

DISSERTATION

A THEORETICAL MODEL OF  
ORGANIZATIONAL AMBIDEXTERITY IN HOSPITALS

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## ABSTRACT

### A THEORETICAL MODEL OF ORGANIZATIONAL AMBIDEXTERITY IN HOSPITALS

This study defined organizational ambidexterity (OA) and offered a theoretical framework for its application in hospitals and human resource development (HRD) theory and practice. Lynham's (2000) general method of theory building research for applied disciplines was used to construct the model. A survey instrument was developed and pretested on a small sample, then mailed nationally to 6,000 directors working in 2,000 randomly selected hospitals. Forty-nine of 50 states participated in the survey. Wyoming was the only state from which responses were not received. Data were collected from 1,490 hospital directors and 893 hospitals and analyzed using principal components factor analysis, confirmatory factor analysis, analysis of variance, and multilevel modeling (MLM). Findings showed exploration and exploitation are two latent factors of one second-order construct; OA specifically. Findings revealed high levels of OA in hospitals generally and higher levels of OA in large hospitals than small ones. Investor-owned and not-for-profit hospitals reported similar levels of OA. Statistical evidence supported the notion OA is positively related to perceived quality and financial performance in hospitals. In the era of healthcare reform, theories and methods with potential for improving perceived quality and financial performance are relevant to meeting customer demand and sustaining hospital operations and strategy.

*Keywords: organizational ambidexterity; ambidextrous firms; exploration, exploitation, hospitals, theory, theory development; human resource development theory, human resource development practice, Lynham's (2002) general method of theory building research; multilevel modeling*

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## TABLE OF CONTENTS

ABSTRACT.....	ii
ACKNOWLEDGEMENTS.....	iv
LIST OF TABLES AND FIGURES.....	xvii
CHAPTER 1: INTRODUCTION.....	1
OA – Grounding in the Literature.....	3
The Problem.....	5
Problem Statement.....	5
Purpose of the Study.....	6
Purpose Statement.....	6
Lynham’s (2002) General Method of Theory Building Research.....	6
Research Questions.....	7
Delimitations.....	8
Limitations.....	9
Significance of the Study.....	10
Researcher’s Perspective.....	11
CHAPTER 2: LITERATURE REVIEW.....	13
Introduction.....	13
History of OA.....	13
Theoretical Frameworks That Inform OA.....	16

Organizational Learning .....	16
The Learner .....	16
The Learning Process .....	18
The Learning Product .....	18
Mental Models .....	19
Strategic Management .....	19
Competitive Advantage .....	20
Marketing .....	21
HRD .....	23
Paradox and Dialectic .....	23
OA Theory .....	26
Need for Unification .....	26
Decreasing the Dysfunction .....	27
Review of OA Case Study Research .....	30
New United Motors Manufacturing, Inc. ....	30
Scandinavian PC Systems .....	31
Information Systems at Mercy Health Partners .....	33
Product Design Companies .....	34
Multi-Unit Research Firms in Europe .....	36
Alternative Work Arrangements in the Professional and Management Services Industry .....	39
Review of OA Empirical Studies .....	40
Two Foundational Empirical Studies .....	40
The Jansen et al. Studies .....	42



The Balanced/Combined View of OA .....	44
OA and Performance in Small Manufacturing Firms .....	46
Exploration in Three Dimensions .....	48
Exploration with Exploitation Added .....	50
Market Orientation and OA .....	51
OA and Customer Capital .....	52
OA and Behavioral Integration of Top Leaders .....	53
OA and Interorganizational Relationships .....	54
OA and Alliance Formation .....	56
Current State of OA Knowledge Supported by Empirical Evidence .....	57
CHAPTER 3: METHOD .....	61
Critical Realist Paradigm .....	61
Ontology .....	61
Epistemology .....	62
Axiology .....	62
Methodology .....	63
Teleology .....	63
Theory-Building Research Design and Rationale .....	63
Conceptual Development: Answers to Research Questions 1 – 4 .....	64
Key Elements of Proposed OA Theory .....	64
How the Key Elements of Proposed OA Theory Inter-relate .....	66
What Explains the Interdependence of the Elements? .....	67
General Limitations or Conditions for the Proposed OA Theory .....	68

Operationalization: Answer to Research Question 1 .....	70
Instrument Development.....	70
Interviews.....	70
Survey Items .....	71
Survey Length.....	72
Validity .....	73
Content Validity.....	73
Response Process Validity .....	73
Internal Structure Validity .....	73
Factor Analysis .....	73
Products of Exploratory Factor Analysis (EFA).....	74
Principal Components Analysis (PCA) .....	75
Factor Rotation.....	76
Eigenvalues .....	77
Communality Coefficients .....	78
Confirmatory Factor Analysis (CFA) .....	78
CFA Model Fit Statistics .....	79
External Validity.....	80
External Ecological Validity.....	80
External Population Validity.....	80
Reliability.....	81
Relationship between Theoretical Constructs: Basic Regression.....	82
Background.....	83

Slopes and Intercepts .....	84
Pilot-Testing.....	85
Demographic Data .....	86
Sample Setting and Characteristics.....	87
Response Rate .....	88
Software Package.....	88
Descriptive Statistics.....	89
Factor Analytic Method and Rotation.....	89
Correlation Tables.....	90
Internal Consistency Reliabilities – Cronbach’s Alpha .....	92
Basic Regression.....	92
Pilot Study: Results, Analysis and Discussion .....	93
The Main Study.....	94
Survey Questionnaire Revisions .....	94
Statistical Design .....	95
Nested Data.....	95
Importance of MLM to Study of OA .....	97
Two Levels of Analysis: Implications for Sample Selection.....	97
Sample Setting and Sample Selection.....	98
Randomization Method Used to Obtain Level-Two Sampling Units.....	99
Data Collection .....	99
Mail Surveys .....	99
Summary .....	100

CHAPTER 4: RESULTS .....	102
Demographic Data of Respondents .....	102
Overall Response Rate .....	102
Descriptive Statistics.....	103
Comments Received .....	103
Estimation Method.....	104
Exploratory Statistics – Normality and Shape .....	104
Frequency Histograms, Box Plots, Normal Probability Plots.....	105
Factor Analysis .....	107
Principal Components Analysis (PCA) .....	108
PCA – Oblique Variance Rotation.....	108
Correlations.....	108
Confirmatory Factor Analysis (CFA) .....	109
Q-Type Factor Analysis and Correlations .....	109
Intraclass Correlations .....	115
Covariance Parameter Estimates – Differences by Hospital Ownership.....	116
Covariance Parameter Estimates – Differences by Number of Hospital Beds .....	118
Cronbach’s Alpha .....	118
Analysis of Variance.....	119
MLM.....	119
Empirical Data Analysis .....	121
Research Hypothesis 1 .....	121

Two-Factor PCA Solution .....	121
Three-Factor PCA Solution .....	121
Four-Factor PCA Solution .....	122
Five-Factor PCA Solution.....	122
Review of PCA Solutions .....	122
PCA Correlations .....	123
CFA Models.....	123
Statistical Significance.....	124
Practical Relevance.....	124
Research Hypothesis 2.....	125
Statistical Significance.....	125
Practical Relevance.....	127
Research Hypothesis 3.....	127
Statistical Significance.....	127
Practical Relevance.....	129
Research Hypothesis 4.....	130
Statistical Significance.....	130
Practical Relevance.....	131
Research Hypothesis 5.....	131
Statistical Significance.....	131
Practical Relevance.....	132
Surprises.....	132
Finance.....	132

ICC's Related to Finance .....	133
Finance Variables: Correlations at the Individual Level .....	134
HR Directors' Responses Compared to Other Job Title Responses .....	134
CHAPTER 5: DISCUSSION.....	136
Theory-Building Research Questions .....	136
Evaluation Criteria .....	136
Swanson's (2007) Evaluation Criteria .....	139
Boundary of OA Theory .....	139
Assumption #1 .....	140
OA: The First Step of a Theoretical Model .....	140
Assumption #2 .....	140
OA: Like Water.....	140
Assumption #3 .....	141
Boundaries of OA: One Type, No Typologies .....	141
Assumption #4 .....	141
OA Levels of Analysis and Conditions of Operation .....	141
Assumption #5 .....	143
OA Produces Wellsprings of Knowledge and Expands Mental Models.....	143
Assumption #6 .....	144
OA is a Virtuous Cycle .....	144
Where Does OA Fall Within Swanson's (2007) Framework? .....	144
Whetten's (1989) Criteria for Evaluating OA Theory .....	147
Comparison of Research Findings with Previous Findings .....	148

OA: Implications for HRD Research, Theory, and Practice.....	150
Limitations of the Study.....	152
Summary and Conclusion.....	153
REFERENCES .....	154
APPENDIX A: Permissions .....	172
APPENDIX B: Jansen’s Summary of Reliabilities and Validities.....	178
APPENDIX C: Interview Protocol.....	182
APPENDIX D: IRB Approval 087-09H.....	185
APPENDIX E: Atuahene-Gima OA Instrument (2005) .....	187
APPENDIX F: Bierly & Daly OA Instrument (2007) .....	188
APPENDIX G: Cao et al. OA Instrument (2009) .....	189
APPENDIX H: Gibson & Birkinshaw OA Instrument (2004) .....	190
APPENDIX I: He & Wong OA Instrument (2004) .....	191
APPENDIX J: Jansen et al. OA Instrument (2008, 2009) .....	192
APPENDIX K: Lubatkin et al. OA Instrument (2006) .....	193
APPENDIX L: Hospital Survey .....	194
APPENDIX M: Hospital Survey Coded for Research Analyses.....	195
APPENDIX N: IRB 008-10H.....	196
APPENDIX O: IRB 016-10H.....	198
APPENDIX P: Factor Solutions for Pilot Data .....	200
APPENDIX Q: Revised Survey Instrument Post Pilot Study .....	206
APPENDIX R: Example of Randomized Hospital List .....	207
APPENDIX S: AHA Random Sample Document.....	208

APPENDIX T: Survey Mailer: Memo to Executive Assistant.....	209
APPENDIX U: Survey Cover Letter .....	210
APPENDIX V: Survey Mailer: Content of Self-Addressed Stamped Envelope .....	211
APPENDIX W: Response Distributions.....	213
APPENDIX X: Comments Received.....	220
APPENDIX Y: Exploratory Statistics for Variable ‘Explore’: Frequency Histogram, Box Plot, and Normal Probability Plot.....	227
APPENDIX Z: Exploratory Statistics for Variable ‘Exploitation’: Frequency Histogram, Box Plot, and Normal Probability Plot .....	228
APPENDIX A1: Exploratory Statistics for Variable ‘OA’: Frequency Histogram, Box Plot, and Normal Probability Plot .....	229
APPENDIX A2: Exploratory Statistics for Variable ‘Quality’: Frequency Histogram, Box Plot, and Normal Probability Plot .....	230
APPENDIX A3: Exploratory Statistics for Variable ‘Finance No Tools’: Frequency Histogram, Box Plot, and Normal Probability Plot .....	231
APPENDIX A4: Exploratory Statistics for Variable ‘Financial Tools’: Frequency Histogram, Box Plot, and Normal Probability Plot .....	232
APPENDIX A5: Exploratory Statistics for Variable ‘Finance’: Frequency Histogram, Box Plot, and Normal Probability Plot .....	233
APPENDIX A6: new tables (3) from Chapter 4.....	234
APPENDIX A7: former tables 3.5 – 3.11.....	236
APPENDIX A8: Plot of Residuals, Y = Quality, X = OA .....	246
APPENDIX A9: Frequency Histogram, Box Plot, Probability Plot, Y = Quality, X = OA.....	247
APPENDIX A10: Plot of Residuals, Y = Finance, X = OA.....	248
APPENDIX A11: Frequency Histogram, Box Plot, Probability Plot, Y = Finance, X = OA.....	249



