communities with zip codes that fell within a five-mile radius of the center of the aerotropolis model airports served as the population for the study (Kasarda & Appold, 2014). The mean population of these airport communities was 454,206. With a population of 22,347, the airport community around Northwest Florida Beaches International Airport in Panama City, Florida, was the least populated airport community, while the airport community around John F. Kennedy International Airport in Jamaica, New York, possessed the largest population with 1,758,949 residents. Even though the 35 airport communities are all adjacent to aerotropolis model airports, the population of aerotropolis communities varied greatly.

Employment to population ratio in the airport community was higher in the airport community than in the airport MSA. Employment in the airport community comprised about 78% of the total working age population. This figure compares with a total working age population rate of 59.2% outside airport communities in 2014 (U.S. Department of Labor, 2016). The airport community around Phoenix Sky Harbor International Airport in Phoenix, Arizona was identified with the most available jobs with 615,497. Northwest Florida Beaches International Airport in Panama City, Florida, contained the fewest available jobs with 9,050. Airport communities around Ted Stevens Anchorage International, Charlotte/Douglas International, Denver International, Dallas-Fort Worth International, Baltimore/Washington International Thurgood Marshall, Phoenix Sky Harbor International, and McCarren International in Las Vegas, Nevada yielded more jobs than working age population. For example, the airport community around Phoenix Sky Harbor International reflected a working age population of 426,653 in 2014 but offered 615,497 jobs. In contrast, the airport community around John F. Kennedy International Airport in Jamaica, New York was well below the mean in 2014 with 21% jobs per working age population. The airport community around John F. Kennedy International Airport reported a working age population of 1,201,905 but offered only 247,519 jobs. Available jobs ranged from 9,050 jobs in the airport community around Northwest Florida Beaches International Airport in Panama City, Florida to 615,497 jobs in the airport community around Phoenix Sky Harbor International Airport. Overall, the airport community was a good source for employment.

Organization of Data Analysis

This study examined the relationship of human capital development on the aerotropolis model. Outcomes included the ranking of airport activity of aerotropolis model airports and determining the available talent pipeline in the airport MSA. Along with the outcomes of the study's research objectives, Chapter IV provided an analysis of the collected research data and a summary of the results.

Research Objective One

Research Objective One determined aerotropolis model performance at each aerotropolis model airport by calculating airport activity, measured as passenger boardings and cargo activity per airport population MSA, to rank the 35 aerotropolis model airports. The passenger activity and cargo activity of the 35 aerotropolis model airports are listed in Tables A7 and A8 in Appendix A. The Z-scores of passenger activity and Z-score cargo activity are used to determine aerotropolis model performance and rank the 35 aerotropolis model airports.

Results for Research Objective One.

High passenger activity dominated high performing aerotropolis model airports. The findings indicated the highest operating aerotropolis model airports included mostly passenger activity. Lowest performing aerotropolis model airports were primarily cargo only airports or passenger only airports.

Passenger Activity. McCarren International Airport in Las Vegas, Nevada demonstrated the highest passenger activity Z-score at 2.1904. Denver International Airport, with a passenger activity Z-score of 2.0109, and Charlotte/Douglas International Airport, with a Z-score of 1.8764, finished second and third respectively, in aerotropolis model airport performance by passenger activity. The Z-scores at McCarren International, Denver International, and Charlotte/Douglas International indicated that passenger activity was about twice the average passenger activity than other aerotropolis model airports. A listing of passenger activity is provided in Table 9. Fort Worth Alliance Airport, a cargo only airport, received a Z-score of -1.2299 and ranked lowest in airport performance by passenger activity. When considering cargo airports, Phoenix -Mesa Gateway Airport, which is located about 21 miles from Phoenix Sky Harbor International, was the second lowest performing aerotropolis model airport in terms of passenger activity with a Z-score of -1.1786 and Rickenbacker International Airport in Columbus, Ohio was the lowest performing aerotropolis model airport by passenger activity with a Z-score of -1.2214. Rickenbacker is promoted primarily as a cargo airport, but Allegiant Airlines began limited seasonally and year-round service at the airport in 2012 (Matzer Rose, 2016; Rickenbacker Columbus Regional Airport Authority, 2016). The negative Z-scores at Phoenix-Mesa Gateway and Rickenbacker International indicated passenger activity performance was below average when compared to the sample population.

Cargo Activity. Aerotropolis model airports that served as a regional or international cargo hub led in cargo activity. When assessing aerotropolis model airport performance by cargo activity, Ted Stevens Anchorage International Airport was the highest performing aerotropolis model airport based on cargo activity with a Z-score of 5.1696. Memphis International Airport ranked second with a Z-score of 2.0174, and Louisville International-Standiford Field placed as the third highest performing aerotropolis model airport by cargo activity with a Z-score of 0.9342. Table 9 indicates the lowest performing aerotropolis model airports by cargo activity were Washington Dulles International in Dulles, Virginia (-0.3131), Phoenix -Mesa Gateway Airport (-0.3241), and Northwest Florida Beaches in Panama City, Florida (-0.3241). Northwest Florida Beaches in Panama City, Florida is equipped to process cargo but reported no cargo in 2014. Communities that were successful in attracting a regional or international cargo hub to the local aerotropolis model airport resulted in above average cargo activity.

Total Activity. When comparing airport passenger and cargo operations, passenger activity was more important than cargo activity (Green, 2007). Based on a total Z-score of passenger activity and cargo activity of 5.9896, Ted Stevens Anchorage International Airport in Anchorage, Alaska was the highest performing aerotropolis model airport in the

United States (see Table 9). McCarren International Airport, located in the tourist-centric city of Las Vegas, Nevada, was the second highest performing aerotropolis model airport with a total Z-score of 1.8925. With a Z-score of -1.5147, Fort Worth Alliance Airport, a cargo only airport located in northern Fort Worth Texas, was the lowest performing aerotropolis model airport. Phoenix -Mesa Gateway Airport, which is located in the Phoenix-Mesa-Scottsdale, AZ MSA city of Mesa, was the second lowest performing aerotropolis model airport with a Z-score of -1.5027. Phoenix Sky Harbor International, also located in the Phoenix-Mesa-Scottsdale, AZ MSA in Phoenix Arizona, exhibited a Z-score near zero (0.0461), which signifies it was near the mean of the 35 aerotropolis model airports in the United States (Field, 2014). Table 9 displays the Z-scores for passenger activity, cargo activity, and total activity. Ted Stevens Anchorage International Airport and Miami International in Miami, Florida were the only aerotropolis airports that achieved Z-scores above the mean (that is, a Z-score greater than zero) for both passenger activity and cargo activity. The lowest performing aerotropolis model airports were primarily cargo only airports or passenger only airports.

Table 9

Aerotropolis Model Airports by Airport Activity- 2014, n = 35

Rank	Aerotropolis Model Airport	Z-score		
		Passenger Activity	Cargo Activity	Total Activity
1	Ted Stevens Anchorage International	0.8200	5.1696	5.9896
2	McCarran International	2.1904	-0.2979	1.8925
3	Denver International	2.0109	-0.2582	1.7527
4	Charlotte/Douglas International	1.8764	-0.3032	1.5732
5	Hartsfield-Jackson Atlanta International	1.6198	-0.2684	1.3514
6	Miami International	1.2804	0.0489	1.3293
7	Memphis International	-0.7698	2.0174	1.2477
8	Orlando International	1.3253	-0.2791	1.0462

Table 9 (continued).

Rank	Aerotropolis Model Airport	Z-score Passenger Activity	Z-score Cargo Activity	Z-score Total Activity
9	Newark Liberty International	1.2029	-0.1865	1.0164
10	Dallas/Fort Worth International	1.0670	-0.2299	0.8371
11	Minneapolis-St Paul International/Wold-Chamberlain	0.4372	-0.2857	0.1515
12	Louisville International-Standiford Field	-0.7878	0.9342	0.1463
13	Phoenix Sky Harbor International	0.3260	-0.2799	0.0461
14	Baltimore/Washington International	0.1284	-0.2999	-0.1716
15	Raleigh-Durham International	0.0610	-0.2752	-0.2142
16	Chicago O'Hare International	-0.0139	-0.2151	-0.2290
17	Detroit Metropolitan Wayne County	0.0306	-0.3024	-0.2718
18	Los Angeles International	-0.0655	-0.2654	-0.3309
19	Indianapolis International	-0.6019	0.0511	-0.5508
20	Philadelphia International	-0.3907	-0.2801	-0.6708
21	Kansas City International	-0.4040	-0.2909	-0.6949
22	Lambert-St Louis International	-0.4826	-0.3053	-0.7879
23	General Mitchell International	-0.5249	-0.2793	-0.8042
24	Northwest Florida Beaches	-0.5350	-0.3241	-0.8591
25	John F Kennedy International	-0.6010	-0.2935	-0.8945
26	Cleveland-Hopkins International	-0.6166	-0.2993	-0.9159
27	Washington Dulles International	-0.6372	-0.3131	-0.9504
28	Pittsburgh International	-0.6721	-0.3003	-0.9724
29	Huntsville International-Carl T Jones Field	-0.8226	-0.1954	-1.0180
30	Piedmont Triad International	-0.8385	-0.2250	-1.0635
31	Jackson-Medgar Wiley Evers International	-0.9102	-0.3059	-1.2161
32	Ontario International	-1.0724	-0.2507	-1.3231
33	Rickenbacker International	-1.2214	-0.2732	-1.4946
34	Phoenix -Mesa Gateway Airport	-1.1786	-0.3241	-1.5027
35	Fort Worth Alliance	-1.2299	-0.2848	-1.5147

Research Objective Two

Research Objective Two identified the talent pipeline of the 35 airport communities. Talent pipeline was measured by determining the number of people completing aerotropolis specific programs per the population of the airport MSA. Increased talent pipeline is important because it lowers the skills gap, strengthens its competitive advantage, and increases productivity for local employers in the airport community (Woods, 2015). Table 10 shows the average number of the working-age population completing an aerotropolis related training or education program in each airport community is 142.73. Overall, talent pipeline scores ranged from 0.00 to 573.10. However, talent pipeline scores for the majority of airport communities ranged from 5.29 to 280.17.

Table 10

Descriptive Statistics for Talent Pipeline, n = 34

Observation	*Minimum*	*Maximum*	*Mean*	*SD*
Talent Pipeline (per million)	0.00	573.10	142.73	137.44

Table 11 displays talent pipeline by airport MSA. The table lists the completions of aerotropolis related training or education programs, the working age population, and talent pipeline in each airport MSA. Working age population is per 1 million people.

Table 11

Talent Pipeline by Airport MSA, n = 34

	Airport MSA	Completions	Working age pop. (1,000,000s)	Talent Pipeline
1	Greensboro-High Point, NC MSA	282	0.492	573.11
2	Anchorage, AK MSA	114	0.274	415.40
3	Fort Worth-Arlington, TX Division.	634	1.576	402.33
4	Miami-Miami Beach-Kendall, FL Division	692	1.797	385.00
5	Phoenix-Mesa-Scottsdale, AZ	969	2.902	333.89
6	Dallas-Plano-Irving, TX Metro Division	634	3.104	204.25
7	Panama City, FL	26	0.128	203.35
8	Columbus, OH	266	1.345	197.72
9	Memphis, TN-MS-AR MSA	133	0.888	149.72
10	Denver-Aurora-Lakewood, CO MSA	273	1.866	146.31

Table 11 (continued).

	Airport MSA	Completions	Working age pop. (1,000,000)	Talent Pipeline
11	Huntsville. AL MSA	42	0.297	141.51
12	Washington-Arlington-Alexandria, DC-VA-MD-WV MSA	542	4.141	130.89
13	Los Angeles-Long Beach-Glendale, CA Metro Division	877	6.943	126.31
14	Pittsburgh, PA MSA	194	1.538	126.10
15	Detroit-Warren-Dearborn, MI MSA	321	2.837	113.14
16	Atlanta-Sandy Springs-Roswell, GA MSA	419	3.798	110.32
17	Jackson, MS MSA	39	0.381	102.45
18	Orlando-Kissimmee-Sanford, FL MSA	141	1.567	89.97
19	Kansas City, MO-KS MSA	116	1.354	85.68
20	Baltimore-Columbia-Towson, MD MSA	139	1.865	74.54
21	Riverside-San Bernardino-Ontario, CA MSA	211	2.922	72.22
22	St. Louis, MO-IL MSA	127	1.846	68.78
23	Newark, NJ-PA Metro Division	101	1.524	66.28
24	New York-Jersey City-White Plains, NY-NJ Metro Division	640	9.686	66.07
25	Louisville/Jefferson County, KY-IN MSA	48	0.838	57.25
26	Indianapolis-Carmel-Anderson, IN MSA	74	1.304	56.73
27	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	147	4.029	36.48
28	Minneapolis-St. Paul-Bloomington, MN-WI	80	2.338	34.21
29	Raleigh, NC MSA	28	0.846	33.11
30	Chicago-Naperville-Elgin, IL-IN-WI MSA	158	6.423	24.60
31	Cleveland-Elyria, OH MSA	20	1.340	14.93
32	Milwaukee-Waukesha-West Allis, WI MSA	12	1.037	11.57
33	Charlotte-Concord-Gastonia, NC-SC MSA	12	1.589	7.55
34	Las Vegas-Henderson-Paradise, NV MSA	0	1.377	0.00

Note: Data provided by Economic Modeling Specialists, Inc. AFW and DFW share talent pipeline but not MSA population. PHX and IWA share talent pipeline and MSA population. The U.S. Census Bureau subdivides 11 MSAs, including the Dallas-Fort Worth-Arlington, TX MSA, Los Angeles-Long Beach-Anaheim, CA MSA, Miami-Fort Lauderdale-West Palm Beach, FL, MSA, New York-Newark-Jersey City, N.Y.-N.J.-Pa. MSA. MSA Classifications adapted from “2010 Geographic Terms and Concepts - Core Based Statistical Areas and Related Statistical Areas”, by U.S. Census Bureau, 2012. Copyright 2012 by U.S. Census Bureau.

Results for Research Objective Two

Talent pipeline did not trend in a similar manner when compared to aerotropolis model performance of the 35 airports in RO1. Talent pipeline, which is the airport-skills workforce training concentration or "completion ratio" of the airport MSA, was wide-ranging among the 35 airport MSAs. Talent pipeline scores of the airport-based programs ranged from zero to 573.11. The Greensboro-High Point, NC MSA held the highest talent pipeline ranking at 573.11. Table 11, which includes the number of the working-age population completing aerotropolis model education and training programs offered by community colleges and universities per the population (per 1,000,000) for each airport MSA, shows that the Greensboro-High Point, NC MSA with a working age population of 492,055, included 282 people who completed aerotropolis-related training and education programs at community colleges and universities in 2014. With 114 people completing aerotropolis-related training and education programs, Anchorage, AK MSA reported the second highest talent pipeline score with 415.40. Anchorage, AK MSA, also finished second to Greensboro-High Point, NC MSA with working age populations less than 500,000. Fort Wort-Arlington, TX Metropolitan Division possessed the third highest talent pipeline score with 402.33 and 634 people completing aerotropolis-related training and education programs. Fort Worth-Arlington, TX Metropolitan Division shares available aerotropolis-related training and education programs at community colleges and universities offered in the larger Dallas-Fort Worth-Arlington, TX MSA. With no one completing aerotropolis-related training and education programs in 2014, Las Vegas-Henderson-Paradise, NV MSA ranked the lowest talent pipeline, with a 0.00 score. With 12 completions of aerotropolis-related training and education programs each, Charlotte-Concord-Gastonia, NC-SC MSA and Milwaukee-Waukesha-West Allis, WI MSA ranked second and third lowest in talent pipeline with scores of 7.55 and 11.57, respectively. As demonstrated from the results, talent pipeline scores differed greatly by the location of the 34 airport MSAs.

Descriptive Statistics for Research Objectives Three and Four

The descriptive statistics provide a snapshot of airport activity and economic activity in the airport MSA and airport community. The descriptive statistics include the minimum and maximum observations, the mean and standard deviation for each variable used in the regression models for research objective three and research objective four. Boardings represent passenger activity at each aerotropolis model airport per airport MSA population. The 35 aerotropolis model airports averaged 3.58 passenger activities per airport MSA population. Most passenger activity ranged between 0.67 and 6.49 passengers per airport MSA population. Cargo represents the landed weight of cargo, measured in metric tons, at each aerotropolis model airport per airport MSA population. The 35 aerotropolis model airports averaged 1.06 cargo activities per airport MSA population. Most cargo activity ranged between 0.67 and 6.49 passengers per airport MSA population. Gross regional product for the 35 airport MSAs averaged $201.5 billion, while employment (the number of people employed per the working age population) averaged 69.62% in the MSAs with an average per capita income of $77,071. Additionally, Table 12 provides information on the gross regional product, employment, and per capita income of the airport communities. The average gross regional product for the airport community was about $26.8 billion. Most gross regional product of the airport communities ranged from $8.25 billion to $45.29 billion. Employment averaged 78.34% in the airport communities. Still, employment in the airport communities was wide-ranging, with most employment falling within a range of 50% to 106%. Per capita income in the airport communities averaged $61,100. The airport communities averaged higher employment and higher per capita income when compared to the airport MSA.

Table 12

Descriptive Statistics of Multiple Regression Models, n = 35

Observation	*Min.*	*Max.*	*Mean*	*SD*
Boardings (V1)	0.00	9.96	3.58	2.91
Cargo (V2)	0.00	18.04	1.06	3.28
Talent (V3)	0.00	573.10	142.73	137.44
MSA Gross Regional Product (V4)	7.60	1,104.21	201.47	214.23
MSA Employment (V5)	0.4601	0.8050	0.6962	0.0661
MSA Per capita income (V6)	30,917	77,071	56,057	10,315
Airport Community Gross Regional Product (V7)	0.71	65.41	26.77	18.52
Airport Community Employment (V8)	0.2059	1.4418	0.7834	0.2747
Airport Community Per capita income (V9)	19,113	121,254	61,110	26,921

Note: Min. means Minimum, Max means Maximum.

Research Objective Three

Research Objective Three used multiple regression to determine if there was a relationship between aerotropolis model success, and aerotropolis model performance and talent pipeline. The accuracy of multiple regression analysis is contingent on certain assumptions about the variables used in the analysis (Cohen et al., 2003). Any deviation from these assumptions can result in errors in determining the effect size or the significance (Cohen et al., 2003). The assumptions for research objective three included no outliers, independence of errors or residuals, linearity, no multicollinearity, and normality. The researcher used Pearson's Correlation to test for multicollinearity. Davis (2011) explains that multicollinearity occurs when there is a high correlation between two x variables or if there is a high correlation between one x variable and the linear combination of other x variables. High multicollinearity results in an unstable model which renders the model unsuitable for predicting (Davis, 2011).

Each of the three dependent variables for Research Objective Three measure the economic success of the airport community. In this study, the airport community is defined as the area within a 5-mile radius of the aerotropolis model airport. The three dependent variables are Airport Community Gross Regional Product, Airport Community Employment, and Airport Community Per Capita Income. Multiple regression tables for each dependent variable are displayed in Tables 16 - 21 (Field, 2014). The researcher evaluated the ANOVA table to determine if any variables have a *p*-value less than 0.05, meaning it was statistically significant in the model (Field, 2014). If any variables are statistically significant in the model, there is a relationship between the dependent and independent variables (Field, 2014). Scatter plots for each of the dependent variables appear in Figures 10 – 12.

Results for Research Objective Three

The findings indicated there was no relationship between the nine CIP aerotropolis model education and training program categories (see Table 12) offered by community colleges and universities (talent pipeline) examined in this study and aerotropolis model success (airport community employment, airport community gross regional product, and airport community per capita income). The results did find, however, a positive relationship between passenger activity and airport community gross regional product, and airport community employment.

The multiple regression model for the Airport Community Gross Regional Product as the dependent variable is statistically significant. The Model Summary and ANOVA for Airport Community Gross Regional Product in Table 13 display the statistics used to test if there is at least one IV in the model that is significant (Field, 2014). When a model is statistically different, the results is not by chance (Field, 2014). The *F*-test is used to determine if the model is a good fit for the data (Field, 2014). For DV, Airport Community Gross Regional Product, $F(6,28) = 3.097$, $p = 0.019$, which means the model is significantly different between the dependent and independent variables. The $R^2 = 0.399$, which means there is 39.9% variability. The IVs explain the extent of variability in the DV by regression model (Field, 2014). A relationship exists between Airport Community Gross Regional Product and aerotropolis model success.

Table 13

Model Summary and ANOVA Table: Airport Community Gross Regional Product (DV), n = 35

Source	*SS*	*df*	*MS*	*F*	*SIG.*
Regression	4,653.774	6	775.629	3.097	0.019
Residual	7,011.725	28	250.419		
Total	11,665.500	34			
$R = 0.632$					
$R^2 = 0.399$					
Adjusted $R^2 = 0.270$					
SE = 15.825					

The multiple regression model for the Airport Community Employment as the dependent variable is statistically significant. The Model Summary and ANOVA for Airport Community Employment in Table 14 display the statistics used to test if there is at least one IV in the model that is significant (Field, 2014). The *F*-test is used to determine if the model is a good fit for the data (Field, 2014). For DV, Airport Community Employment, $F(6,28) = 2.454$, $p = 0.049$, which means the model is significantly different between the dependent and independent variables. The $R^2 = 0.345$, which means there is 34.5% variability in the DV. The IVs explain the extent of variability in the DV by regression model (Field, 2014). A relationship exists between Airport Community Employment and aerotropolis model success.

Table 14

Model Summary and ANOVA Table: Airport Community Employment (DV), n = 35

Source	*SS*	*df*	*MS*	*F*	*SIG.*
Regression	0.884	6	0.147	2.454	0.049
Residual	1.681	28	0.060		
Total	2.565				
$R = 0.587$					
$R^2 = 0.345$					
Adjusted $R^2 = 0.204$					
$SE = 0.245$					

The multiple regression model for the Airport Community Per Capita Income as the dependent variable is not statistically significant. This finding indicates it cannot be determined that a significant difference exists between the dependent and independent variables. The Model Summary and ANOVA for Airport Community Per Capita Income in Table 15 displays the statistics used to test if there is at least one IV in the model that is significant (Field, 2014). The *F*-test is used to determine if the model is a good fit for the data (Field, 2014). For DV, Airport Community Per Capita Income, $F(6,28) = 2.409$, $p = 0.019$, means the model is not significantly different using multiple regression. The $R^2 = 0.340$, which means there is 34.0% variability. The IVs explain the extent of variability in the DV by regression model (Field, 2014). A relationship does not exist between Airport Community Per Capita Income and aerotropolis model success.