## LIST OF TABLES AND FIGURES

Table 1.1 Classifications of Exploration and Exploitation (EE).....	1
Table 1.2 Selected OA Definitions .....	2
Table 1.3 Matrix of OA Descriptions .....	3
Figure 1.1 Lynham’s General Method of Theory Building Research in Applied Disciplines.....	6
Table 1.4 OA Theory Building Research Questions, Theory Building OA Research Question, and Empirical OA Research Hypotheses .....	8
Figure 2.1 Literature Review Schematic (History, Conceptual Papers, and Case Study Research .....	14
Figure 2.2 Literature Review Schematic (Statistical Empirical Studies) .....	15
Table 2.1 OA Studies Sorted by Country .....	15
Table 2.2 OA Studies Sorted by Firm Type .....	16
Table 2.3 Characteristics of the Business Environment .....	20
Figure 2.3 Typology of Organizational Ambidexterity .....	29
Table 2.4 OA Archetypes .....	29
Table 2.5 Scope of the Ambidextrous Organization.....	30
Table 2.6 Four Core Processes of Intra and Interorganizational Learning.....	33
Table 2.7 Ambidexterity Competency .....	34
Figure 2.4 Data Structure: Paradoxes of Innovation.....	36
Table 2.8 Summary of Enabling Practices for ‘Contextual’ Ambidexterity .....	39
Table 2.9 Interview Questions Asked to Explore AWA.....	39

Table 2.10 He and Wong’s Hypotheses: Supported by the Evidence .....	41
Figure 2.5 He and Wong’s (2004) Model of OA.....	41
Table 2.11 Gibson and Birkinshaw’s Hypotheses: Supported by the Evidence.....	42
Figure 2.6 Gibson and Birkinshaw’s (2004) Model of OA .....	42
Table 2.12 Summary of Findings from all Jansen et al. Studies.....	43
Figure 2.7 Jansen et al.’s (2009) Model of OA.....	44
Table 2.13 Cao et al.’s (2009) Summary of Reliability and Validity Evidence .....	45
Table 2.14 Summary of Findings – Cao et al. (2009).....	46
Table 2.15 Bierly and Daly’s (2007) Statistical Support for Hypotheses.....	47
Figure 2.8 Exploration – Performance and Exploitation – Performance Relationships ....	47
Table 2.16 Sidhu et al.’s (2004) Statistical Support for Hypotheses .....	49
Table 2.17 Sidhu et al.’s (2007) Statistical Support for Hypotheses .....	51
Table 2.18 Atuahene-Gima’s (2005) Statistical Support for Selected Hypotheses .....	52
Table 2.19 Cegarra-Navarro and Dewhurst’s (2007) Statistical Support for Hypotheses .....	53
Table 2.20 Lubatkin et al.’s (2006) Statistical Support for Research Hypotheses .....	54
Table 2.21 Definitions for Im and Rai’s (2008) Constructs .....	55
Figure 2.9 Knowledge Sharing Ambidexterity in Long-Term Interorganizational Relationships.....	55
Table 2.22 Findings from Im and Rai’s (2008) Study .....	56
Table 2.23 Description of EE According to Lavie and Rosenkopf’s (2006) Three Domains .....	57
Figure 3.1 Theoretical Model Organizational Ambidexterity .....	69
Table 3.1 Guidelines for Identifying Significant Factors .....	76
Table 3.2 Hospital OA Survey Instrument: Summary of Validity and Reliability.....	82

Figure 3.2 Gender Frequency Distribution in Pilot Study .....	86
Figure 3.3 Age Frequency Distribution in Pilot Study .....	87
Figure 3.4 Frequency Histogram According to Job Title .....	87
Table 3.3 Pilot Study Sample Sizes and Response Rates .....	88
Table 3.4 Pilot Study Descriptive Statistics.....	89
Table 3.5 Pilot Study Correlation Matrix (Structure Coefficients).....	91
Table 3.6 Pilot Study Cronbach's Alpha .....	92
Table 3.7 Model Summary with Fit Statistics .....	93
Table 3.8 Revised Survey items.....	95
Table 4.1 Descriptive Statistics.....	103
Table 4.2 Exploratory Statistics .....	106
Table 4.3 Exploratory Statistics .....	107
Table 4.4. Descriptive Statistics: Responses to Constructs by Strategy and Quality Directors.....	110
Table 4.5 Q-type Correlation Matrix: Similarity of Responses between Strategy and Quality Directors .....	111
Table 4.6 Descriptive Statistics: Responses to Constructs by HR and Quality Directors.....	112
Table 4.7 Response Correlation Matrix: HR and Quality Directors.....	113
Table 4.8 Descriptive Statistics: Responses to Constructs by HR and Strategy Directors.....	114
Table 4.9 Response Correlation Matrix: Strategy and Human Resources Directors.....	115
Table 4.10 Intraclass Coefficients (ICC) .....	116
Table 4.11 NFP = Not-for-Profit, FP = For-Profit, NS = Not Significant.....	117
Table 4.12 Intraclass Coefficient (ICC) Variance Related to General Ownership Status.....	117

Table 4.13 OA Means by Hospital Bed Size .....	118
Table 4.14 Comparisons of OA Means and Significance Levels According to Bed Size .....	118
Table 4.15 Cronbach's Alphas for Each Survey Item .....	118
Table 4.16 ANOVA, Y = Quality, X = OA .....	119
Table 4.17 ANOVA, Y = Finance, X = OA .....	119
Table 4.19 MLM, Y = Quality, X = OA .....	120
Table 4.19 MLM, Y = Finance, X = OA .....	120
Table 4.20 Finance Variables: ICCs .....	133
Table 4.21 Mean Levels Reported by Job Title .....	135
Table 5.1 Seven Criteria for Evaluating a Theory .....	137
Table 5.2 Selected Formal Criteria for Evaluating a Theory .....	138
Table 5.3 Six-Component Theory for Applied Disciplines .....	139
Figure 5.1 Swanson's (2007) Six-Component Theoretical Components of a Core Discipline .....	145
Figure 5.2 Swanson's (2007) Six-Component Theoretical Components of a Core Discipline .....	146
Table 5.4 Seven Criteria for Evaluating a Theory .....	147
Table 5.5 Criteria Selected Formal Criteria for Evaluating a Theory.....	148

## CHAPTER 1: INTRODUCTION

Organizational ambidexterity (OA) is defined in March’s (1991) seminal paper as the ability of companies to simultaneously explore and exploit. Exploration is defined as knowledge for search, novelty, experimentation, innovation, radical change and creation of new products, processes, and services (March, 1991, 1999; O’Reilly & Tushman, 2008). Exploitation is defined as knowledge for continuous improvement, modification, refinement, and incremental change of current products, processes, and services (March, 1991, 1999; O’Reilly & Tushman, 2008). Exploration and exploitation (EE) are components of OA described by different scholars in Table 1.1. Various definitions of OA are shown in Table 1.2. A matrix of OA descriptions is displayed in Table 1.3.

*Table 1.1. Classifications of Exploration and Exploitation (EE)*

<b>Author</b>	<b>What is EE?</b>
Andriopoulos & Lewis, 2009	Knowledge processes
Atuahene-Gima, 2005	Two types of competences
Benner & Tushman, 2002	Two learning routines which pull in opposite directions
Bierly & Daly, 2007	Two types of knowledge strategies
Cao, Gedajlovic, & Zhang, 2009	Knowledge sharing activities
Cegarra-Navarro & Dewhurst, 2007	Two key factors of organizational learning
Guttel & Konlechner, 2009	Two antagonistic learning modes
He & Wong, 2004	Two types of learning logics
Holmqvist, 2004	Two types of learning logics
Litrico & Lee, 2008	Two basic dynamics of organizational learning
March, 1991	Two types of learning activities
Miller, Zhao, & Calantone, 2006	Two organizational tensions
Peretti & Negro, 2006	Two types of knowledge
Prange & Schlegelmilch, 2010	Two innovation archetypes
Taylor & Greve, 2006	Practices for combining knowledge
Uotila, Maula, Keil, & Zahra, 2009	Two orientations of firms' activities
Vera & Crossan, 2004	Tensions of novelty and continuity

*Table 1.2. Selected OA Definitions*

<b>Author</b>	<b>OA Definition</b>
Atuahene-Gima, 2005	"The interactive effect of competence exploitation and exploration determines the nature of their balance, which ensures the firm's simultaneous pursuit of incremental and radical innovations" (p. 62).
Cegarra-Navarro & Dewhurst, 2007	"Ambidexterity is an organization's context to achieve alignment and adaptability simultaneously within the organization learning processes" (p. 1720).
Gupta, Smith, & Shalley, 2006	"Ambidexterity refers to the synchronous pursuit of both exploration and exploitation via loosely coupled and differentiated subunits or individuals, each of which specializes in either exploration or exploitation" (p. 693).
He & Wong, 2004	"OA is the need for firms to achieve a balance between exploration and exploitation innovation strategies" (p. 481).
Holmqvist, 2004	"Ambidexterity may be one strategy through which certain organizations can manage exploitation and exploration. However, this strategy does not address the fundamental problem for all organizations of balancing exploitation and exploration; rather it proposes how these forces coexist... 'coexistence' does not mean that the two process of exploitation and exploration have similar importance, while 'balancing' does" (p. 277).
Im & Rai, 2008	"Simultaneously pursuing innovation and short-term operational objectives in interorganizational relationships (IORs)" (p. 1281).
Jansen et al., 2009	"OA is a dynamic capability referring to the routines and processes by which ambidextrous organizations mobilize, coordinate, and integrate dispersed contradictory efforts, and allocate, reallocate, combine, and recombine resources and assets across differentiated exploratory and exploitative units" (p. 797).
Lubatkin, Simsek, Ling, & Veiga, 2006	"Ambidextrous firms are capable of exploiting existing competencies as well as exploring new opportunities with equal dexterity" (p. 647).
Raisch & Birkinshaw, 2008	"OA is defined as an organization's ability to be aligned and efficient in its management of today's business demands while simultaneously being adaptive to changes in the environment" (p. 375).
Simsek, Heavey, Veiga, & Souder, 2009	"Ambidexterity refers to an organization's ability to perform differing and often competing, strategic acts at the same time" (p. 865).
Taylor & Helfat, 2009	"OA is how firms can compete in both existing and new businesses, and simultaneously explore new businesses while exploiting existent ones"(p. 718).

*Table 1.3. Matrix of OA Descriptions*

Author(s)	Framework Strategic Management = SM Organizational Learning = OL	Components of OA Exploration Exploitation = EE	Component Sequence & Type	Component Relationship	Level of Analysis
Atuahene-Gima (2005)	SM & Marketing Theory	EE	Simultaneous Orthogonal	Multiplicative E*E	Firm
Bierly & Daly (2007)	SM	EE	Simultaneous Orthogonal	Multiplicative E*E	Firm
Cao, Gedajlovic & Zhang (2009)	SM	E-E = Balanced Dimension E*E Combined Dimension	Simultaneous Bipolar Simultaneous Orthogonal	Subtractive E-E Multiplicative E*E	Firm
Cegarra-Navarro & Dewhurst (2007)	OL	EE	Simultaneous Orthogonal	Not stated	Firm
Gibson & Birkinshaw (2004)	Organizational Behavior	AA (similar to EE)	Simultaneous Orthogonal	Multiplicative E*E	Business Unit
He & Wong (2004)	OL	EE	Simultaneous Orthogonal	Multiplicative E*E & Subtractive E-E	Firm
Im & Rai (2008)	OL	EE	Simultaneous Orthogonal	Additive E+E	Inter-Firm Relationships
Jansen, et al. (2005)	SM & OL	EE	Simultaneous Orthogonal	Multiplicative E*E	Business Unit
Jansen, et al. (2006)	SM & OL	EE	Simultaneous Orthogonal	Multiplicative E*E	Business Unit
Jansen, et al. (2008)	SM & OL	EE	Simultaneous Orthogonal	Multiplicative E*E & Additive E+E	Firm
Jansen, et al. (2009)	SM	EE	Simultaneous Orthogonal	Additive E+E	Firm

## OA - Grounding in the Literature

EE have been discussed within an organizational learning (OL) framework (Auh & Menguc, 2005; Brown & Duguid, 1991; Cegarra-Navarro & Dewhurst, 2007; Crossan, Lane, & White, 1999; Huber, 1991; Katila & Ahuja, 2002; March, 1991). OL is “the

capability for organizations to create, disseminate, and act upon generated knowledge” (Auh & Menguc, 2005, p. 1652). March (1991) was first to declare EE the learning activities needed to produce OA. March held that EE are bipolar ends of the same continuum, which must be balanced along that continuum for firms to successfully adapt to environmental changes. March’s seminal views of OA are sometimes called the “received framework” of OA (Sidhu et al., 2007).