Table 15

Model Summary and ANOVA Table: Airport Community Per Capital Income, n = 35

Source	*SS*	*df*	*MS*	*F*	*SIG.*
Regression	8,390,323,436	6	1,398,387,239	2.409	0.053
Residual	16,250,386,498	28	580,370,946.4		
Total	24,640,709,934	34			
R = 0.583					
R^2 = 0.340					
Adjusted R^2 = 0.199					
SE = 24,093.6					

The regression output tables contain the results of the multiple regression models (Field, 2014). The beta coefficients for the multiple regression model are displayed in the Regression Output Tables. When examining the Regression Output in Table 16, Table 17, and Table 18, the *p*-value for Boardings is statistically significant for the DV, Airport Community Gross Regional Product (p=0.042) and significant for the DV, Airport Community Employment (p=0.004). The p-values for Community Per Capita Income was not considered because the model is not statistically significant (p=0.053). The Regression Output Tables also display the beta coefficients for each IV. Based on these coefficients, the equation for the three regression lines are as follows:

Y = AC Gross Regional Product = 45.340 + 2.223(Boardings) – .347(Cargo) -.005(Talent) + .024(MSA Gross Regional Product) – 78.9647(MSA Employment) + .000 (MSA Per Capita Income)

Y = AC Airport Employment = 267 + .0500(Boardings) + .015(Cargo) + .000(Talent) – .000(MSA Gross Regional Product) + 1.113(MSA Employment) – .000(MSA Per Capita Income)

Y = AC Per Capita Income = 30,879.44 + 4,120.54 (Boardings) + .560 (Cargo) – .0518(Talent) – 26.086 (Gross Regional Product) – 42.739 (MSA Employment) + .891(MSA Per Capita Income)

Table 16

Regression Output: Airport Community Gross Regional Product (DV), n = 35

Variables	Coefficients	*SE*	*t*	*Sig.*	95% Confidence Interval		Collinearity Statistics	
					Lower	Upper	Tol.	VIF
Intercept	45.340	35.107	1.291	.270	-26.573	117.254		
Boardings	2.223	1.045	2.128	.042	.083	4.364	.795	1.258
Cargo	-.347	1.035	-.335	.740	-2.468	1.774	.637	1.570
Talent	-.005	.023	.226	.823	-.053	.042	.731	1.367
MSA_GRP	.024	.023	1.005	.323	-.024	.071	.293	3.411
MSA_EMP	-78.9647	71.863	-1.009	.281	-226.168	68.241	.326	3.063
MSA_INC	.000	.001	.760	.454	-.002	.002	.204	4.901

Note: MSA_GRP is MSA Gross Regional Product, MSA_EMP is MSA Employment, and MSA_INC is MSA Per Capita Income

Table 17

Regression Output: Airport Community Employment (DV), n = 35

Variables	Coefficients	*SE*	*t*	*Sig.*	95% Confidence Interval		Collinearity Statistics	
					Lower	Upper	Tol.	VIF
Intercept	.267	.544	.491	.627	-.846	117.254		
Boardings	.050	.016	3.121	.004	.017	4.364	.795	1.258
Cargo	.015	.016	.919	.366	-.018	1.774	.637	1.570
Talent	.000	.000	.386	.702	-.001	.042	.731	1.367
MSA_GRP	-.000	.000	-.273	.787	-.001	.071	.293	3.411
MSA_EMP	.949	1.113	.853	.401	-1.330	68.241	.326	3.063
MSA_INC	-.000	.000	-.674	.506	.000	.002	.204	4.901

Note: MSA_GRP is MSA Gross Regional Product, MSA_EMP is MSA Employment, and MSA_INC is MSA Per Capita Income

Table 18

Regression Output: Airport Community Per Capita Income (DV), n = 35

Variables	Coefficients	*SE*	*t*	*Sig.*	95% Confidence Interval		Collinearity Statistics	
					Lower	Upper	Tol.	VIF
Intercept	30,879.44	53,445	0.578	.568	-78,599	140,358		
Boardings	4,120.54	1,590	2.591	.015	862.43	7,378	.795	1.258
Cargo	560.76	1,576	0.356	.731	-2,667	3,789	.637	1.570
Talent	-0.518	35.150	-0.015	.989	-71.48	71.48	.731	1.367
MSA_GRP	-26.086	35.621	-0.732	.467	-99.05	46.88	.293	3.411
MSA_EMP	-42,739	109,401	-0.391	.696	-266,837	181,360	.326	3.063
MSA_INC	0.891	0.887	1.005	.320	-.925	2.708	.204	4.901

Note: MSA_GRP is MSA Gross Regional Product, MSA_EMP is MSA Employment, and MSA_INC is MSA Per Capita Income.

Linearity. An assumption of multiple regression is that a linear relationship exists between the independent variables and the dependent variable (Field, 2014). According to Field, linearity occurs when the outcome variable (dependent variable) serves as a linear function of the predictor variables (independent variables). Field suggests violating the linearity assumption negatively impacts the regression coefficient and results in underestimating the relationship between the variables. Scatterplots (Figures 11, 12, and 13) were used to visually test the linearity assumption between the dependent variables Airport Community Gross Regional Product, Airport Community Employment, and Airport Community Per Capita Income and the independent variables, Boardings, Cargo, and Talent Pipeline. After visual inspection of the scatter plots generated by IBM SPSS, no prominent deviations were apparent. The linearity assumption was considered to be satisfied for research objective three (Field, 2014).

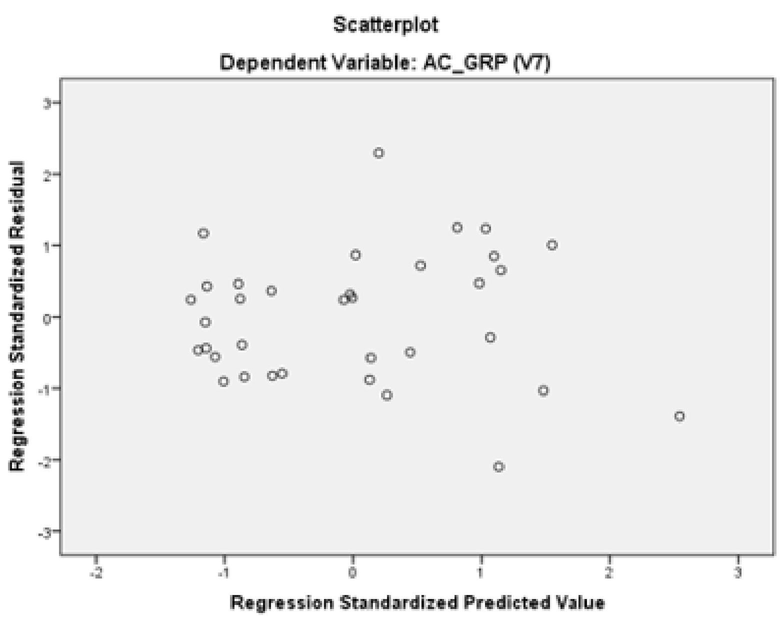

Figure 11. Scatter Plot of Dependent Variable Airport Community Gross Regional Product

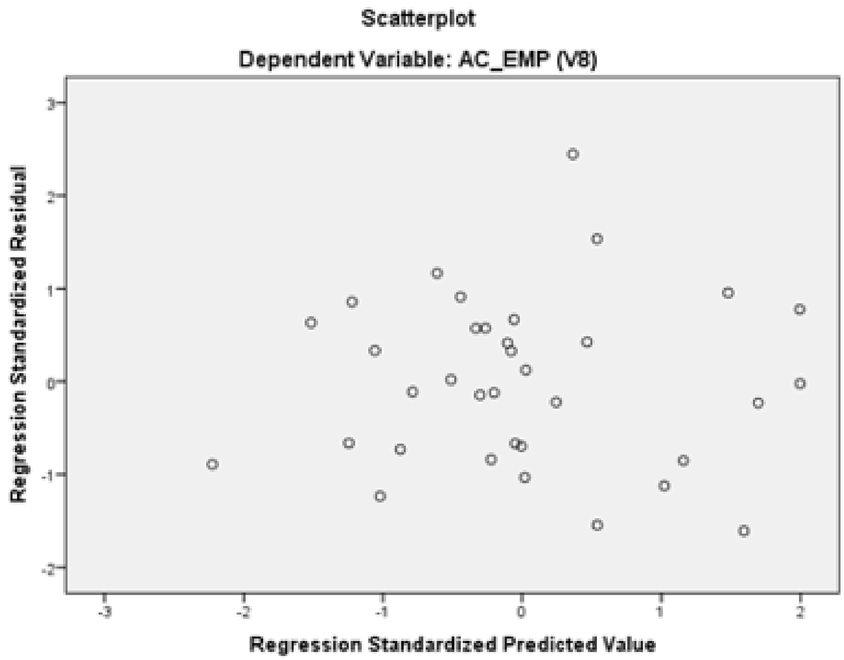

Figure 12. Scatter Plot of Dependent Variable Airport Community Employment

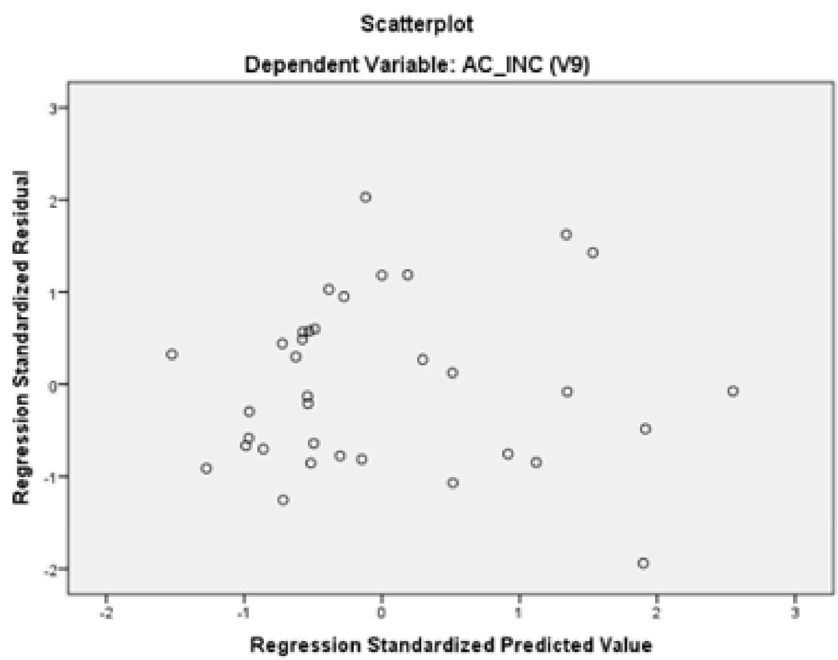

Figure 13. Scatter Plot of Dependent Variable Airport Community Per Capita Income

Normality. The data was examined using a probability plot (p-plot) to test for normality (Cohen et al., 2003; Field, 2014). P-plots are graphs used to evaluate the fit of a distribution to the data (Field, 2014). The plotting of each observation against its estimated cumulative probability results in the p-plot by creating an estimated cumulative distribution function (Field, 2014). If the data points plot close to the diagonal line of the graph, there is normality (Field, 2014). P-plots in Figure 14 all track close to the diagonal line of the graph, resulting in normality (Field, 2014).

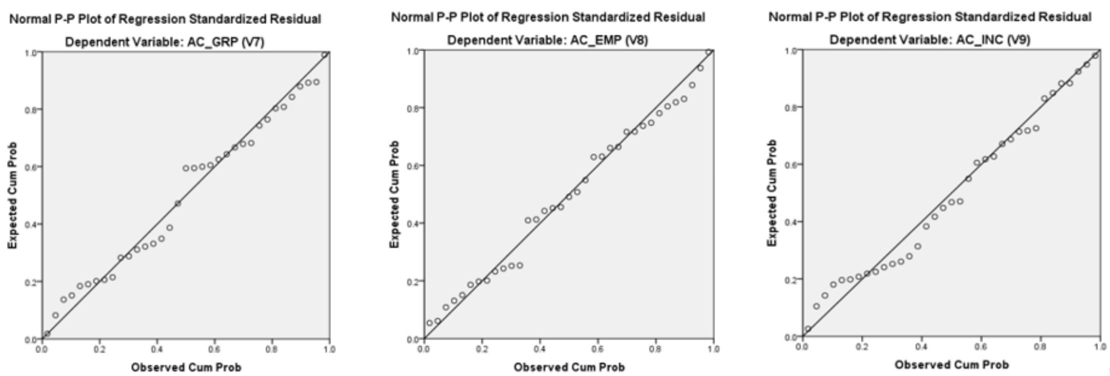

Figure 14. P-Plots of Dependent Variables Airport Community Gross Regional Product, Airport Community Employment, and Airport Community Per Capita Income

Multicollinearity. The IBM SPSS regression output produces a variance inflation factor (VIF) and tolerance statistic. VIF indicates the degree in which one predictor variable is related to other predictors (Field, 2014). VIF should be less than 10 and the tolerance statistic should more than 0.2 (Field, 2014). The largest VIF for RO3 was 4.901 (MSA Per Capita Income), and the lowest tolerance statistic was 0.204 (MSA Per Capita Income), which were within acceptable standards for multicollinearity. Pearson's Correlation was also performed in IBM SPSS to determine for multicollinearity (Field, 2014). Pearson's Correlation is a statistical method that determines the linear relationship between two variables (Cohen et al., 2003). The results of the Pearson's correlation presented in Table 13 show that the control variables are not highly correlated, *r* ranges from 0.002 to 0.528 in absolute value. These results indicate multicollinearity is not an issue.

Control Variables. Control variables (MSA Per Capita Income, MSA Employment, and MSA Per Capita Income) were used in the multiple regression models to control for any variance in the airport MSA and the dependent variables (Airport Community Gross Regional Product, Airport Community Employment, and Airport Community Per Capita Income) of the airport community (Bernerth & Aguinis, 2016; Trochim, 2006). The results revealed no influence of the control variables (no multicollinearity) on the dependent variables as displayed in the Pearson's Correlation Matrix in Table 22, therefore the results of the control variables are not recorded (Bernerth & Aguinis, 2016).

Table 19

Pearson's Correlation Matrix, n = 35

	Variables	1	2	3	4	5	6	7	8	9
1	Boardings	1								
2	Cargo	.061	1							
3	Talent	-.137	.314	1						
4	MSA_GRP	.002	-.202	-.193	1					
5	MSA_EMP	-.004	.030	-.235	-.119	1				
6	MSA_INC	.221	.228	-.075	.528	.525	1			
7	AC_GRP	.405	-.061	-.110	.456	-.179	.304	1		
8	AC_EMP	.488	.202	.030	-.272	.105	.000	.412	1	
9	AC_INC	.522	.210	-.003	-.027	.100	.287	.557	.881	1

Note: MSA_GRP is MSA Gross Regional Product, MSA_EMP is MSA Employment, and MSA_INC is MSA Per Capita Income. AC_GRP is Airport Community Gross Regional Product, MSA_EMP is Airport Community Employment, and MSA_INC is Airport Community Per Capita Income.

Research Objective Four

Research Objective Four determined if there was a relationship between aerotropolis model airport performance and human capital development. The multiple regression analysis for research objective four was performed by comparing the dependent variable, Talent Pipeline (HCD), with Passenger Activity and Cargo Activity. ANOVA and multiple linear regression tables for the dependent variable are displayed in Table 20 and Table 21 (Field, 2014). The researcher evaluated the ANOVA table to determine if any variables have a *p*-value less than 0.05, meaning it was statistically significant in the model (Field, 2014). If any variables are statistically significant in the model, there is a relationship between the variables (Field, 2014).

Results for Research Objective Four

The findings suggested there was not a relationship between aerotropolis model performance and human capital development. Passenger activity and cargo activity was not affected by talent pipeline and therefore there was not a relationship between aerotropolis model airport performance and human capital development. The multiple regression model for DV, Human Capital Development (which is measured as talent pipeline), is not statistically significant. The Model Summary and ANOVA Table 19 provides information concerning the multiple regression analysis of RO4. The *F*-test is used to determine if the model is a good fit for the data (Field, 2014). The $p = 0.124$ for DV, Human Capital Development, which means the model is not significantly different when comparing the independent and dependent variables. The $R^2 = 0.122$, which means there is 12.2% variability. The Regression Output Table (Table 21) displays the beta coefficients for each IV. Based on these coefficients, the equation for the regression line is *y* = Human Capital Development = -7.385 (Boardings) + 13.550 (Cargo).

Table 20

Model Summary and ANOVA Table: Human Capital Development (DV), n = 35

Source	*SS*	*df*	*MS*	*F*	*SIG.*
Regression	78,991.963	2	39,295.981	2.231	0.124
Residue	563,700.577	32	17,615.643		
Total	642,292.54	34			
R = 0.350					
R^2 = 0.122					
Adjusted R^2 = -0.068					
Std. Error = 132.724					

Table 21

Regression Output: Human Capital Development (DV), n = 35

Variables	Coefficients	*SE*	*t*	*Sig.*	95% Confidence Interval		Collinearity Statistics	
					Lower	Upper	Tol.	VIF
Intercept	154.943	36.308	4.262	.000	80.799	228.900		
Boardings	-7.395	7.826	-.945	.352	-23.323	8.553	.996	1.004
Cargo	13.503	6.944	1.943	.061	-0.597	27.647	.996	1.004

Note. Plots generated from IBM SPSS. Tol. = Tolerance.

An examination of the scatter plot and *p*-plot (Figure 15) for linearity and normality revealed problems with linearity and homoscedasticity (Field, 2014). In a normal distribution, the residual is dispersed throughout the scatterplot (Field, 2014). The results from the scatterplot (Figure 15) displayed heteroscedasticity and non-linearity, with residuals concentrated in one area of the graph (Field, 2014). The data was examined using a probability plot (*p*-plot) to test for normality (Cohen et al., 2003; Field, 2014). Most of the points in the *p*-plot in Figure 15, however, were positioned away from the diagonal line, which suggested the standardized residual distribution was not normal. A lack of normality indicates the data may not be normally distributed (Field, 2014).

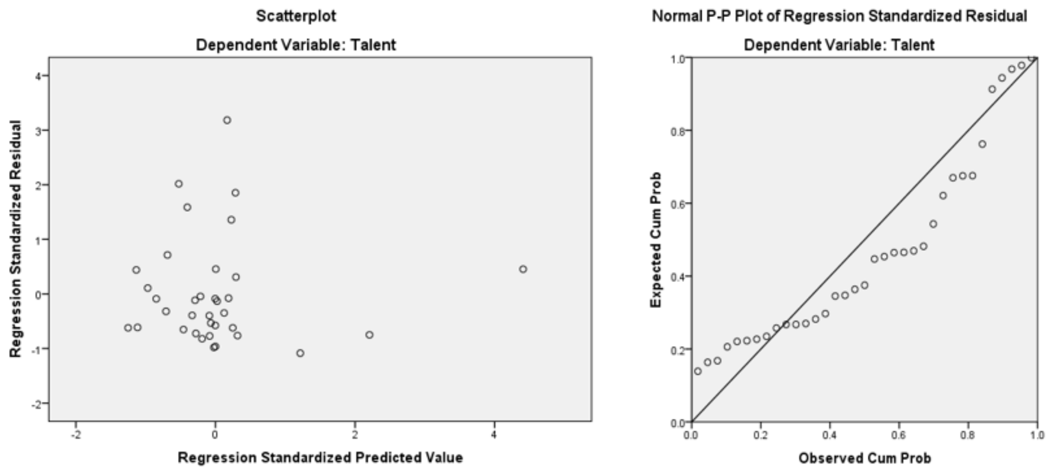

Figure 15. Scatter Plot and P-Plot for Dependent variable HCD (DV)

Chapter Summary of Findings

Findings from the study indicated that there was not a relationship between the talent pipeline of the airport MSA and the success of the airport community. However, the findings did reveal a positive relationship between passenger activity and airport community gross regional product, and passenger activity airport community employment. Other findings from the study suggested there was not a relationship between aerotropolis model airport performance and human capital development. Finally, when ranking the aerotropolis model airports and talent pipeline of the Airport community, passenger activity was more important to aerotropolis model success than cargo activity and talent pipeline did not affect the ranking of aerotropolis model airport performance. The final summary and conclusions of this study will follow in Chapter V. Additionally, study limitations, implications of the results and recommendations for further study will be discussed in the next chapter.

CHAPTER V – FINDINGS, CONCLUSIONS & RECOMMENDATIONS

Chapter I of this study introduced the statement of the problem, the purpose of the research, and the four research objectives. Additionally, Chapter I presented the conceptual model with the theoretical framework and the significance of the study. Chapters II – IV addressed the literature review, research methodology, and the research findings of the study. Chapter V begins with a summary of the study, followed by a discussion of the findings, conclusions, and recommendations (Creswell, 2014; Jackson, 2015). The chapter concludes with a discussion of the implications of study limitations and offers suggestions for future research.

Summary of the Study

Airports are one of the largest investments any municipality or region can pursue and are a vital component in connecting that municipality or region to the global marketplace (Florida et al., 2015). Recognizing the potential economic benefits of the airport, many local leaders and policymakers living in airport communities adopted the aerotropolis model concept in anticipation that airports would provide new means for economic growth in the 21st century (Hyer, 2013; Kasarda 2000, 2006, 2011). According to Kasarda and Appold (2014), the aerotropolis model is focused on the airport as the economic catalyst to stimulate the local economy. The successful aerotropolis model provides an array of non-air-related services to the community by generating more revenue for the Airport community than with just air-related services (Hazel, 2013; Reiss, 2007). Unfortunately, efforts to implement the aerotropolis model as an economic development strategy in airport communities have not always been successful (Appold, 2013; Van Wijk, 2011). While community leaders and policymakers focused efforts to improve the physical capital of the airport, officials have often overlooked investment in human capital development (Freestone & Baker, 2011; Simmonds & Hack, 2000; Storper, 2010; Van Wijk, 2011). Porter and Kramer (2011) emphasize the importance of investing in people. Porter and Kramer believed the quality of human capital must be considered a key strategy to the success of the aerotropolis if airport activity is to play a larger role in the airport community.

The population of the study consisted of the 35 airports in the United States classified by Kasarda and Appold (2014) as aerotropolis model airports and the communities within a five-mile radius of these airports. Archival data from publically accessible databases provided the data for the study. All data used in the study was from the 2014 calendar year unless otherwise noted. The purpose of this quantitative explanatory, quasi-experimental study was to determine the relationship between human capital development and the aerotropolis model airport performance and the relationship between the human capital development and aerotropolis model success.

Limitations

Limitations are influences beyond the control of the researcher (Roberts, 2010). Creswell (2014) points out that identifying and discussing limitations of the study is important because it addresses potential gaps in the design, instrumentation, and study population. Limitations also should identify any researcher bias (Creswell, 2014). The limitations of this study include the population size, the methodology, and the accuracy of the archival data. A discussion on the implications of the study limitations is offered later in this chapter.

Aerotropolis Model Performance and Airport Community Success

The research of Kasarda and Appold (2014), and Kasarda and Lindsay (2011) on the aerotropolis model suggests aerotropolis model performance, measured as passenger activity and cargo activity in this study, generates economic growth or success to the airport community. Economists have often used gross regional product, employment and per capita income as measurements of this success (Glaeser & Gottlieb, 2008, 2009). These economic growth indicators collected from the airport community demonstrate the economic output spillover from aerotropolis model performance. Collectively, these economic growth indicators were identified as airport community success. In this study, the researcher determines if a relationship exists between aerotropolis model performance and airport community success.