EE have also been grounded in the strategic management (SM) literatures where they are referred to as dynamic capabilities or innovation processes (Jansen, Tempelaar, Van den Bosch, & Volberda, 2009; Jansen, Van den Bosch, & Volberda, 2005, 2008; Judge & Blocker, 2008; O’Reilly & Tushman, 2008). Dynamic capabilities are operational and strategic processes and routines internal to firms that “use resources - - specifically the processes to integrate, reconfigure, gain and release resources - - to match and even create market change” (Eisenhardt & Martin, 2000, p. 1107). Dynamic capabilities “enhance congruence between the firm’s strategy and the changing business environment by helping firms create innovative strategic value” (Judge & Blocker, 2008, p. 915).

These theoretical groundings have produced consensus that OA provides firms with competitive advantage. Competitive advantage enhances the bottom line and contributes to firm survival (Andriopoulos & Lewis, 2009; Markman, Gianiodis, & Phan, 2009; Smith & Tushman, 2005). Most conceptual papers and research studies in this field have tried to understand how and why OA provides competitive advantage.



## The Problem

**Problem Statement:** *The problem is there is presently no widely accepted definition or theoretical model of OA. As a result, what OA is and how it works is not fully understood.*

Human Resource Development (HRD) research is problem-focused (Chermack, 2008; Chermack & Swanson, 2008). Since March's seminal 1991 paper, OA has been well-studied. However, no two studies contain identical definitions of OA. This makes it difficult to glean cumulative knowledge from extant studies (Gibson & Birkinshaw 2004; Gupta, Smith, & Shalley, 2006; He & Wong, 2004). Table 1.2 provides a selection of OA definitions.

Some studies present a model of OA but don't define or operationalize the term OA (Miller, Zhao, & Calantone, 2006). Others discuss EE but do not mention OA (Anand, Mesquita, & Vassolo, 2009; Auh & Menguc, 2005; Lavie & Rosenkopf, 2006; Litrico & Lee, 2008; Perretti & Negro, 2006; Quintana-Garcia & Benavides-Velasco, 2008). There is disagreement whether OA is done simultaneously, structurally, or sequentially (Holmqvist, 2004; March, 1991; Tushman & O'Reilly, 1996). Studies differ in their unit of analysis - - individual, team, business unit, or firm. Researchers dispute whether OA is a bipolar or orthogonal concept. A bipolar construct places EE on opposite ends of a single continuum. An orthogonal concept views EE as two different features entirely. Table 1.3 provides a matrix of OA descriptions.

A variety of theories in a field of study is beneficial because good theory advances a discipline and encourages further theory development (Easterby-Smith & Araujo, 1999). The field of OA possesses a variety of research but OA remains a topic that is conceptually underdeveloped and unfocused. This is a problem, as Swanson

(2009) emphasizes “Having rival theories in a discipline is not disturbing. Not having well-developed theory is disturbing, however” (p. 95).

### Purpose of the Study

**Purpose Statement:** *The purpose of this study is to define, develop, and test a theoretical model of OA.*

### Lynham’s (2002) General Method of Theory Building Research

The author used Lynham’s (2002) *General Method of Theory Building Research* shown in Figure 1.1.

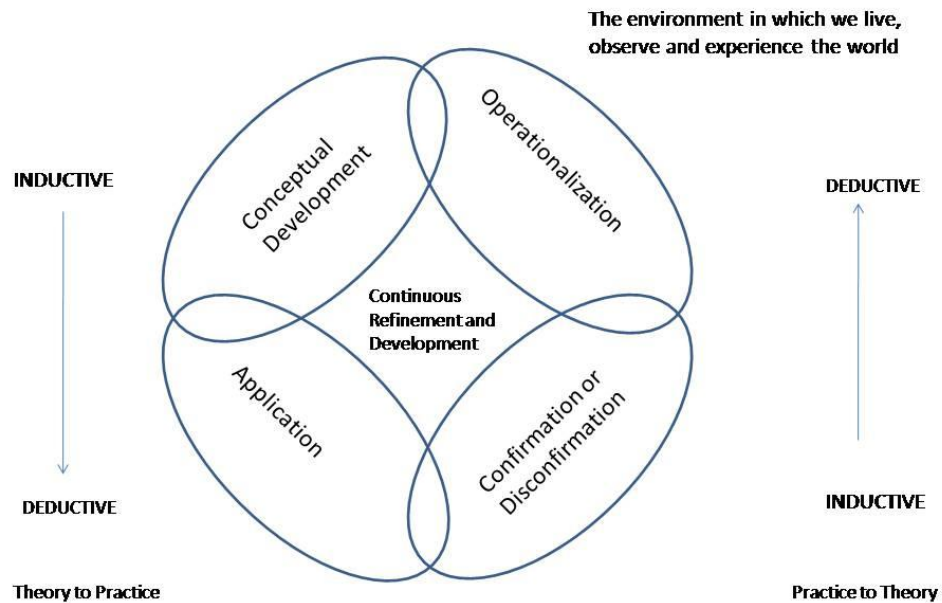


Figure 1.1. General Method of Theory Building Research in Applied Disciplines. Reprinted with permission (Appendix A). Lynham, S. A. (2002). The general method of theory-building research in applied disciplines. *Advances in Developing Human Resources*, 4(3), p. 231.

The *general method* is a framework for building theories “that shape and are shaped by phenomena of interest to human resource development (HRD) professionals” (Storberg-Walker, 2006, p. 229). The *general method* is holistic in nature, iterative in

practice, and “takes the theorist on the full journey – from imagination to application” (Storberg-Walker, 2006, p. 230). Although the *general method* can be entered into at any phase, the first two components of the *general method* were used as a “theorizing-to-practice strategy of applied theory-building research” (Lynham, 2002, p. 231). This enabled development of a conceptual framework and operationalization of OA. Storberg-Walker (2006) explains the “*outcome* of a completed operationalization phase is an operationalized theoretical framework; the *process*, as in the first phase, is dependent on the phenomenon and left up to the theorist to specify” (p. 253). Conceptual development and operationalization require imagination and critical thinking (Storberg-Walker, 2006). Inductive reasoning methods were used to develop and categorize constructs and define relationships among their attributes (Carlile & Christensen, 2005).

Next, the confirmation or disconfirmation phase of the *general method* (Lynham, 2002) was applied as a practice-to-theory building strategy (Lynham, 2002) to produce normative theory. Specifically, a valid and reliable OA survey instrument was developed to conduct a survey of executives in the hospital industry. Data from the survey were analyzed and results used to propose implications for HRD theory, research, and practice.

### **Research Questions**

The following research questions and hypotheses were proposed to guide this inquiry. Table 1.4 presents research questions associated with the conceptual development component of the *general method*, highlights the research question that aligns with the operationalization component of the *general method*, and depicts the research hypotheses associated with the confirmation or disconfirmation phase of the

*general method.* These hypotheses were tested by quantitative research design and statistical methods detailed in Chapter Three.

*Table 1.4. OA Theory Building Research Questions, Theory Building OA Research Question, and Empirical OA Research Hypotheses (Lynham, 2002)*

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<b>Conceptual Development</b>	
Research Question 1.	What are the key elements of a theory of OA?
Research Question 2.	How are these elements inter-related?
Research Question 3.	What explains the interdependence of the elements?
Research Question 4.	What are the general limitations or conditions under which the theory of OA is said to operate?
<b>Operationalization</b>	
Research Question 1.	What is the theoretical framework of OA?
<b>Confirmation or Disconfirmation</b>	
Hypothesis 1.	Exploration and exploitation are two independent constructs which are additive and complementary in nature. Higher scores on each result in higher levels of OA in the organization. (RQ 1, RQ 2)
Hypothesis 2.	Investor owned hospitals will have higher OA levels than Not-For-Profit hospitals. (RQ3).
Hypothesis 3.	Larger sized hospitals will have higher levels of OA than small and/or medium sized hospitals. (RQ3, RQ4)
Hypothesis 4.	Hospital quality (measured by self-report of Medicare Quality Indicators) is positively related to hospitals' level of OA. (RQ 2)
Hypothesis 5.	Hospitals with high levels of OA will have higher levels of net income than hospitals with lower scores. (RQ 2, RQ 4)

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### **Delimitations**

Delimitations of a study refer to its boundaries (Roberts, 2004). The time period during which data was collected for this study was June 11, 2010 – September 29, 2010. The research setting was a randomized third of all general acute care hospitals in the United States. The target sample consisted of American Hospital Association (AHA) member hospitals that self-identified as ‘medical-surgical’ hospitals. The study was composed of two levels. The first level sampling unit consisted of top strategic planning, quality, and human resource (HR) executives in the sampled hospitals, a total of 6,000 individuals. The second level sampling unit consisted of 2,000 acute care hospitals

randomly selected from all AHA member hospitals in the United States. Specialty hospitals, such as rehabilitation centers, psychiatric facilities, and long-term care hospitals were excluded.

This study presented a theoretical model of OA. A model “is a metaphor for a process: a way to describe something, such as the composing process, which refuses to sit still for a portrait” (Flower & Hayes, 1981). The model described OA as a unitary element consisting of exploration and exploitation bonded together as a single unit represented by the yin/yang symbol. OA enabled wellsprings of knowledge flows (Leonard, 1995) across multiple contradictory structures, processes, individual and group competencies and behaviors, social contexts, and organization culture within or between those units and/or organizations. Wellsprings of knowledge flows were shown to nourish mental models and encourage change. Changed mindsets allow products, services, and processes to be refined, leading to earnings growth and firm sustainability. The sequence of processes described in the model produce a virtuous cycle, defined as a “reinforcing loop of success” (Akkermans, Bogerd, & Vos, 1999).

The theoretical model presented was comprehensive but the study focused on the unitary element OA and firm performance (a proxy indicator for earnings growth). The study did not investigate wellsprings of knowledge, mental models, and firm sustainability, proposed as important theoretical elements in an OA framework. These remain propositions without empirical supporting evidence.

### **Limitations**

A limitation of the theory-building component of this study is a theory is “never complete” (Lynham, 2002, p. 233). Developing theory is an iterative process and this

study was the first step in the process. A second limitation of this study was extraneous environmental variables may have affected participants' motivation to complete the survey. A third limitation of the study was that inferential statistical techniques were used to specify and test a model of OA. These statistical techniques allowed the researcher to establish relationships between variables and suggest, but not prove causation.

The study setting and large number of organizations surveyed were strengths of this research. Hospitals are very similar to each other. All must follow the same regulations and standards. However, no two hospitals are completely identical, and healthcare, like politics is essentially local. Therefore, a limitation of this study may be the information obtained cannot necessarily be generalized to other hospitals or different types of healthcare organizations.

### **Significance of the Study**

This research extended the field of OA in three main ways. First was the connection between HRD and OA and the placement of OA within Swanson's (2007) theory framework for applied disciplines. OA theory enriches current HRD knowledge base (Bodwell, 2010). Knowledge base is defined by Lynham (2000) as "the collection and integrated system of intellectual and practical concepts, components, principles, theories, and practices that underlie and form the foundations of a discipline or field of study and practice" (p. 161). The knowledge base of a firm is its intellectual capital (Bierly & Daly, 2007). The theoretical model presented in this study described OA as a dynamic process consisting of constructs useful to HRD.

Second, this was one of the first OA studies to be conducted in hospitals. Hospitals account for a large part of the healthcare sector, which in turn accounts for 17 percent of the gross domestic product (GDP) (Bauer & Hagland, 2008). Garcia and Benavides-Velasco (2008) contend “innovative competence is strongly sector-specific” (p. 496). Manufacturing, high technology firms, and financial services firms have comprised the settings for prior OA research. The setting for this research was the general acute-care hospital. Hospitals are highly reliable organizations (HRO) with different cultures than firms in other sectors (Weick & Sutcliffe, 2001). Conducting research in this setting posed an opportunity to understand knowledge and practice of OA in ways previously unexplained.

Third, multi-level statistical modeling (MLM) methods (discussed in Chapter Three) were used to analyze survey data at two levels. MLM methods have been infrequently used to study OA within the hospital setting. Basic regression methods depict relationships among variables at one level. MLM extends basic regression because it depicts relationships among variables at two levels. This results in a more nuanced understanding of organizational phenomena within their specific context (Bamberger, 2008; Carlile & Christensen, 2005; Diez Roux, 2002).

### **Researcher’s Perspective**

I have been a healthcare executive for many years and loved every minute of it. My career has given me ‘a front row seat in the theater of life.’ I have worked with caring and intelligent people. Long ago, an administrator told me ‘we always wear two hats – the hat of the job we are in today along with the hat of the job we will be in

tomorrow.’ I found this notion compelling. I put this into practice by focusing on daily operations while simultaneously stretching toward an unknown but better future.

When I discovered OA during my doctoral studies, I realized the literature was describing the ‘two-hat’ phenomenon I had heard of much earlier. I recognized OA was a ‘young’ concept, lacking a cumulative and substantial knowledge base. I knew right away I loved the topic and could extend current thinking and research on the subject.

OA has infrequently been discussed in the HRD literature. I believe this must change. Chermack and Swanson (2008, p. 129) contend “helping organizations prepare for the future has historically been a concern of the HRD profession.” HRD professionals are uniquely able to advocate for ambidextrous work processes that help organizations attain their goals (Gilley & Maycunich, 2000a, 2000b; Swanson, 2009). Finally, HRD practices that promote team learning, creativity and innovation can build ambidextrous skills that impact the bottom line (Bierly & Daly, 2007; Birkinshaw & Gibson, 2004; Gilley, Callahan, & Bierema, 2003; Gilley, Dean, & Bierema, 2001; Ostroff & Bowen, 2000).



## **CHAPTER 2: LITERATURE REVIEW**

### **Introduction**

In this chapter I have described research streams relevant to organizational ambidexterity (OA). Applicable research studies came from a search of the 'ISI Web of Science Data Base' and 'GoogleScholar' using keywords *ambidextrous firms*, *ambidextrous organizations*, *organizational ambidexterity*, and *firm ambidexterity* (Chermack & Passmore, 2005; Torraco, 2005). Reference lists of selected articles were also reviewed. Pertinent research bases included organizational learning (OL), strategic management (SM), marketing, HRD, paradox, and dialectic. These knowledge areas, along with OA case studies and empirical research selected for their foundational contributions to the literature were discussed and analyzed. A summary of the chapter presents the overall 'state of OA knowledge.'

### **History of OA**

The term OA was first used by Duncan (1976). It was not until 1991 when March (1991) published his seminal paper on OA that the concept became popular. Other OA conceptual papers based on OL and SM extended March's original framework (Benner & Tushman, 2003; Gupta, Smith, & Shalley, 2006; O'Reilly & Tushman, 2004; Raisch & Birkinshaw, 2008; Simsek, 2009; Smith & Tushman, 2005; Tushman & O'Reilly, 1996). Case study research (Adler, Goldoftas, & Levine, 1999; Andriopoulous & Lewis, 2009; Holmqvist, 2004; Litrico & Lee, 2008) and quantitative regression-based studies followed. Figure 2.1 displays a schematic of OA history, conceptual papers, and case

study research. Figure 2.2 presents a literature review schematic of OA empirical studies.

Table 2.1 depicts selected empirical studies of OA sorted by country, and Table 2.2

shows empirical studies of OA sorted by firm type.

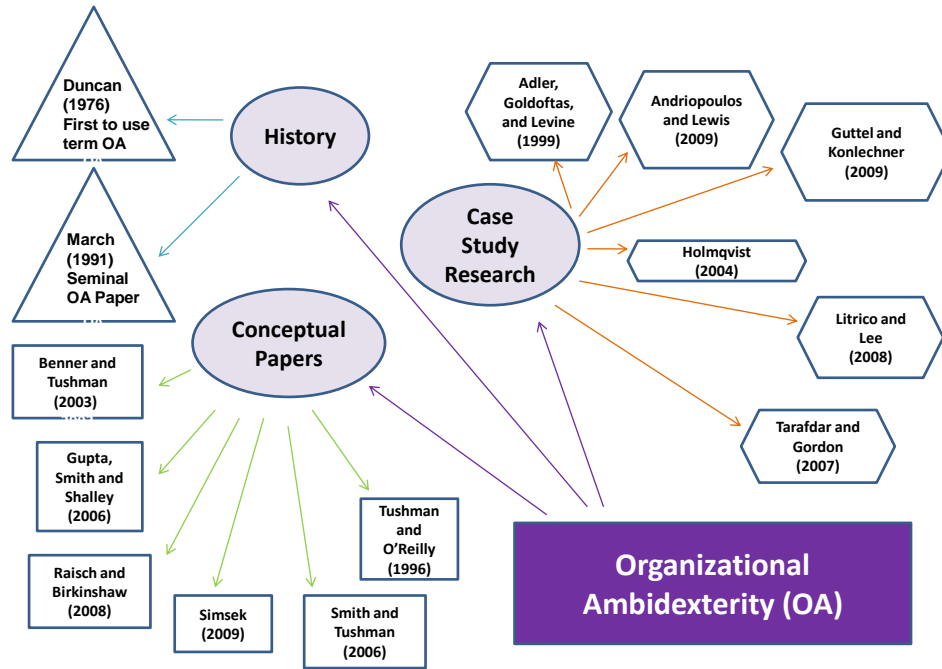


Figure 2.1. Literature Review Schematic (History, Conceptual Papers, and Case Study Research).

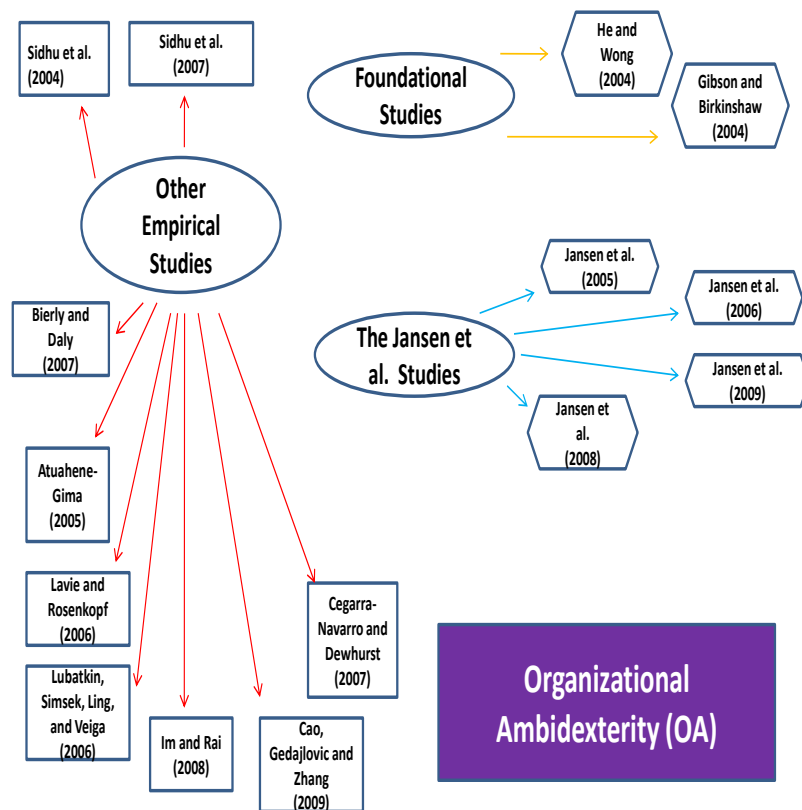


Figure 2.2. Literature Review Schematic (Statistical Empirical Studies).

Table 2.1. OA Studies Sorted by Country

Author	Country
Atuahene-Gima, 2005	China
Cao et al., 2009	China
Li, Lin, & Chu, 2008	Taiwan
Jansen et al., 2006	Netherlands
Jansen et al., 2008	Netherlands
Jansen et al., 2009	Netherlands
Sidhu et al., 2007	Netherlands
Bierly & Daly, 2007	United States, Mid-Atlantic region
Im & Rai, 2008	United States
Lavie & Rosenkopf, 2006	United States
Lubatkin et al., 2006	United States, New England region
He & Wong, 2004	Singapore & Malaysia
Gibson & Birkinshaw, 2004	Japan, Canada, India, France, South Korea, United States
Katila & Ahuja, 2002	Europe, Japan, North America
Morgan & Berthon, 2008	United Kingdom

*Table 2.2. OA Studies Sorted by Firm Type (chronological order)*

<b>Author</b>	<b>Firm Type</b>
Bierly & Daly, 2007	Manufacturing
Gibson & Birkinshaw, 2004	Manufacturing
He & Wong, 2004	Manufacturing
Jansen et al., 2009	Manufacturing
Lubatkin et al., 2006	Manufacturing
Sidhu et al., 2007	Manufacturing
Atuahene-Gima, 2005	High-tech (electronics)
Cao et al., 2009	High-tech
Katila & Ahuja, 2002	High-tech (industrial robotics)
Lavie & Rosenkopf, 2006	High-tech (software)
Li, Lin, & Chu, 2008	High-tech
Morgan & Berthon, 2008	High-tech (bioscience)
Jansen et al., 2006	Financial services
Jansen et al., 2008	Financial services
Cegarra-Navarra & Dewhurst, 2007	Telecommunications Optometry
Im & Rai, 2008	Logistics

## **Theoretical Frameworks That Inform OA**

### **Organizational Learning**

#### **The Learner**

Table 1.1 demonstrates exploration and exploitation (EE) (the components of OA) are grounded in organizational learning (OL) theories. Although there is no universal theory of OL (Easterby-Smith, 1997; Fiol & Lyles, 1985), the general OL schema includes a learner, a learning process, and a learning product (Argyris & Shon, 1996). Researchers have discussed this schema by focusing on one or all of the three elements. Some scholars believe the individual is the learner (Holmqvist, 2009; Shrivastava, 1983). Others believe the organization is the learner (Cohen & Levinthal, 1989; Dixon, 1992). Researchers comment it is difficult to discern whether it is the individual learner who learns in an organization or whether it is the organization itself (Gioia & Sims, 1986). Many believe OL is “likely to remain an ‘umbrella’ concept for many related concepts” (Argote, 1999, p. 13).

Concepts relevant to the individual as learner include cognition (processes of knowing), and the information processing model, where individuals “acquire, form, store, manipulate, and discard information” (Akgun et al., 2003, p. 841; Huber, 1991). Other concepts point to the organization as learner. One is the notion of ‘absorptive capacity,’ which refers to the organization’s learning ability. Organizations with high absorptive capacity are able imitate or adapt the innovations of others to their own needs, and are also able to create and exploit new knowledge (Cohen & Levinthal, 1989).

A high level of absorptive capacity translates to high levels of EE and subsequent OA. But organizations vary in the levels of absorptive capacities and/or learning abilities they possess (Argote, 1999; Katila & Ahuja, 2002). This variance is the difference between ‘discovering’ organizations and ‘enacting’ organizations (Brown & Duguid, 1991). Discovering organizations possess a reactive stance and adapt efficiently and logically to environmental changes. Conversely, enacting organizations proactively create the changes in the environment they would like to see, and then respond to them. In this conceptual framework, discovering organizations possess high exploitative competence whereas enacting organizations are highly explorative.

Marquardt (1999) describes the difference between individual and organizational learning as follows:

OL occurs through the shared insights, knowledge, and mental models of members of the organization. Second, it builds on past knowledge and experience – that is, on organizational memory, which depends on institutional mechanisms (e.g., policies, strategies, and explicit models) used to retain knowledge. Third, OL represents the enhanced intellectual and productive capability gained through corporate-wide commitment to continuous improvement (pp. 21-22).