Findings

When examining aerotropolis model performance, the highest ranking aerotropolis model airports displayed high passenger activity. This finding supports the research of Brueckner (2003) and Green (2007) on the importance of airport performance to the economy. Using air transportation data from 1970 (pre-airline deregulation), Brueckner compared several economic indicators including employment, income, and population size of the airport MSA with passenger activity. Brueckner discovered there was a proportionate relationship between an MSA's population and passenger boardings. Green compared the passenger boardings per capita (passenger activity) at 83 commercial airports between 1990 and 2000 with the population growth in the respective airport MSA. Green found there was a strong correlation between the presence of an airport and economic success of the airport MSA.

High passenger activity linked closely to airport community success. The findings indicated a positive relationship between passenger activity (a component of aerotropolis model performance) and Airport Community Gross Regional Product, and Airport Community Employment. This finding supports the research of Cooley (1894) on the theory of transportation. Cooley believed transportation was the most important factor in determining the development and wealth of a city. Cooley explained where an interruption or break in the logistics transportation chain occurs, in this instance the aerotropolis model, increased population and wealth occurs.

In contrast to passenger activity, there was not a relationship between cargo activity and airport community gross regional product, and airport community employment. Button and Yuan's (2013) research on the influence of air cargo activity on economic development may offer an explanation why cargo activity did not contribute to economic growth. Button and Yuan's findings were inconclusive but did indicate there was a weak positive causal relationship between air cargo activity and local economic development. Mayer (2016) described cargo activity as relatively small in comparison to passenger activity and the economy. Several researchers including Alkaabi and Debbage (2011), Allroggen, Wittman, and Malina (2015), and Lakew (2015) believed that passenger activity could be 10 times more economically impactful to a community than cargo activity.

The lowest performing aerotropolis model airports were primarily cargo only airports or primarily passenger only airports. However, passenger activity was more vital to aerotropolis model airport performance than cargo activity. Two aerotropolis model airports in the study, Rickenbacker International Airport in Columbus, OH, and Fort

Worth Alliance Airport are primarily cargo airports. Recently, limited passenger service by Allegiant Airlines began from Rickenbacker International Airport (Matzer Rose, 2016). Nearby John Glenn Columbus International Airport provides much of the passenger traffic in the Columbus, OH MSA. Fort Worth Alliance Airport is exclusively a cargo airport. Passenger traffic originates from Dallas-Fort Worth International Airport. Phoenix-Mesa Gateway Airport is primarily a passenger airport. These three aerotropolis model airports demonstrated the lowest total activity.

Conclusions

Too much emphasis is placed on cargo activity in the aerotropolis model. Passenger activity was more vital to aerotropolis model performance than cargo activity. Airport connectivity drives passenger activity. Passenger activity drives gross regional product and employment in the airport community. When considering the total activity of aerotropolis model airports, external factors not related to the airport community drive performance. Aerotropolis model airports classified as major hubs for passenger traffic, located in high tourists areas or home to cargo integrators were the highest performing. More cargo activity must be generated at the aerotropolis model airport than passenger activity to provide the same economic impact in the airport community.

Recommendations

When developing a strategy for the aerotropolis model, community leaders, and policymakers must be aware of the different economic impacts of passenger activity and cargo activity and plan accordingly. Community leaders and policymakers must determine the goals of the airport community in regards to how community stakeholders can encourage and build upon the factors that bring about high aerotropolis performance.

Airport community gross regional product and airport community employment are generated faster with passenger activity than with cargo activity. Economic growth from cargo activity is possible but requires different skill sets than passenger activity. As strategies are developed for the aerotropolis model, it is important that community leaders and policymakers understand economic impact resulting from passenger activity and cargo activity. When considering expansion of the airport, community leaders and planners should understand that passenger activity and cargo activity impact the airport community differently regarding gross regional product and employment. Policymakers and community leaders should evaluate what factors the airport community is willing to undertake to support the aerotropolis model.

Talent Pipeline and Airport Community Success

Becker (1962, 1993) and Shultz (1961, 1975) understood that investment in human capital leads to greater economic success in a community. The literature points to other research that supports this theory as well. Sweetland's (2006) review of the historical and methodological foundations of human capital development theory summarized that communities obtained economic benefits by investing in people. Studies by Gennaioli et al. (2011) and Hamilton and Liu (2014) also validated the work of Becker and Shultz by affirming a correlation between education and training, and the wealth of a community. In this study, the researcher examined the benefits of the airport MSA to investment in human capital development by determining the relationship between talent pipeline and airport community success.

Findings

The findings of this study indicated there was not a relationship between the nine CIP aerotropolis model education and training program categories offered by community colleges and universities (talent pipeline) examined in this study and airport community success (measured as airport community employment, airport community gross regional product, and airport community per capita income).

Conclusions

At first examination, this finding appears to contradict the research by Becker and Shultz on the human capital development theory. The disconnect in human capital development and airport community success in this study could be attributed to trends in the air transportation industry that require new skills other than the nine CIP aerotropolis model education and training program categories offered by community colleges and universities (Cronin et al., 2016; Tyszko, Sheets, & Fuller, 2014). For example, Cronin et al. indicate demand for engineering and information technology as new skills required by the air transportation industry.

Recommendations

Although there was not a relationship between the nine CIP training and education programs evaluated in this study, the literature emphasizes the economic benefits of having a well-trained workforce. It is just as important that policymakers consider human capital development needs in addition to infrastructure improvements such as roads, expanded runways, and cargo hangers. Policymakers and community leaders should identify other training programs other than the nine CIP training programs examined in this study to determine training programs that meet the needs of the employers in the airport community.

Talent Pipeline and Aerotropolis Model Performance

The talent pipeline of a community is critical to workforce performance (Becker, 1993; Gennaioli, Porta, Lopez-de-Silanes, & Shleifer, 2011). A recent Transportation Research Board report suggested the evolving state of the air transportation industry directly impacts the workforce (Cronin et al., 2016). The evolution of the transportation industry brings uncertainty as to how airport education and training programs can react to a fluctuating environment (Cronin et al., 2016). This study examined the relationship between the talent pipeline of the aerotropolis model airport and aerotropolis model performance (measured as passenger activity and cargo activity).

Findings

The findings suggested there was not a relationship between aerotropolis model performance and talent pipeline. Passenger activity and cargo activity was not affected by talent pipeline, and therefore there was not a relationship between aerotropolis model airport performance and human capital development. Additionally, the researcher expected the talent pipeline to trend in a similar manner as aerotropolis performance when compared to the ranking of the performance of the 35 aerotropolis model airports. However, completion rates did not trend with airport MSA population. This finding is in opposition to the human capital theory that suggests communities obtain economic benefits by investing in people (Sweetland, 1996). This finding also contrasts to research by Barlow (2006) and Gordon (2009) that encourages communities to provide a continual supply of highly skilled workers to help boost the economy. The size of the working age population exhibited some effect on the talent pipeline. The working age population of the two smallest airport MSAs, Greensboro-High Point, NC MSA and Anchorage, AK MSA, possessed the highest talent pipeline scores. Greensboro-High Point, NC MSA, and Anchorage, AK MSA included working age populations under 500,000. MSAs with large working age populations scored low in talent pipeline. In contrast with the high talent pipeline scores of the two smallest airport MSAs, eight of the 10 airport MSAs with the lowest talent pipeline scores comprised working age populations over 1,500,000. Unexpectedly, the talent pipeline or completion ratio was not proportional airport passenger activity and airport cargo activity.

Conclusions

The literature could offer an explanation for the inconsistency in the findings that resulted from this study. Woods (2015) suggested there is often a disconnect between the training programs the community offers and the training programs required by the local businesses. As a result, local businesses are forced to seek alternative methods to gain skilled employees (Stahl et al., 2012). These methods included recruiting retirees to fill vacant positions, recruiting people from other companies or markets, using technology and machines to help perform the work, launching internal training programs, and leaving the position vacant (Stahl et al., 2012).

Recommendations

Awareness of changing trends in the air transportation industry and knowing the importance of providing a continuous supply of talent to the airport community, policymakers, and community leaders could avoid potential skills gaps in workforce development training programs. It is important for policymakers and community leaders to understand the impact of passenger activity and cargo activity when developing human capital development strategies for the aerotropolis model airport. There are unique training needs associated with each of these airport activities. Brueckner (2003) and Green (2007) suggested passenger activity and cargo activity leads to the growth of service-related industries. However, Lakew (2015), Tyszko, Sheets, and Fuller (2014) and Woods (2015), indicated that an increase of professionally skilled, white collar jobs resulted from increased passenger activity, and increased cargo activity brought an increase in manufacturing jobs. These occupations would require unique skill-sets to satisfy the workforce requirements of the aerotropolis model. The failure to understand the importance of the unique talent requirements of jobs associated with passenger activity and cargo activity may lead policymakers and community leaders to ignore strategies designed to increase human capital development in the airport community.

Community leaders and policymakers in airport communities should evaluate training and education programs to determine if the programs are fulfilling the needs of the businesses in the airport community. A shift in operational measures by the air transportation industry has resulted in less dependency on some occupations but created a demand for other occupations. Larger and more technologically sophisticated aircraft, with the ability to carry more passengers and more cargo more efficiently, are replacing smaller, less efficient planes. This change lowers the demand for primary jobs associated with air transportation but increases the demand for engineers and information technologists. Policymakers should devise strategies that target specific training programs that benefit the airport community. Gordon (2009) suggests communities that prepare residents to acquire higher skill-sets will see increased gross regional product and employment. There needs to be an ongoing collaboration between community leaders, policymakers, local training and education officials, and airport community businesses. Policymakers and educational institutions should collaborate with companies to design training programs that are relevant to meeting the operational requirements of the airport community (Woods, 2015).

Just because people receive training in the airport community does not mean they will find jobs in the airport community. Given the mobility of individuals, it is possible for workers to be trained in one locale and find employment in another locale. An example from the findings of this study is Las Vegas, Nevada, an airport that ranks highest in passenger activity but ranks last in talent pipeline.

Implications of Study Limitations

It is important to note the implications of the limitations involved in this study. As discussed earlier in this chapter, an important limitation of this study is population size. Kasarda (2013) admits that some of the criteria for the classification of aerotropolis model airports is subjective. This study consisted of a census of aerotropolis model airports as identified by Kasarda and Appold (2014) located in the United States. As a result, the sample size was limited to 35. It was anticipated the sample size might affect the methodology of this study, however, the regression models appeared to be a good fit (Davis, 2011).

Suggestions for Future Research

This study provides suggestions for future research based on the limitations and findings from this research. Suggestions for future research in this study can be divided into two areas: (a) those suggestions focused on expanding the number of airports used in the study, and (b) those ideas devoted to further evaluating the impact of human capital development in the airport community. Listed below are seven suggestions for future research:

- Expand the study to include all cargo airports in the population study. Since Kasarda (2013) considers airports with cargo capabilities as critical to the success of the aerotropolis model, repeating this study to include qualified cargo airports would expand the population to 115 airports (U.S. Department of Transportation, 2014a). Table A4 in Appendix A provides detailed information about qualified cargo airports in the United States.
- Expand the study to include all commercial airports in the population study. Expanding the population size to include all commercial airports would further increase the population to 565 airports (U.S. Department of Transportation, 2014a). Additionally, the expanded population size would also allow for a more robust use of multiple linear regression (Keith, 2015).
- Utilize structural equation modeling (SEM) as a methodology. The advantage of SEM is that it allows for more flexible modeling. SEM tests the overall model instead of testing individual coefficients (Keith, 2015).
- Additional research to determine what skills are required in the airport community in addition to the nine CIP programs evaluated in this study. The researcher expected a positive correlation between aerotropolis model activity and talent pipeline. A study to determine if aerotropolis model training programs in the airport MSA would result in increased employment in the airport community would be helpful to community leaders and educators.