### **The Learning Process**

Some researchers choose the learning process itself as a focus of OL. OL is defined by Pisano (1994) “as a problem-solving process triggered by gaps between actual and potential performance” (p. 86). OL is a process that enhances the strategic renewal of an organization (Crossan, Lane, & White, 1999). Additionally, OL is a process occurring when “knowledge about action-outcome relationships and the effect of the environment on these relationships is developed” (Duncan & Weiss 1979, p. 84). The link between organizations and their environments may be achieved through OL, a process “of identifying environmental changes and contexts, and successfully coping with them” (Shrivastava, 1983, p. 11).

### **The Learning Product**

The learning product of OL is change; the creation of something new. The ‘something new’ need not be tangible or observable; it may be related to insights or new understandings (Huber, 1991). Huber’s (1991) classic and oft-cited definition of OL is relevant here. He argues “an entity learns if, through its processing of information, the range of its potential behaviors is changed” (p. 89). The learning product of change implies learning does not only involve learning something new, but unlearning something old that is blocking the way for the new to emerge (Schein, 1999; Szulanski, 2003). For Weick (1991), the outstanding characteristic of learning is combination of same stimulus and different response (SSDR). Weick (1991) contends individual learning occurs when SSDR is accomplished at the individual level and organizational learning occurs when SSDR is accomplished by groups of people in the organization. Others believe learning

and change occur throughout the firm, at individual, team, and organization levels (Akgun, Lynn, & Byrne, 2003).

### **Mental Models**

OA is grounded in work on mental models. Langan-Fox, Anglim, and Wilson (2004) define mental models as “internal (mental) representations of objects, actions, situations or people, and are built on experience and observation, of both the world in general and the particular entity of interest” (p. 333). This is similar to Argyris and Shon’s (1996) notion of ‘theory-in-use,’ which is an inner characterization of actions, values, and embedded assumptions constructed from observing patterns of action. Huber and Lewis (2010) define mental model as a “person’s mental representation of a system and how it works” (p. 7). This definition includes “(1) the variables included in the system, (2) the properties and states of those variables, and (3) the causal or other relationships among those variables” (Huber & Lewis, 2010, p. 7). Chermack (2007) noted three stages of an effective organizational learning process as “(1) mapping mental models, (2) challenging mental models, and (3) improving mental models” (p. 10). Mental models shape managerial perceptions of their environment and enable sense-making in complex situations (Johnson & Huff, 1998). This in turn affects development and use of EE strategies (Atuahene-Gima, 2005).

### **Strategic Management**

The current business environment is replete with disruptive events and has been characterized in many ways. Table 2.3 presents a list of notable scholars along with how they describe the current business environment. Firms exist to convert knowledge and/or technologies into products and services customers want (Grant, 1996; Wang & von

Tunzelmann, 2000). As systems, organizations are in constant interaction with forces in the external environment (Kast & Rosenzweig, 1972; Katz & Kahn, 1978; von Bertalanffy, 1972). These forces create what Van de Ven et al. (2008) call external context events, and include “shifting priorities by external groups, new information about competitors, or other environment events” (p. 71) that disrupt learning processes of teams or organizations. Lorsch (1976) explains an organization’s internal functioning is contingent on the “uncertainty or complexity of the external environment” (p. 142). OA may limit this contingency effect because the learning processes of EE occur simultaneously and may not be as easily disrupted as non-ambidextrous processes (Benner & Tushman, 2003).

*Table 2.3. Characteristics of the Business Environment – Chronological Order*

<b>Author</b>	<b>Environmental Characteristics</b>
Bourgeois, 1980	Uncertain
Dess & Beard, 1984	Dynamic
Daft & Lengel, 1986	Uncertain
Bourgeois & Eisenhardt, 1988	High velocity
Brown & Eisenhardt, 1997	Turbulent
Brown & Eisenhardt, 1998	Chaotic
Prange, 1999	Heightened volatility
Preskill & Torres, 1999	Unpredictable
Wang & von Tunzelmann, 2000	Complex
Markman & Baron, 2003	High pressured
Lavie & Rosenkopf, 2006	Turbulent and uncertain
Andriopoulos & Lewis, 2009	Dynamic
Champy, 2009	Hypercompetitive
O’Reilly, Harreld, & Tushman, 2009	Fragile
Jordon et al., 2010	Complex
Feldstein, 2010	Uncertain
Wu, 2010	Volatile

### **Competitive Advantage**

There is agreement firms must find competitive advantage to survive (Barney, 1991; Burgelman & Grove, 2007; Eisenhardt & Martin, 2000; Mintzberg, Ahlstrand, &



Lampel, 1998; Porter, 2008, Teece, Pisano, & Shuen, 1997; Wernerfelt, 1984).

Competitive advantage is defined as superior profitability (Teece, 2000). It consists of a firm's "ownership of scarce but relevant and difficult-to-imitate (knowledge) assets, especially know-how" (Teece, 2007, p. 1319). Learning is fundamental to competitive advantage, built by "keeping customers happy" (Teece, 2000, p. 48). Bierly and Daly (2007) agree a firm's knowledge base is its key competitive advantage, consisting of "tangible and intangible knowledge, experience, and skills of employees in an organization" (p. 493).

Competitive advantage differs from sustainable advantage (Teece, 2007). A firm's current level of performance is contingent on satisfying customers it currently has, while its ultimate survival is contingent on developing processes, products, and services customers will demand in the future (Benner & Tushman, 2003). To remain competitive over time, firms must become ambidextrous. They must "integrate and build upon their current competencies while simultaneously developing fundamentally new capabilities" (Benner & Tushman, 2003, p. 238). Knott (2002) conceptualizes this as persistent tension between "success in a competitive environment versus survival in a changing environment" (p. 339). This can also be viewed as essential tension between the paradoxical elements EE.

## **Marketing**

When discussing relationships between satisfied customers, OL, SM, competitive advantage, and financial performance, the function of marketing theory with its focus on customer orientation cannot be left out. Traditionally, "one of the most basic concepts in marketing is the 'marketing mix'" (Zeithaml & Bitner, 2000, p. 18). The marketing mix

is defined as elements firms use to communicate with and satisfy their customers (Zeithaml & Bitner, 2000). The marketing elements are commonly known as the ‘four Ps’ – product, place, promotion, and price. General marketing is focused on tangible goods and products. However, as the country has moved to a service economy, ‘services marketing’ has become more important.

‘Services marketing’ is a sub-specialty of general marketing. The marketing mix has expanded from four to seven Ps. In addition to product, place, promotion, and price, there is now “people, process, and physical evidence” (Zeithaml & Bitner, 2000, p. 19). These concepts drawn from services marketing are important for OA research because OA is accomplished by people engaged in processes located in organizational environments. Services marketing for hospitals aims for excellence in these three additional marketing domains.

People issues include “employees (recruiting, training, motivation, rewards, and teamwork) and customers (education and training)” (Zeithaml & Bitner, 2000, p. 19). Physical evidence includes features such as “facility design, signage, and employee dress” (Zeithaml & Bitner, 2000, p. 19). Processes in hospitals include the “flow of activities in a process (whether they are standardized or customized), the number of steps in a process (simple or complex) and customer involvement in the processes” (Zeithaml & Bitner, 2000, p. 19). Christensen (1997) proposes a systems model of processes.

Organizations create value as employees transform inputs of resources – people, equipment, technology, product designs, brands, information, energy, and cash – into products and services of greater worth. The patterns of interaction, coordination, communication, and decision-making through which they accomplish these transformations are processes (p. 187).

## **HRD**

An HRD framework is useful in building a theoretical model of OA (Ehnert, 2009). There are three ways HRD theory functions effectively as a framework for OA. First, a core belief of HRD is “organization, work process, group, and individual performance is mediated through human expertise and effort” (Swanson, 2009, p. 97). OA is required for sustainable organization performance and requires human expertise to develop and implement innovations that result from simultaneous application of EE (Tushman & O’Reilly, 1996).

A second core belief of HRD is theorists and practitioners should help their organizations navigate change, develop innovations, and create alternative futures (Ruona, 2000; Swanson, 2009). The product of OA is change. Continuous improvement and radical innovation are ways to produce change. This in turn enhances firms’ ability to survive (March, 1991).

Innovations are equally important to firm survival. “Innovating firms can reasonably anticipate higher profits than non-innovating firms” (von Hippel, 1988, p.5). Profits (economics) belong to HRD core theory base (Bodwell & Glick, 2010; Swanson, 2009), and Swanson (2009) declared financial performance is a key outcome variable for the HRD field. Finally, organizational learning provides a strong theoretical base to study OA, and learning is a strong component theme throughout HRD literature (Callahan, 2003; Ruona, 2000; Swanson & Holton, 2009).

## **Paradox and Dialectic**

Although the topic of OA has been extensively studied, we understand little about it (Simsek, 2009). The reason for this is the wide variety of definitions and types of OA

that exist. One explanation for this plurality may be attributed to the fact OA is a paradox. Slaatte (1968) explains:

A paradox is an idea involving two opposing thoughts or propositions which, however contradictory, are equally necessary to convey a more imposing, illuminating, life-related or provocative insight into truth than either fact can muster in its own right.... What the mind seemingly cannot think, it must think (p.4).

Rasche (2008) contends paradoxes contain “contradictory self-referential reasoning” (p. 9). He elaborates “paradoxes are not dysfunctions but statements that meaningfully indicate the margins of knowledge” (Rasche, 2008, p. 12). An example of a paradox is ‘the more we change, the more we stay the same.’ Paradoxes such as this produce tension because it is natural to question how two opposite concepts could be happening at the same time. According to Poole and Van de Ven (1989), “organizational and management theories involve a special type of paradox – social paradoxes” (p. 564). Organizations live in constant paradox; they are “admixture of stability and change” (Poole & Van de Ven, 1989). Lewis (2000) declares “organizations (are) inherently paradoxical, embroiled in tensions and reinforcing cycles at their very core” (p. 760).

Three interrelated ways to manage paradox – “acceptance, confrontation, and transcendence” are proposed by Lewis (2000, p. 764), while Poole and Van de Ven (1989) propose four general methods for working with paradoxes in which “two opposing theses, A and B, might be related (p. 565).”

(1) We can keep A and B separate and their contrasts appreciated; (2) We can situate A and B at two different levels or locations in the social world (e.g., micro and macro levels, respectively); (3) We can separate A and B temporally in the same location; or (4) We can find some new perspective which eliminates the opposition between A and B. Stated schematically, the four relations correspond to opposition, spatial separation, temporal separation, and syntheses, respectively. They represent a logically exhaustive set of relationships opposing terms can take

in the social world. Each of the four methods represents a different way of transforming our theories and ways of thinking (p. 565).

Divergence and fragmentation in the OA field is representative of these paradoxical tensions. Scholars have used each method described above to explain and define OA. Table 1.3 summarizes ways different researchers describe OA paradoxes. Additional problems with the OA paradox of simultaneous EE occur when EE “overlap with measures of conceptually related constructs such as strategic orientation and innovation, which often include items pertaining to experimentation and risk-taking” (Sidhu, Volberda, & Commandeur, 2004, p. 918). Theories of OA acknowledging a paradoxical base have been infrequently articulated but are becoming more common (Andriopoulos & Lewis, 2009, 2010; Ehnert, 2009). This benefits HRD and organization development theory, as Cameron and Quinn (1988) note “excellence in science seems to be inherently linked to the tension of paradox” (p. 6).

Dialectic approaches can assist in understanding paradoxical meanings provided by contradictory evidence. Therefore, a study of OA is by definition a dialectical approach. Synthesis occurs from creative tensions posed by two diametrical oppositions – EE. When two diametrical oppositions occur simultaneously, as they do in OA, a paradox is created. Therefore, ‘dialectics-as-ontology’ as well as “dialectics-as-method” seems well suited for OA research.

Mitroff and Mason (1981) believe the “dialectic (or dialectical reasoning) is more than an abstract principle or method of philosophic thought” (p. vii). Rather, the dialectic can be construed as a concrete method of social science. Mitroff and Mason (1981) explain:

In a dialectical design, we are following a scheme suggested by Churchman's interpretation of Hegel (Churchman, 1971). Here the plan (thesis) is opposed by the counterplan (antithesis) both of which are constructed and argued for from the same databank (the essence). Hegel's theory leads us to predict that the manager – the observer of the conflict – will integrate and form a new and expanded world view (the synthesis). The synthesis includes exposing hidden assumptions and developing a new conceptualization of the planning problem the organization faces (p. 8).

### **OA Theory**

Torraco's (1997) classic definition of a theory informs us "a theory describes what something is and how it works" (p. 115). Sutton and Staw (1995) explain "theory is about connections among phenomena, a story about why acts, events, structure and thoughts occur" (p. 378). The key components of a value-added theoretical contribution are the journalists' questions of who, what, when, where, why, and how (Van de Ven (1989). For theory building research, the most important question is why (Van de Ven, 1989). We need theory to "explain the meaning, nature, and challenges of a phenomenon...so that we may use that knowledge and understanding to act in more informed and effective ways" (Lynham, 2002, p. 222).

### **Need for Unification**

Some argue plurality of opinions is a good starting place for new concepts and theories to emerge. This researcher believes fragmentation in the OA field is beginning to rob a good concept of its utility. There is little agreement by scholars on what OA is and how it works. Lack of cumulative work and theory building on this topic is becoming dysfunctional. The result may be a concept that had much promise but is doomed to underserve because of its many definitions and variations.

## **Decreasing the Dysfunction**

Researchers have recommended ways to decrease dysfunction in the OA field so we need not become stuck in the mud of OA definitions and varieties. First, it is useful to view OA literature as a reflection of choices researchers have made regarding paradox (Andriopoulos & Lewis, 2010). Paradoxical thinking is the salve for linear thinking. Linear thinking is not recommended in volatile and turbulent environments (Eisenhardt & Brown, 1998; Lewis, 2000). Allowing the relationship between EE to co-exist simultaneously creates a paradox that permits the OA phenomenon to become useful for managers. Lewis (2000) contends managers need to recognize, become comfortable with, and profit from tensions and anxieties that arise from paradoxical thinking. Van de Ven and Poole (1988) agree, “to accept a paradox is an enlightened conceptual stance...acknowledging things need not be consistent” (p. 23). They argue “seemingly opposed viewpoints can inform one another” (p. 23).

Acceptance of paradox also permits the “study of dialectic between opposing levels and forces” (Van de Ven & Poole, 1988, p. 23). Eisenhardt and Westcott (1988) declare “the contribution of paradox to management thinking is the recognition of its power to generate creative insight and change” (p. 170). Creative insight and change enhances the ability of managers to shape “a context where the confrontation of contradictory forces may be a factor of effectiveness and progress, not of anarchy and decline” (Bouchikhi, 1998, p. 230). Organization life is messy and complex (Swanson, 2005). Relying solely on linear thinking will not allow OA to emerge in organizations.

A second way to decrease dysfunction in the field is to resolve four key issues posed by Gupta, Smith, and Shalley (2006). These issues pertain to (1) definitions and

connotations, (2) orthogonality versus continuity, (3) ambidexterity versus punctuated equilibrium, and (4) duality versus specialization. Definitions and connotations focus on the diversity of definitions for OA, exploration, and exploitation. Orthogonality versus continuity refers to whether OA are two different ends of one continuum or two completely different constructs. Ambidexterity versus punctuated equilibrium concerns the temporal aspects of OA. The area of contention is whether EE are done simultaneously or whether there are times of stability with little change punctuated by cycles of radical innovation. Finally, duality versus specialization points to whether companies explore and exploit at the same time or whether they specialize in one or the other.

A third way to decrease dysfunction in the field is to create an OA typology. Simsek et al. (2009) proposed four fundamental archetypes of OA, sorted by temporal and structural dimensions seen in Figure 2.3. Table 2.4 presents a descriptive overview of Simsek et al.'s (2009) archetypes and Table 2.5 provides representative definitions of these archetypes.



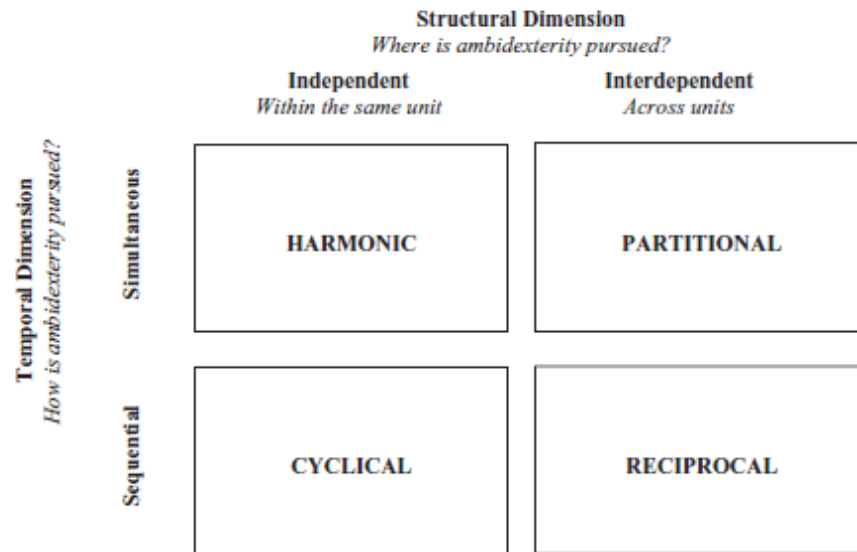


Figure 2.3. Typology of Organizational Ambidexterity (Simsek et al., 2009). Reprinted with permission (Appendix A) from Simsek et al. A Typology for Aligning Organizational Ambidexterity’s Conceptualization, Antecedents, and Outcomes. *Journal of Management Studies*, July 2009, p. 868.

Table 2.4 OA Archetypes (Simsek et al., 2009, p. 870)

Archetype	Description
Harmonic	Simultaneous pursuit of exploitation and exploration within a subsystem, for example, a business unit.
Cyclical	Sequential pursuit of exploitation and exploration within a subsystem, for example, a business unit.
Partitional	Simultaneous pursuit of exploitation and exploration across subsystems, for example business units, or even organizations.
Reciprocal	Sequential pursuit of exploitation and exploration within and across subsystems.
Archetype	Representative Definition
Harmonic	“Ambidexterity is the behavioral capacity to simultaneously demonstrate alignment and adaptability across an entire business unit” (Gibson and Birkinshaw, 2004)
Cyclical	“Cycling between long periods of exploitation and short bursts of exploration” (Gupta et al., 2006)
Partitional	“Ability to simultaneously pursue both incremental and discontinuous innovation that result from hosting multiple contradictory structures, processes, and cultures, within the same firm” (Tushman and O’Reilly, 1996)
Reciprocal	None

Simsek et al.’s (2009) typology is useful as a way of resolving the four issues proposed by Gupta et al. (2006). However, only two archetypes acknowledge a paradoxical base: the harmonic and partitional types. Because simultaneous opposites are

central features of paradox, it is the paradox of OA that gives it power as an organizational phenomenon. Therefore, this researcher therefore believes Simsek et al.'s (2009) cyclical and reciprocal archetypes may not be as useful as others for describing or defining OA theories or constructs. Fortunately, Simsek et al.'s (2009) two paradoxical archetypes can be combined by removing notions of alignment and adaptability and replacing them with EE. EE are components of OA regarded by most researchers as orthogonal.

The scope of ambidextrous organizations is summarized by Puhan (2008, p. 31) in Table 2.5. Puhan (2008) proposes “senior team integration, common visions and values, and common senior-team rewards as linking mechanisms that are critical to the success of ambidexterity” (p. 31).

*Table 2.5. Scope of the Ambidextrous Organization (Puhan, 2008)*

<b>Alignment of</b>	<b>Exploitative Units</b>	<b>Explorative Units</b>
Strategic intent	Cost, profit	Innovation, growth
Critical tasks innovation	Efficiency, incremental	Adaptability, breakthrough innovations
Competencies	Operational	Entrepreneurial
Structure	Formal, mechanistic	Adaptive, loose
Culture	Efficiency, low risk, Quality, customers	Risk taking, speed, flexibility, experimentation

### **Review of OA Case Study Research**

#### **New United Motors Manufacturing, Inc. (Adler, Goldoftas, & Levine, 1999)**

Adler et al. (1999) conducted case study research on automobile model changeover practices at New United Motors Manufacturing, Inc. (NUMMI) in Fremont, California. NUMMI was a joint venture between General Motors (GM) and Toyota.

Toyota was responsible for daily operations at the plant. Research took place from 1993 to 1994. NUMMI was chosen as the research setting because it was known to have exceptional efficiency, flexibility, and quality in amounts that far surpassed the Big Three car manufacturers of Ford, Chrysler, and GM. The authors conducted approximately 60 interviews with individuals from all ranks of the company. They supplemented the interviews with document review of a variety of company and union materials.

Adler et al. (1999) discovered that training and trust, plus four generic factors allowed NUMMI to manage trade-offs between efficiency, flexibility, and quality. These factors were metaroutines, enrichment, switching, and partitioning. Metaroutines consisted of “standardized procedures for changing existing routines and for creating new ones” (p. 50). Enrichment was the ability to add nonroutine tasks to routine production tasks. Switching permitted NUMMI to maintain “separate times for routine and nonroutine tasks and to switch employees between them sequentially” (p. 50). Partitioning allowed “creation of subunits that specialized in routine or in nonroutine tasks” (p. 50).

#### **Scandinavian PC Systems (Holmqvist, 2004)**

Holmqvist (2004) conducted case study research at Scandinavian PC Systems (SPCS) between 1997 and 1999. The study consisted of formal interviews, informal and formal observations, and review of documents related to product-development activities. Holmqvist used these methods to analyze EE in intra and interorganizational learning processes. Intraorganizational learning takes place “when groups, departments, and teams share experiences and jointly learn exploitative rules of refinement and focused attention and explorative rules of experimenting and trialing” (p. 72). Conversely,

interorganizational learning occurs when “collective learning takes place from experience, in the form of interorganizational rules of exploitation and exploration, achieved by formal organizations collaborating in strategic alliances and other interorganizational collaborations” (p. 72).

Holmqvist (2004) reviewed EE within an OL framework and viewed EE as non-substitutable, complementary processes. Holmqvist (2004) asserted learning emerges as a result of dissatisfaction with current situations and practices. Therefore, dissatisfaction with exploration may engender exploitation while dissatisfaction with exploitation may spawn exploration.

Holmqvist’s (2004) major contribution to the OA literature is an “integrated framework that conceptualizes how exploitation is interlaced with exploration within and between organizations” (p. 80). Results of Holmqvist’s (2004) study revealed four different OL processes that link exploitation, exploration, intraorganizational learning and interorganizational learning. These processes include (1) opening-up extension, (2) focusing internalization, (3) opening-up internalization, and (4) focusing extension. Extension facilitates intraorganizational learning as one organization opens up its experience to others in efforts to exploit each others’ expertise. Extension also facilitates interorganizational learning when organizations collaborate together to product new (explorative) experiences. Internalization results when interorganizational learning generates intraorganizational learning. Table 2.6 displays explanations of Holmqvist’s OL processes.

*Table 2.6. Four Core Processes of Intra and Interorganizational Learning (Holmqvist, 2004)*

<b>Process</b>	<b>Description</b>
Opening-up extension	"Intraorganizational exploitation that generates interorganizational exploration" (p. 73). "Interorganizational exploration refers to the process whereby a collective of organizations, such as a strategic alliance, creates variety in experience through experimenting and free association" (p. 73).
Focusing internalization	"Interorganizational exploration generates intraorganizational exploitation" (p. 73).
Opening-up internalization	"Interorganizational exploitation that generates intraorganizational exploration" (p. 73). "Intraorganizational exploration refers to the process by which a formal organization creates variety in its experience" (p. 73).
Focusing extension	"Refers to intraorganizational exploration generating interorganizational exploitation" (p. 73).