- Research the mobility of aerotropolis model employees. Employees may receive training in one region but are hired in another area of the United States. A possible focus of this study would be to specifically target job recruitment related to aerotropolis model employers in the airport community to determine if there is a correlation with new hires from these companies and local training programs.
- Develop a stronger model to measure the human capital component of the aerotropolis model.
- Research is needed on a possible skills gap in the airport community. Additional research related to talent pipeline will be needed to determine if existing training programs offered by the airport MSA are in alignment with the skill-set that is required by businesses located in the airport community.

Information from this study could serve as a foundation for these suggested research topics. These subjects for future research would help provide additional information to policymakers and community leaders to develop clear strategies for economic success in the airport community.

Summary

A community's existence depends on trade and transportation. As competition in the global marketplace transitions to air transportation in the 21st century, the airport emerged as the fifth wave of transportation. Seeing the economic benefits of the airport, many local leaders and policymakers of airport communities adopted the aerotropolis model concept, espoused by Kasarda, in anticipation that airports will be the new catalyst for economic growth.

Unfortunately, not all efforts to implement aerotropolis economic development strategies in airport communities have been successful. In the same manner that transportation has shaped cities over history, human capital development efforts also influence the shape of cities. Local leaders are often quick to build infrastructure to construct the aerotropolis model but ignore the human capital development opportunities needed for success.

The following research question was central to this study: Is human capital development the missing component of the aerotropolis model economic development strategy? Four research objectives guided this study to determine the impact of human capital development on the aerotropolis model. The researcher examined all 35 airports based on the aerotropolis model to determine the relationship of human capital development, measured as talent pipeline, on aerotropolis model success. The researcher determined that external factors not related to the airport community drove performance. Additionally, the study identified other factors besides human capital development that influenced airport activity. Findings from the study suggested there could be a disconnect in the training programs offered by the airport MSA and the needs of the businesses in the airport community. And last, an unexpected outcome was that passenger activity plays a more vital role to the success of the airport community than cargo activity.

Table A1.

Aerotropolis Model Airport Activity Influences

Rank	Aerotropolis Model Airport	Passenger Influences	Cargo Influences
1	Ted Stevens Anchorage International	M	Q, F
2	McCarran International	L, T	Q
3	Denver International	L	Q
4	Charlotte/Douglas International	L	Q
5	Hartsfield-Jackson Atlanta International	L, T	Q
6	Miami International	L, T	Q, D, F, U
7	Memphis International	M	Q, F
8	Orlando International	L, T	Q
9	Newark Liberty International	L	Q, F
10	Dallas/Fort Worth International	L, T	Q, U
11	Minneapolis-St Paul International/Wold-Chamberlain	L	Q
12	Louisville International-Standiford Field	S	Q, U
13	Phoenix Sky Harbor International	L	Q
14	Baltimore/Washington International Thurgood Marshall	L	Q
15	Raleigh-Durham International	M	Q
16	Chicago O'Hare International	L, T	Q
17	Detroit Metropolitan Wayne County	L	Q
18	Los Angeles International	L, T	Q, D
19	Indianapolis International	M	Q, F
20	Philadelphia International	L, T	Q, U
21	Kansas City International	M	Q
22	Lambert-St Louis International	M	Q
23	General Mitchell International	M	Q
24	Northwest Florida Beaches	S	
25	John F Kennedy International	L, T	Q, D
26	Cleveland-Hopkins International	M	Q
27	Washington Dulles International	L, T	Q
28	Pittsburgh International	M	Q
29	Huntsville International-Carl T Jones	S	Q
30	Piedmont Triad International	S	Q, F
31	Jackson-Medgar Wiley Evers	S	

Table A1 (continued).

Rank	Aerotropolis Model Airport	Passenger Influences	Cargo Influences
32	Ontario International	M, T	Q, U
33	Rickenbacker International	N	Q
34	Phoenix -Mesa Gateway Airport	S	X
35	Fort Worth Alliance	0	Q, F

Notes: The table of Airports Classified by the FAA as Qualifying Cargo Airports in 2014 is adapted from data provided by "Passenger boarding (enplanement) and all-cargo data for U.S. airports - Previous years." From U.S. Department of Transportation, Federal Aviation Administration, 2015 and "Airport City and Aerotropolis Locations Worldwide." From Airport cities: The evolution, by J. D. Kasarda, 2013, Airport World. Copyright (2013) by Airport World. See Table A2 in Appendix 2 for a statement of permission from the author. Airport Hub Classification is adapted from data provided by "*Airport categories*". From U.S. Department of Transportation, Federal Aviation Administration, 2014a. Airport Addresses provided by Economic Modeling Specialists, Inc.

Abbreviations Guide for Passenger and Cargo Influences:

T-Airport serves a top 20 U.S. City for tourists in 2014 (See Table A2, Appendix A)

D-Sorting Air hub for DHL (See Table A3, Appendix A)

F-Sorting Air hub for FedEX (See Table A3, Appendix A)

U-Sorting Air hub for UPS (See Table A3, Appendix A)

L-Classified by the FAA as a Large Passenger Hub Airport (See Table A4, Appendix A)

M-Classified by the FAA as a Large Passenger Hub Airport (See Table A4, Appendix A)

S-Classified by the FAA as a Large Passenger Hub Airport (See Table A4, Appendix A)

N-Classified by the FAA as a non-hub passenger airport (See Table A4, Appendix A)

0-Unclassified, Cargo-only airport (See Table A4, Appendix A)

Q-Classified by the FAA as a qualified cargo airport in2014 (See Table A4, Appendix A)

X- None

APPENDIX B – Aerotropolis Model Statistics

Table A2.

Top Twenty U.S. Tourist Destinations in 2014

Rank	City	International Tourists (2013)	Total Tourists (2014)
1	Orlando, FL	3,716,000	62,000,000
2	New York, NY	9,579,000	56,400,000
3	Chicago, IL	1,378,000	50,200,000
4	Los Angeles, CA	3,781,000	43,400,000
5	Las Vegas, NV	2,851,000	41,400,000
6	Philadelphia, PA	673,000	39,700,000
7	Atlanta, GA	577,000	37,000,000
8	San Diego, CA	833,000	33,800,000
9	Tampa – St. Petersburg, FL	449,000	29,800,000
10	Dallas – Plano -Irving, TX	449,000	24,900,000
11	Boston, MA	1,282,000	24,270,000
12	Anaheim – Santa Ana, CA	481,000	21,000,000
13	Washington, DC	1,698,000	20,200,000
14	Seattle, WA	481,000	19,200,000
15	San Francisco, CA	3,044,000	18,010,000
16	Houston, TX	801,000	14,800,000
17	Miami, FL	4,005,000	14,600,000
18	San Jose, CA	416,000	10,000,000
19	Flagstaff – Grand Canyon – Sedona, AZ	545,000	8,500,000
20	Honolulu, HI	2,563,000	8,300,000

Note: Data provided by DKShifflet (J. Eslingler, personal communication, November 14, 2016). Data for international travel provided by National Trade and Tourism Office, 2016. From 2014 U.S. Travel and Tourism Statistics (Inbound) and "Most Popular U.S. Cities Among International Travelers in 2013." From Shift Archives. Copyright (2014) by Skift, Inc. See Appendix H for a statement of permission from the author.

APPENDIX C – Aerotropolis Model Statistics

Table A3.

Sorting Hubs of DHL, FedEx, and UPS at U.S. Airports

Integrator	Airport	Facility
DHL	Cincinnati/Northern Kentucky International[1]	DHL Global Hub
	Los Angeles International	DHL Gateway Hub-West Coast
	Miami International	DHL Gateway Hub-Caribbean
	John F Kennedy International	DHL Gateway Hub-East Coast
FedEx	Memphis International	World SuperHub
	Indianapolis International	National Hub
	Ted Stevens Anchorage International	Ted Stevens Anchorage Hub
	Oakland International Airport[1]	West Coast Hub
	Newark Liberty International	Newark, NJ/Liberty Hub
	Fort Worth Alliance	Fort Worth/Alliance Hub
	Miami International	Latin America Hub
	Piedmont Triad International	Mid-Atlantic Hub
UPS	Louisville International-Standiford Field	Worldport
	Philadelphia International	Regional Hub
	Ontario International	Regional Hub
	Dallas/Fort Worth International	Regional Hub
	Chicago Rockford International[1]	Regional Hub
	Columbia (SC) Metropolitan[1]	Regional Hub
	Miami International	Regional Hub

Note: Data from "Key Country Facts: United States", 2016, *DHL Website*. Copyright (2016) by DHL; "Global Reach-About FedEx", 2016, *FedEx Website*. Copyright (2016) by FedEx"; and UPS Air Operations Facts", 2016, *United Parcel Service Website*. Copyright (2016) by United Parcel Service. All airport sorting hubs operated by DHL, FedEx, and UPS are located at airports that are identified as aerotropolis model airports by John Kasarda and Steve Appold except Chicago Rockford International, Cincinnati/Northern Kentucky International, Columbia Metropolitan, and Oakland International.

APPENDIX D – Aerotropolis Model Statistics

Table A4.

Airports Classified by the FAA as Qualifying Cargo Airports in 2014

Rank	Airport Name	Metropolitan Area	Service Level	Hub	Aerotropolis Model
1	Memphis International	Memphis, TN-MS-AR MSA	P	M	Y
2	Ted Stevens Anchorage International	Anchorage, AK MSA	P	M	Y
3	Louisville International-Standiford Field	Louisville/Jefferson County, KY-IN MSA	P	S	Y
4	Chicago O'Hare International	Chicago-Naperville-Elgin, IL-IN-WI MSA	P	L	Y
5	Miami International	Miami-Miami Beach-Kendall, FL Metro Division	P	L	Y
6	Indianapolis International	Indianapolis-Carmel-Anderson, IN MSA	P	M	Y
7	Los Angeles International	Los Angeles-Long Beach-Glendale, CA Metro Division	P	L	Y
8	Cincinnati/Northern Kentucky International	Cincinnati, OH-KY-IN MSA	P	M	N
9	John F Kennedy International	New York-Jersey City-White Plains, NY-NJ Metro Division	P	L	Y
10	Dallas/Fort Worth International	Dallas-Plano-Irving, TX Metro Division	P	L	Y
11	Metropolitan Oakland International	Oakland-Hayward-Berkeley, CA Metro Division	P	M	N
12	Newark Liberty International	Newark, NJ-PA Metro Division	P	L	Y
13	Ontario International	Riverside-San Bernardino-Ontario, CA MSA	P	M	Y
14	Hartsfield - Jackson Atlanta International	Atlanta-Sandy Springs-Roswell, GA MSA	P	L	Y
15	Honolulu International	Urban Honolulu, HI MSA	P	L	N

Table A4 (continued).