### **Information Systems at Mercy Health Partners (Tarafdar & Gordon, 2007)**

Tarafdar and Gordon (2007) developed seven information systems (IS) competencies for process innovation. One of these was ambidexterity, which they defined as "the ability to achieve and balance strategic vision and operational excellence" (p. 364). They viewed an ambidextrous organization as one that "simultaneously explores and exploits," or is both "flexible and efficient" (p. 364). Tarafdar and Gordon (2007) extended the ambidexterity concept to the supply and demand aspects of the IS function in companies. The 'supply' aspect refers to delivering information technology (IT) services to support current business functions, similar to the exploitation component of OA. The 'demand' aspect pertains to the use of IT to help the company innovate, similar to the exploration component of OA.

The setting for Tarafdar and Gordon's (2007) case study was Mercy Health Partners (MHP), "a healthcare provider in the Mid-western region of USA and one of the largest healthcare organizations in the region" (p. 367). The researchers' data collection methods involved interviews and review of documents prior to the implementation of two IS innovations at four hospitals within the MHP system. Their aim was to analyze the influence of IS competencies on different phases of process innovations. The research

took place from November 2003 to November 2006 in a variety of timelines, schedules, and phases.

Tarafdar and Gordon (2007) coded IS competencies axially and identified six corresponding themes. They used open coding to analyze interview transcripts and document reviews. These procedures allowed the researchers to isolate instances where aspects of each competency helped the activities associated with different phases of IT innovations. Findings of the research with respect to ambidexterity and its supply (exploitation) and demand (exploration) aspects were that the hospital had different criteria for approving supply side products and demand side products. The ambidexterity competency enabled the hospital to recognize the importance of investing in IT for the future (demand-side) and to look upon such investments with a long-term rather than short-term lens. Table 2.7 shows how the IS competency of ambidexterity influenced process innovations.

*Table 2.7. Ambidexterity Competency (Tarafdar & Gordon, 2007, p. 372)*

Ambidexterity	How Ambidexterity Facilitated Process Innovations
1. Appropriate (and different) criteria for approving ‘supply side’ (regular maintenance and upgrades and relatively simple new acquisition related) projects and ‘demand side’ (complex, strategic, innovation oriented and large scale change related) projects – to facilitate approval and evaluation of the two projects studied in this research.	Enabled the firm to recognize the strategic importance of the innovations and apply appropriate long-term evaluation criteria.

### **Product Design Companies (Andriopoulos & Lewis, 2009)**

Andriopoulos and Lewis (2009) conducted a comparative case study of five ambidextrous firms using research methods specified by Eisenhardt (1989) and Yin (1994). Companies in the product design industry were chosen because they rely on knowledge workers, similar to other knowledge-intensive industry sectors such as biotechnology, art, and medicine. The researchers chose companies recognized as high

performers in their industry; firms that maintained both consistent profitability and top rankings for innovation. The firms differed in size, age, and industry specialization. Each company operated in the United States.

Andriopoulos and Lewis (2009) conducted their study over more than four years. Data collection methods included semistructured interviews using a grounded theory approach, review of archival data, and observations. Results revealed three paradoxes of innovation that are managed to create OA in firms. These are strategic intent, customer orientation, and personal drivers. The paradoxes associated with strategic intent are a simultaneous emphasis on profits and breakthroughs (innovations). The paradoxes contributing to customer orientation are tight coupling and loose coupling. The paradoxes included in personal drivers are discipline and passion. Andriopoulos and Lewis (2009) found it vital to use a paradoxical lens to produce OA theory. Figure 2.4 depicts Andriopoulos and Lewis' (2009) conceptual framework of OA.

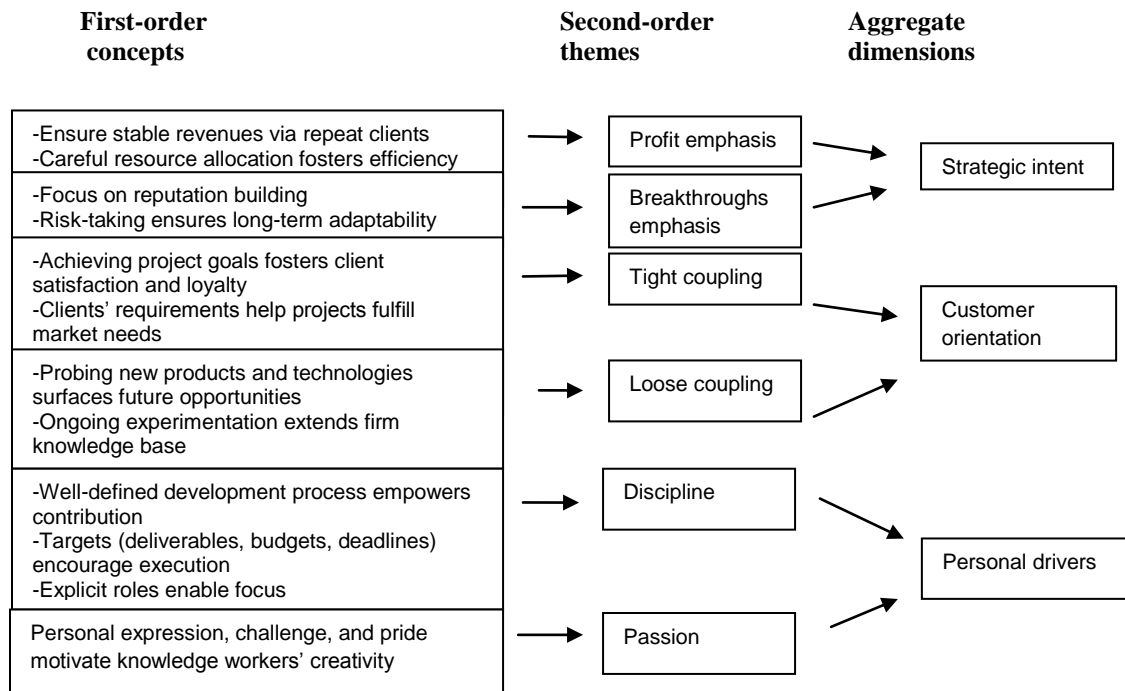


Figure 2.4. Data Structure: Paradoxes of Innovation (Andriopoulos & Lewis, 2009, p. 701). Reprinted with permission (Appendix A).

### Multi-Unit Research Firms in Europe (Guttel & Konlechner, 2009)

Guttel and Konlechner (2009) used case study research methods as suggested by Creswell (2007), Eisenhardt (1989), and Yin (2003) to study research organizations in Europe from 2005 to 2008. Independent subdivisions of one company formed the units of analysis and each subdivision was considered an organization with few ties to its larger holding company, fictitiously named RCA. Each organization was considered to be contextually ambidextrous “ambidexterity that arises from the cultural values and norms of the organizational context” (Guttel & Konlechner, 2009, p. 151). Guttel and Konlechner’s purpose was to reveal “the methods of creating and maintaining this type of ambidexterity” (2009, p. 151). They did not specify whether their ‘contextual’ ambidexterity was an orthogonal or bipolar construct.



Researchers conducted semistructured interviews with heads of departments and divisions, employees, and union representatives. Additionally, Guttel and Konlechner (2009) reviewed management and strategic reports, consulting reviews, and HR policies along with other pertinent documents. Finally, the researchers performed on-site observations of company activities and practices.

Results of the study revealed several ways in which companies achieved an ambidextrous business model. First, the companies integrated the different and opposing needs of research creativity and reliable service delivery. The underlying principle of research is exploration, whereas the underlying principle of reliable service delivery is exploitation. In their standardized consulting projects, companies applied standardized routines to produce products and services clients needed. Guttel and Konlechner (2009) characterized the consulting domain (service delivery) as needing “reliability, consistency and risk avoidance, and use of already established procedures” (p. 158). Conversely, the research domain needed experimentation, radical search, creativity, and construction of new procedures (exploration).

At the organizational level, companies studied by Guttel and Konlechner (2009) reified their joint objectives of research and service by use of balanced score cards and intellectual capital statements. These company standards were translated to individual performance reviews that ensured employees were maintaining the right balance between research and service (defined as 70% of available man-days for research and 30% for service). A variety of teams and different project structures existed within organizations. Some used detailed and formal rules and processes to accomplish their goals. Others used very simple rules to decide how to meet their company’s expectations and clients’

needs. Guttel and Konlechner (2009) describe relationships within and between project teams as “loose-tight,” similar to Eisenhardt and Martin’s (2000) notion of a “semistructure.” The semistructures kept organizations flexible to meet different demands but structured enough to work cohesively and were used as vehicles to integrate the opposing demands of research and service.

Second, sample companies demonstrated strength in their HR systems. HR ensured staff competencies in both research and service. HR possessed strong competencies of their own in recruitment and selection of new hires, talent training and development, and career management. This resulted in companies staffed with workers who demonstrated a broad skill base. The best employees were rewarded with a permanent employment contract similar to tenure. These HR practices enabled an ambidextrous mindset in each company.

Third, all employees worked in both research and service project teams. This allowed them to obtain a common frame of reference while developing and maintaining ambidextrous skills in both areas (research and service). The project teams served as “knowledge bridges” for communication among employees and provided teams with ability and autonomy to make fast decisions. Guttel and Konlechner (2009) noted “Knowledge flows constantly and quasi-automatically as employees participate in exploratory and exploitative project teams, usually simultaneously” (p. 163). These scheduling practices enabled an ambidextrous mindset in each company. Table 2.8 summarizes practices that enable ‘contextual’ ambidexterity.

*Table 2.8. Summary of Enabling Practices for ‘Contextual’ Ambidexterity (Guttel & Konlechner, 2009)*

<b>Process</b>	<b>Description</b>
Ambidextrous Business Model	“Requires integration of research (exploratory) and service delivery (exploitation)” (p. 157).
Formal Structures	<p>“Formal structures facilitate switching between exploratory and exploitative learning on the organizational, team, and individual levels” (p. 159). They are:</p> <ol style="list-style-type: none"> <li>1. <b>Operationalized business model and target agreement.</b> “Intellectual capital statements, balanced score cards, or other strategic controlling indicators are used to define joint objectives in research and in service” (p. 159)... “The organization’s main objectives are translated to the individual level by the use of target agreements, such as management by objectives (MBO),” (p. 159) and performance reviews that keep employees accountable for putting in hours dedicated to joint objectives in research and service.</li> <li>2. <b>Semisttructures.</b> These loose-tight relationships in project teams “keep the organization flexible enough to conduct various projects with different demands but also provides enough structure to preserve organizational cohesion” (p. 159).</li> <li>3. <b>Fluid project-based structures.</b> “The use of a modular project structure fosters equilibrium between research and service and exploration and exploitation. Moreover, the fluid project structure enables evolutionary adaptation to changing conditions.</li> <li>4. <b>HR systems.</b> These systems are strong in hiring and selecting new employees, training and development of all talent, providing career management, and maintaining ambidextrous staff competencies.</li> </ol>

### **Alternative Work Arrangements in the Professional and Management Services Industry (Litrico & Lee, 2008)**

Litrico and Lee (2008) used case study research methods to investigate a total of eight individual cases of alternative work arrangements (AWA) in the form of reduced-load work at three different firms from 1996 to 1998. They note “data were collected using in-depth qualitative interviews of multiple stakeholders in each reduced-load arrangement to obtain multiple perspectives of the reduced load arrangement” (p. 1001).

Table 2.9 presents the list of interview questions used.

*Table 2.9. Interview Questions Asked to Explore AWA (Litrico & Lee, 2008, p. 1002)*

1.	What was the rationale for negotiating the reduced-load arrangement?
2.	What were the changes and adjustments that resulted from the AWA?
3.	What were the factors facilitating or hindering the particular reduced load arrangement?
4.	What were the perceived outcomes of the arrangement, both for the individual concerned, and for the organization?
5.	More generally, what were the factors that proved critical to making reduced-load arrangements work?