Rank	Airport Name	Metropolitan Area	Service Level	Hub	Aerotropolis Model
16	Philadelphia International	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	P	L	Y
17	George Bush Intercontinental/Houston	Houston-The Woodlands-Sugar Land, TX MSA	P	L	N
18	Seattle-Tacoma International	Seattle-Tacoma-Bellevue, WA MSA	P	L	N
19	Phoenix Sky Harbor International	Phoenix-Mesa-Scottsdale, AZ MSA	P	L	Y
20	Denver International	Denver-Aurora-Lakewood, CO MSA	P	L	Y
21	San Francisco International	San Francisco-Redwood City-South San Francisco, CA Metro Division	P	L	N
22	Portland International	Portland-Vancouver-Hillsboro, OR-WA MSA	P	L	N
23	Minneapolis-St Paul International/Wold-Chamberlain	Minneapolis-St. Paul-Bloomington, MN-WI MSA	P	L	Y
24	Salt Lake City International	Salt Lake City, UT MSA	P	L	N
25	General Edward Lawrence Logan International	Boston-Cambridge-Newton, MA-NH MSA	P	L	N
27	Boeing Field/King County International	Seattle-Tacoma-Bellevue, WA MSA	P	N	N
28	Chicago/Rockford International	Rockford, IL MSA	P	N	N
29	Bradley International	Hartford-West Hartford-East Hartford, CT MSA	P	M	N
30	Orlando International	Orlando-Kissimmee-Sanford, FL MSA	P	L	Y
31	San Antonio International	San Antonio-New Braunfels, TX MSA	P	M	N
32	Rickenbacker International	Columbus, OH MSA	P	N	Y

Table A4 (continued).

Rank	Airport Name	Metropolitan Area	Service Level	Hub	Aerotropolis Model
33	Detroit Metropolitan Wayne County	Detroit-Warren-Dearborn, MI MSA	P	L	Y
34	Fort Worth Alliance	Fort Worth-Arlington, TX Metro Division	R	-	Y
35	San Diego International	San Diego-Carlsbad, CA MSA	P	L	N
36	Albuquerque International Sunport	Albuquerque, NM MSA	P	M	N
37	Piedmont Triad International	Greensboro-High Point, NC MSA	P	S	Y
38	General Mitchell International	Milwaukee-Waukesha-West Allis, WI MSA	P	M	Y
39	Fort Lauderdale/Hollywood International	Fort Lauderdale-Pompano Beach-Deerfield Beach, FL Metro Division	P	L	N
40	Kansas City International	Kansas City, MO-KS MSA	P	M	Y
41	El Paso International	El Paso, TX MSA	P	S	N
42	Baltimore/Washington International Thurgood Marshall	Baltimore-Columbia-Towson, MD MSA	P	L	Y
43	Washington Dulles International	Washington-Arlington-Alexandria, DC-VA-MD-WV MSA	P	L	Y
44	Manchester	Manchester-Nashua, NH MSA	P	S	N
45	Reno/Tahoe International	Reno, NV MSA	P	S	N
46	Des Moines International	Des Moines-West Des Moines, IA MSA	P	S	N
47	Laredo International	Laredo, TX MSA	P	N	N
48	Raleigh-Durham International	Raleigh, NC MSA	P	M	Y
49	Austin-Bergstrom International	Austin-Round Rock, TX MSA	P	M	N
50	Huntsville International-Carl T Jones Field	Huntsville, AL MSA	P	S	Y
51	Richmond International	Richmond, VA MSA	P	S	N

Table A4 (continued).

Rank	Airport Name	Metropolitan Area	Service Level	Hub	Aerotropolis Model
52	Pittsburgh International	Pittsburgh, PA MSA	P	M	Y
53	Spokane International	Spokane-Spokane Valley, WA MSA	P	S	N
54	Jacksonville International	Jacksonville, FL MSA	P	M	N
55	Tampa International	Tampa-St. Petersburg-Clearwater, FL MSA	P	L	N
56	Columbia Metropolitan	Columbia, SC MSA	P	S	N
57	McCarran International	Las Vegas-Henderson-Paradise, NV MSA	P	L	Y
58	Eppley Airfield	Omaha-Council Bluffs, NE-IA MSA	P	M	N
59	Lambert-St Louis International	St. Louis, MO-IL MSA	P	M	Y
60	Cleveland-Hopkins International	Cleveland-Elyria, OH MSA	P	M	Y
61	Sacramento Mather	Sacramento-Roseville-Arden-Arcade, CA MSA	R	-	N
62	Charlotte/Douglas International	Charlotte-Concord-Gastonia, NC-SC MSA	P	L	Y
63	Joe Foss Field	Sioux Falls, SD MSA	P	S	N
64	Boise Air Terminal/Gowen Field	Boise City, ID MSA	P	S	N
65	Lubbock Preston Smith International	Lubbock, TX MSA	P	S	N
66	Charleston AFB/International	Charleston-North Charleston, SC MSA	P	S	N
67	Syracuse Hancock International	Syracuse, NY MSA	P	S	N
68	Tulsa International	Tulsa, OK MSA	P	S	N
69	Nashville International	Nashville-Davidson-Murfreesboro-Franklin, TN MSA	P	M	N

Table A4 (continued).

Rank	Airport Name	Metropolitan Area	Service Level	Hub	Aerotropolis Model
70	Louis Armstrong New Orleans International	New Orleans-Metairie, LA MSA	P	M	N
71	Buffalo Niagara International	Buffalo-Cheektowaga-Niagara Falls, NY MSA	P	M	N
72	Sacramento International	Sacramento-Roseville-Arden-Arcade, CA MSA	P	M	N
73	McGhee Tyson	Knoxville, TN MSA	P	S	N
74	The Eastern Iowa	Cedar Rapids, IA MSA	P	S	N
75	Harrisburg International	Harrisburg-Carlisle, PA MSA	P	S	N
76	Greater Rochester International	Rochester, NY MSA	P	S	N
77	Snohomish County (Paine Field)	Seattle-Bellevue-Everett, WA Metro Division	R	-	N
78	Kahului	Kahului-Wailuku-Lahaina, HI MSA	P	M	N
79	Valley International	Brownsville-Harlingen, TX MSA	P	N	N
80	Greenville-Spartanburg International	Greenville-Anderson-Mauldin, SC MSA	P	S	N
81	Gerald R Ford International	Grand Rapids-Wyoming, MI MSA	P	S	N
82	Shreveport Regional	Shreveport-Bossier City, LA MSA	P	N	N
83	Will Rogers World	Oklahoma City, OK MSA	P	S	N
84	Wichita Dwight D Eisenhower National	Wichita, KS MSA	P	S	N
85	Fort Wayne International	Fort Wayne, IN MSA	P	N	N
86	Kona International at Keahole	Kailua, HI CDP	P	S	N
87	General Downing - Peoria International	Peoria, IL MSA	P	N	N
88	Springfield-Branson National	Springfield, IL MSA	P	N	N

Table A4 (continued).

Rank	Airport Name	Metropolitan Area	Service Level	Hub	Aerotropolis Model
89	Norfolk International	Virginia Beach-Norfolk-Newport News, VA-NC MSA	P	S	N
90	Willow Run	Ann Arbor, MI	R	-	N
91	Grand Forks International	Grand Forks, ND-MN MSA	P	N	N
92	Great Falls International	Great Falls, MT MSA	P	N	N
93	Birmingham-Shuttlesworth International	Birmingham-Hoover, AL MSA	P	S	N
94	Hilo International	Hilo, HI MSA	P	S	N
95	Albany International	Albany	P	S	N
96	Long Beach /Daugherty Field/	Long Beach	P	S	N
97	Southwest Georgia Regional	Albany-Schenectady-Troy, NY MSA	P	N	N
98	Mobile Downtown	Mobile, AL MSA	GA	-	N
99	Tucson International	Tucson, AZ MSA	P	S	N
100	Bill and Hillary Clinton National/Adams Field	Little Rock-North Little Rock-Conway, AR MSA	P	S	N
101	Stewart International	Kingston, NY MSA	P	N	
102	St Pete-Clearwater International	Tampa-St. Petersburg-Clearwater, FL MSA	P	S	N
103	Capital Region International	Lansing-East Lansing, MI MSA	P	N	N
104	Roanoke Regional/Woodrum Field	Roanoke, VA MSA	P	N	N
105	Toledo Express	Toledo, OH MSA	P	N	N
106	Southwest Florida International	Cape Coral-Fort Myers, FL	P	M	N
107	Fairbanks International	Fairbanks, AK MSA	P	S	N
108	Lihue	Lihue, HI CDP	P	S	N
109	Theodore Francis Green State	Providence-Warwick, RI-MA MSA	P	M	N
110	City of Colorado Springs Municipal	Colorado Springs, CO MSA	P	S	N

Table A4 (continued).

Rank	Airport Name	Metropolitan Area	Service Level	Hub	Aerotropolis Model
111	Lafayette Regional/Paul Fournet Field	Lafayette, LA MSA	P	N	N
112	Fresno Yosemite International	Fresno, CA MSA	P	S	N
	The airports listed below were not classified by the FAA as qualified cargo airports in 2014 but were identified as aerotropolis model airports by Kasarda and Appold.				
	Jackson-Medgar Wiley Evers	Jackson, MS MSA	P	S	Y
	Northwest Florida Beaches International	Panama City, FL MSA	P	S	Y
	Phoenix-Mesa Gateway	Phoenix-Mesa-Scottsdale, AZ MSA	P	S	Y

Note: The table of Airports Classified by the FAA as Qualifying Cargo Airports in 2014 is adapted from data provided by "Passenger boarding (enplanement) and all-cargo data for U.S. airports - Previous years." From U.S. Department of Transportation, Federal Aviation Administration, 2015 and "Airport City and Aerotropolis Locations Worldwide." From Airport cities: The evolution, by J. D. Kasarda, 2013, Airport World. Copyright (2013) by Airport World. See Table A2 in Appendix 2 for a statement of permission from the author. Airport Hub Classification is adapted from data provided by "*Airport categories*". From U.S. Department of Transportation, Federal Aviation Administration, 2014a. Airport Addresses provided by Economic Modeling Specialists, Inc.

APPENDIX E – Aerotropolis Model Statistics

Table A5.

Airport Communities by Population, Working age population, and Jobs

	Airport Name	Airport LOCID	Airport Community - 2014		
			Population	Jobs	Working age population
1.	Ted Stevens Anchorage International	ANC	194,162	149,922	136,313
2.	Hartsfield - Jackson Atlanta International	ATL	477,091	204,030	303,241
3.	Charlotte/Douglas International	CLT	290,405	255,337	203,251
4.	Chicago O'Hare International	ORD	731,815	466,445	480,425
5.	Cleveland-Hopkins International	CLE	496,468	231,334	331,000
6.	Rickenbacker International	LCK	180,634	76,022	120,826
7.	Denver International	DEN	86,094	56,998	56,955
8.	Detroit Metropolitan Wayne County	DTW	319,761	116,629	215,215
9.	Washington Dulles International	IAD	494,316	277,852	348,849
10.	Fort Worth Alliance	AFW	254,309	70,950	168,963
11.	Dallas/Fort Worth International	DFW	416,895	365,915	293,684
12.	Baltimore/Washington International Thurgood Marshall	BWI	428,294	241,331	295,039
13.	Piedmont Triad International	GSO	261,417	149,506	175,638
14.	Huntsville International-Carl T Jones Field	HSV	83,559	55,517	59,361
15.	Indianapolis International	IND	301,265	145,459	201,705
16.	Jackson-Medgar Wiley Evers International	JAN	166,340	78,700	111,512
17.	Kansas City International	MCI	95,063	39,223	64,146
18.	McCarran International	LAS	569,867	504,496	389,650
19.	Los Angeles International	LAX	763,133	373,998	538,497
20.	Louisville International-Standiford Field	SDF	475,313	300,154	320,184
21.	Memphis International	MEM	409,768	210,662	274,058
22.	Miami International	MIA	78,895	497,402	653,105
23.	General Mitchell International	MKE	375,840	132,320	248,183
24.	Minneapolis-St Paul International/Wold-Chamberlain	MSP	565,138	383,922	398,882

Table A5 (continued).

	Airport Name	Airport LOCID	Airport Community - 2014		
			Population	Jobs	Working age population
25.	John F Kennedy International	JFK	1,758,949	247,519	1,201,905
26.	Newark Liberty International	EWR	1,203,170	409,364	833,464
27.	Northwest Florida Beaches	ECP	22,347	9,050	14,798
28.	Ontario International	ONT	701,404	335,793	483,653
29.	Orlando International	MCO	331,298	150,880	233,457
30.	Philadelphia International	PHL	641,866	200,392	432,829
31.	Phoenix Sky Harbor International	PHX	604,956	615,497	426,902
32.	Phoenix -Mesa Gateway Airport	IWA	335,380	67,751	214,525
33.	Pittsburgh International	PIT	179,351	103,660	119,149
34.	Raleigh-Durham International	RDU	320,229	198,843	229,156
35.	Lambert-St Louis International	STL	382,422	222,672	252,608

Note: Data provided with permission by Economic Modeling Systems, Inc. (EMSI)

APPENDIX F – Airport Model Statistics

Table A6.

Addresses of Aerotropolis Model Airports

	Aerotropolis Model Airport	IATA Code	Address
1	Ted Stevens Anchorage International	ANC	5000 W International Airport Rd, Anchorage, AK 99502
2	Hartsfield - Jackson Atlanta International	ATL	6000 N Terminal Pkwy, Atlanta, GA 30320
3	Charlotte/Douglas International	CLT	5501 R C Josh Birmingham Pkwy, Charlotte, NC 28208
4	Chicago O'Hare International	ORD	10000 W O'Hare Ave, Chicago, IL 60666
5	Cleveland-Hopkins International	CLE	5300 Riverside Dr, Cleveland, OH 44135
6	Rickenbacker International	LCK	2295 John Cir Dr, Columbus, OH 43217
7	Denver International	DEN	8500 Peña Blvd, Denver, CO 80249
8	Detroit Metropolitan Wayne County	DTW	9000 Middlebelt Rd, Romulus, MI 48174
9	Washington Dulles International	IAD	1 Saarinen Cir, Dulles, VA 20166
10	Fort Worth Alliance	AFW	2221 Alliance Blvd, Fort Worth, TX 76177
11	Dallas/Fort Worth International	DFW	International Pkwy, DFW Airport, TX 75261
12	Baltimore/Washington International Thurgood Marshall	BWI	7062 Friendship Rd Baltimore, MD 21240
13	Piedmont Triad International	GSO	1000 Ted Johnson Pkwy, Greensboro, NC 27409
14	Huntsville International-Carl T Jones Field	HSV	1000 Glenn Hearn Blvd SW, Huntsville, AL 35824
15	Indianapolis International	IND	7800 Col. H. Weir Cook Memorial Dr, Indianapolis, IN 46241
16	Jackson-Medgar Wiley Evers International	JAN	100 International Dr, Jackson, MS 39208
17	Kansas City International	MCI	1299 International Square, Kansas City, MO 64153
18	McCarran International	LAS	5757 Wayne Newton Blvd, Las Vegas, NV 89119
19	Los Angeles International	LAX	1 World Way, Los Angeles, CA 90045

Table A6 (continued).

	Aerotropolis Model Airport	IATA Code	Address
20	Louisville International-Standiford Field	SDF	600 Terminal Dr., Louisville, KY 40209
21	Memphis International	MEM	2491 Winchester Rd., Memphis, TN 38116
22	Miami International	MIA	2100 NW 42nd Ave, Miami, FL 33126
23	General Mitchell International	MKE	5300 S Howell Ave., Milwaukee, WI 53207
24	Minneapolis-St Paul International/Wold-Chamberlain	MSP	4300 Glumack Dr., St Paul, MN 55111
25	John F Kennedy International	JFK	Van Wyck and JFK Expressway, Jamaica, NY 11430
26	Newark Liberty International	EWR	3 Brewster Rd, Newark, NJ 07114
27	Northwest Florida Beaches	ECP	6300 W Bay Pkwy, Panama City, FL 32409
28	Ontario International	ONT	2500 East Terminal Way, Ontario, CA
29	Orlando International	MCO	1 Jeff Fuqua Blvd, Orlando, FL 32827
30	Philadelphia International	PHL	8000 Essington Ave, Philadelphia, PA 19153
31	Phoenix Sky Harbor International	PHX	3400 E Sky Harbor Blvd, Phoenix, AZ 85034
32	Phoenix -Mesa Gateway Airport	IWA	6033 S Sossaman Rd, Mesa, AZ 85212
33	Pittsburgh International	PIT	1000 Airport Blvd, Pittsburgh, PA 15231
34	Raleigh-Durham International	RDU	2400 John Brantley Blvd, Morrisville, NC 27560
35	Lambert-St Louis International	STL	10701 Lambert International Blvd, St. Louis, MO 63145

Note: Airport Addresses provided by Economic Modeling Specialists, Inc.

APPENDIX G – Airport Model Statistics

Table A7.

Aerotropolis Model Airports by Passenger Activity - 2014

Rank	Aerotropolis Model Airport	Passenger Boardings	MSA Population	Passenger Activity
1	McCarran International	20,620,248	2,069,681	9.96
2	Denver International	26,000,591	2,754,258	9.44
3	Charlotte/Douglas International	21,537,725	2,380,314	9.05
4	Hartsfield - Jackson Atlanta Intl.	46,604,273	5,614,323	8.30
5	Orlando International	17,278,608	2,321,418	7.44
6	Miami International	19,471,466	2,662,874	7.31
7	Newark Liberty International	17,773,405	2,508,124	7.09
8	Ted Stevens Anchorage Intl.	2,381,826	398,892	5.97
9	Minneapolis-St Paul International/Wold-Chamberlain	16,972,678	3,495,176	4.86
10	Phoenix Sky Harbor International	20,344,867	4,489,109	4.53
11	Dallas/Fort Worth International	30,804,567	6,954,330	4.43
12	Baltimore/Washington International Thurgood Marshall	11,022,200	2,785,874	3.96
13	Raleigh-Durham International	4,673,869	1,242,974	3.76
14	Detroit Metro. Wayne County	15,775,941	4,296,611	3.67
15	Chicago O'Hare International	33,843,426	9,554,598	3.54
16	Los Angeles International	34,314,197	10,116,705	3.39
17	Philadelphia International	14,792,339	6,051,170	2.44
18	Kansas City International	4,982,722	2,071,133	2.41
19	Lambert-St Louis International	6,108,758	2,806,207	2.18
20	General Mitchell International	3,228,607	1,572,245	2.05
21	Northwest Florida Beaches	394,570	194,929	2.02
22	John F Kennedy International	26,244,928	14,327,098	1.83
23	Indianapolis International	3,605,908	1,971,274	1.83
24	Cleveland-Hopkins International	3,686,315	2,063,598	1.79
25	Washington Dulles International	10,415,948	6,033,737	1.73
26	Pittsburgh International	3,827,860	2,355,968	1.62
27	Memphis International	1,800,268	1,343,230	1.34
28	Louisville Intl.-Standiford Field	1,634,983	1,269,702	1.29
29	Huntsville International-Carl T Jones Field	523,248	441,086	1.19
30	Piedmont Triad International	851,157	746,593	1.14

Table A7 (continued).

Rank	Aerotropolis Model Airport	Passenger Boardings	MSA Population	Passenger Activity
31	Jackson-Medgar Wiley Evers Intl.	537,821	577,564	0.93
32	Ontario International	2,037,346	4,441,890	0.46
33	Phoenix-Mesa Gateway Airport	669,807	4,489,109	0.15
34	Rickenbacker International	49,486	1,994,536	0.02
35	Fort Worth Alliance	0	2,350,233	0.00

Note: Data provided by Economic Modeling Specialists, Inc. and Federal Aviation Administration, All Boarding and Cargo Data, 2014.

APPENDIX H – Airport Model Statistics

Table A8.

Aerotropolis Model Airports by Cargo Activity- 2014

Rank	Aerotropolis Model Airport	Cargo (Metric Tons)	MSA Population	Cargo Activit y
1	Ted Stevens Anchorage International	7,197,571	398,892	18.04
2	Memphis International	10,330,373	1,343,230	7.69
3	Louisville Intl.- Standiford Field	5,247,320	1,269,702	4.13
4	Indianapolis International	2,429,432	1,971,274	1.23
5	Miami International	3,262,592	2,662,874	1.23
6	Newark Liberty International	1,133,655	2,508,124	0.45
7	Huntsville International- Carl T. Jones Field	186,454	441,086	0.42
8	Chicago O'Hare International	3,420,724	9,554,598	0.36
9	Piedmont Triad International	242,968	746,593	0.33
10	Dallas-Fort Worth International	1,424,611	4,604,097	0.31
11	Ontario International	1,070,861	4,441,890	0.24
12	Denver International	596,361	2,754,258	0.22
13	Los Angeles International	1,949,248	10,116,705	0.19
14	Hartsfield - Jackson Atlanta	1,026,430	5,614,323	0.18
15	Rickenbacker International	333,321	1,994,536	0.17
16	Raleigh-Durham International	199,572	1,242,974	0.16
17	Orlando International	342,970	2,321,418	0.15
18	General Mitchell International	231,373	1,572,245	0.15
19	Phoenix Sky Harbor International	651,776	4,489,109	0.15
20	Philadelphia International	874,415	6,051,170	0.14
21	Fort Worth Alliance	302,975	2,350,233	0.13
22	Minneapolis-St Paul	441,193	3,495,176	0.13
23	Kansas City International	225,723	2,071,133	0.11
24	John F Kennedy International	1,438,339	14,327,098	0.10
25	McCarran International	178,146	2,069,681	0.09
26	Cleveland-Hopkins International	167,981	2,063,598	0.08
27	Baltimore/Washington International	221,150	2,785,874	0.08
28	Pittsburgh International	184,091	2,355,968	0.08
29	Detroit Metropolitan Wayne County	306,051	4,296,611	0.07
30	Charlotte/Douglas International	163,328	2,380,314	0.07
31	Lambert-St Louis International	172,911	2,806,207	0.06

Table A8 (continued).

Rank	Aerotropolis Model Airport	Cargo (Metric Tons)	MSA Population	Cargo Activity
32	Jackson-Medgar Wiley Evers	34,540	577,564	0.06
33	Washington Dulles International	217,690	6,033,737	0.04
34	Phoenix-Mesa Gateway Airport	40	4,489,109	0.00
35	Northwest Florida Beaches	0	194,929	0.00

Note: Data provided by Economic Modeling Specialists, Inc. Fort Worth Alliance Airport (cargo only) is also located in the Dallas-Fort Worth MSA. Dallas-Irving MSA Division and Fort Worth-Arlington MSA Division are used for cargo calculations of Dallas-Fort Worth International and Fort Worth Alliance Airports. The Researcher used 2013 cargo activity for Phoenix-Mesa Gateway Airport (IWA). According to Brian O'Neill, General Manager, the larger than normal amount of cargo processed at IWA in 2014 resulted from a one-time shipment of American Boeing Apache AH-64D Helicopters to Russia. IWA processed 425 metric tons in 2014 but returned to 40 tons in 2015. (B.O. O'Neill, personal communication, May 24, 2016).

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All the best

Joe

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> All the best

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Birgit

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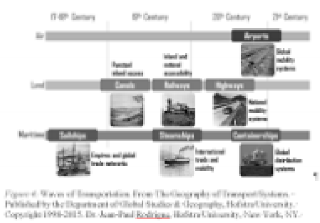

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