Litrico and Lee (2008) found that EE existed in a variety of levels or contexts, including individual, family, work group, and organization. Explorative behaviors were found most frequently at individual and family levels. A mixed bag of explorative and

exploitative behaviors was found at work-group and organization levels. They found in some cases that exploration fueled exploitation whereas in other cases exploitation constrained exploration. In still other cases, they found explorative behaviors co-existing non-competitively with exploitative behaviors.

Litrico and Lee (2008) shed light on the “complex interactions of exploration and exploitation across contexts” (p. 1017). They are some of the first scholars to look at components of OA – EE – at the micro levels of individuals and groups. Their study provides evidence that context affects OA by its influence on EE, and supports Gibson and Birkinshaw’s (2004) notion that context affects OA at the business-unit level. This study also provides evidence for Bodwell’s working definition of OA.

### **Review of OA Empirical Studies**

#### **Two Foundational Empirical Studies**

He and Wong (2004) and Gibson and Birkinshaw (2004) each published (now) foundational empirical studies of OA. These two studies are the empirical research base for most OA studies conducted after 2004, and I will begin by focusing on them because of their importance. I will then discuss the four Jansen et al. (2005, 2006, 2008, 2009) empirical studies. I will review another nine empirical studies and conclude with a summary of what is known about OA.

Using an OL framework, He and Wong (2004) investigated how EE related to sales growth (a proxy dependent variable representing firm performance) in manufacturing firms in Singapore and Malaysia. They designed an eight-item questionnaire ranking firms on an orthogonal depiction of EE. Firms with equal scores on both dimensions were considered ambidextrous (He & Wong, 2004). Firms were

labeled ambidextrous if they had low but equal scores or if they had high but equal scores. This recognition led to the following two versions of the “ambidexterity hypothesis” (p. 484), supported by evidence as shown in Table 2.10. He and Wong’s model of OA is presented in Figure 2.5.

*Table 2.10. He and Wong’s Hypotheses: Supported by the Evidence*

Hypothesis 1A.	There is a positive interaction effect between explorative and exploitative innovation strategies on firm performance. (Beta = 4.539, $p < 0.035$ ; Effect Size $r = .418$ ).
Hypothesis 1B.	The relative imbalance (absolute difference) between explorative and exploitative innovation strategies is negatively related to firm performance. (Beta = -3.026, $p < 0.10$ ; Effect size $r = .412$ ).

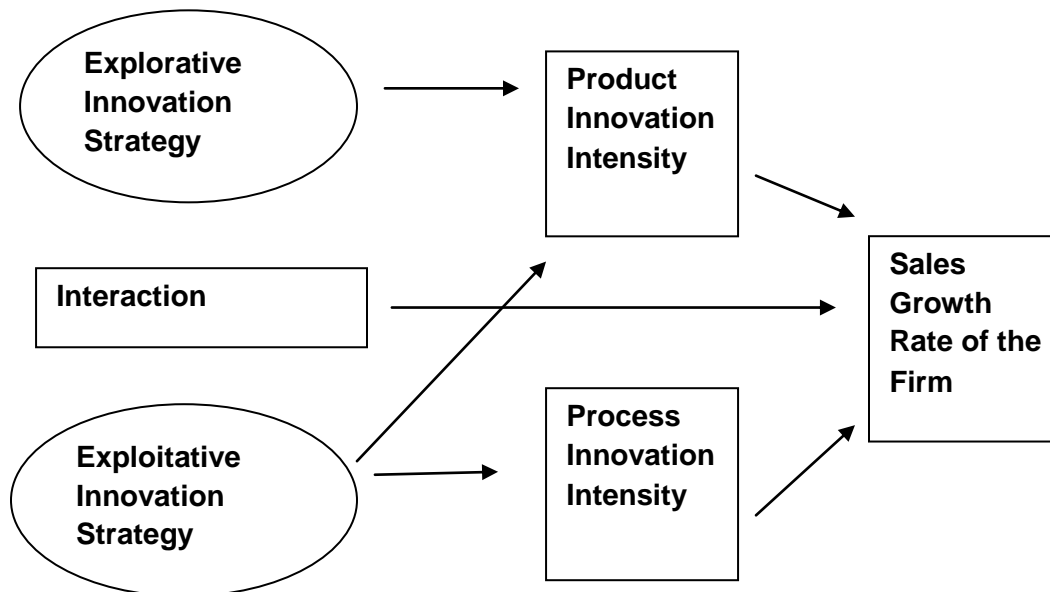


Figure 2.5. Model of OA (He & Wong, 2004, p. 490). Reprinted with permission (Appendix A).

Gibson and Birkinshaw (2004) used an organizational behavior (OB) framework for their study and called their version of ambidexterity ‘contextual ambidexterity (CA).’ It had very similar features to ‘regular’ OA – it was orthogonal and made up of adaptation (similar to exploration) and alignment (quite similar to exploitation).

The researchers proposed that organization context, defined as performance management and social context, influenced alignment and adaptability. The more a business unit is able to simultaneously adapt and align, the higher are its ambidexterity and business unit's performance. Gibson and Birkinshaw (2004) used ordinary least squares (OLS) multiple regression to test their hypotheses, which were supported by evidence shown in Table 2.11. Gibson and Birkinshaw's model of OA is displayed in Figure 2.6.

*Table 2.11. Gibson and Birkinshaw's Hypotheses: Supported by the Evidence*

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Hypothesis #1 – Ambidexterity is positively related to performance. (Beta = 0.47, $p < 0.01$ ; Effect Size $r = .866$ , Explained Variance 75%)
Hypothesis #2 – Organization context is positively related to ambidexterity. (Beta = 0.68, $p < 0.01$ ; Effect size $r = .830$ , Explained Variance 69%)
Hypothesis #3 – Ambidexterity mediates the relationship between context and performance. (Beta = 0.58, $p < 0.001$ ; Effect Size $r = .866$ , Explained Variance 75%)

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Figure 2.6. Model of OA (Gibson & Birkinshaw, 2004, p. 210). Reprinted with permission (Appendix A).

### The Jansen et al. Studies

In 2005, Jansen, Van den Bosh, and Volberda built upon He and Wong's (2004) and Gibson and Birkinshaw's (2004) foundational studies by investigating the impact of environmental and organizational antecedents of OA. The Jansen et al. (2005, 2006, 2008, 2009) studies asserted ambidexterity was comprised of two orthogonal concepts operating simultaneously. In contrast to the two 2004 foundational studies, ambidexterity was the dependent variable rather than performance. The Jansen et al. studies were

highly reliable and valid. See Appendix B for a summary of the Jansen et al. studies' reliabilities and validities. See Table 2.12 for the findings of each Jansen et al. study.

Figure 2.7 depicts Jansen et al.'s (2009) model of OA.

*Table 2.12. Summary of Findings from all Jansen et al. Studies*

Year	Unit of Analysis	Frame-work	Components of OA, Type, Relationship & Sequence	Independent Variables	Dependent Variable	Effect Size	Significance
2005	Business unit	OL & SM	EE, Multiplicative, Orthogonal, Simultaneous	(1) Decentralization * Dynamism; (2) Competitiveness * Connectedness	(1) Ambidexterity, (2) Ambidexterity	(1) DEC* CON = stronger OA .489 (2) DYN * COMP = stronger OA .489	(1) Beta =0.16; $p < 0.01$ ; (2) Beta = 0.11, $p < 0.05$
2006	Business unit	OL & SM	EE, Multiplicative, Orthogonal, Simultaneous	(1) Exploratory innovation * Environmental dynamism; (2) Exploitative innovation * Environmental competitiveness	(1) Financial Performance; (2) Financial Performance	(1) EXP * ENV = stronger \$\$\$ .685 (2) EXPLOIT * COMP = stronger \$\$\$ .685	(1) Beta =0.15; $p < 0.01$ ; (2) Beta = 0.19, $p < 0.00$
2008	Firm level	OL & SM	EE, Multiplicative and Additive (They did regressions using both measures), Orthogonal, Simultaneous	(1)Senior Team (ST) Shared Vision – (2) ST contingency rewards; (3) ST social interaction * Transformational Leadership (TL)	(1) Ambidexterity, (2) Ambidexterity, (3) Ambidexterity	(1) Positive direct effect .600 (2) Positive direct effect, .600 (3) Positive direct effect, .600.	(1) Beta = 3.78; $p < 0.01$ (2) Beta = 1.82, $p < 0.01$ (3) Beta = 5.48, $p < 0.01$
2009	Firm level	SM	EE, Additive (Strongest explanatory power - stronger than multiplying E & E or subtracting E from E), Orthogonal, Simultaneous	(1) Exploratory innovation * Environmental dynamism; (2) Exploitative innovation * Environmental competitiveness	(1) Ambidexterity; (2) Ambidexterity; (3) Ambidexterity	(1) Positive direct effect .374 (2) Positive direct effect, .479 (3) Positive direct effect, .479.	(1) Beta = 0.23; $p < 0.01$ (2) Beta = 0.15, $p < 0.05$ (3) Beta = 0.17, $p < 0.05$

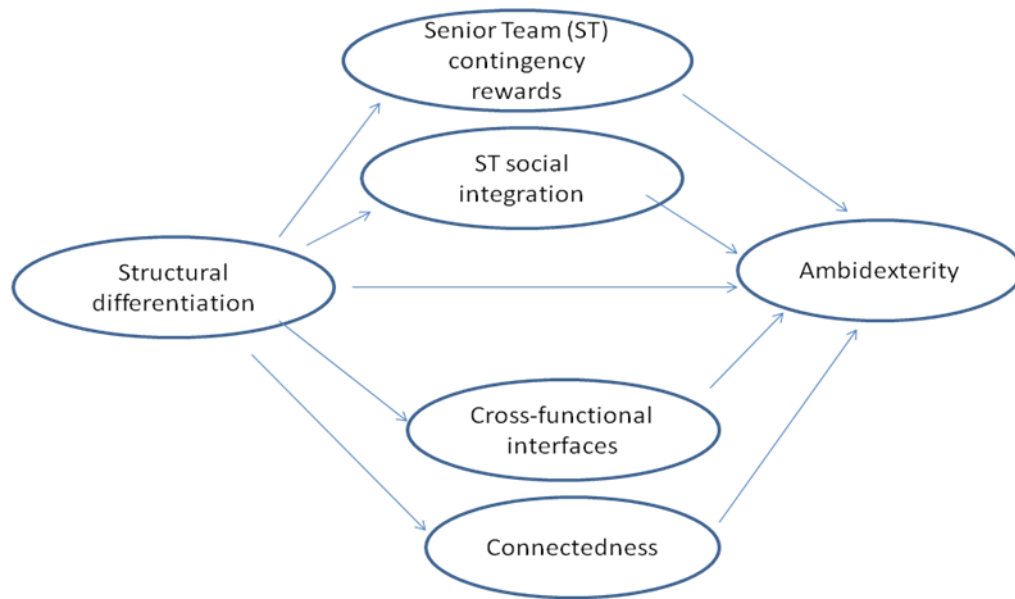


Figure 2.7. Model of OA (Jansen et al., 2009). Reproduced with permission (Appendix A) from Jansen et al., (2009). Structural differentiation and ambidexterity: The mediating role of integration mechanisms. *Organization Science*, 20(4), p. 798.

### **The Balanced/Combined View of OA (Cao et al., 2009)**

Cao et al. (2009) proposed that bipolar OA and orthogonal OA are two dimensions of a unitary OA construct. Cao et al. (2009) used He and Wong’s (2004) instrument to test ambidexterity levels in 200 randomly selected high technology firms in China.

The authors found correlation between the balanced dimension (BD) of OA and the combined dimension (CD) of OA to be non-significant ( $r = 0.091$ ) and pointed out this “provides a strong preliminary indication that BD and CD represent two distinct dimensions of OA” (Cao et al., 2009, p. 789). Because Jansen et al. (2009) and others (He & Wong, 2004) had already provided compelling evidence EE are two different and non-substitutable ideas, the notation BD and CD added little new to the OA theory base.



Cao et al. (2009) considered firm size and organizational environment (environmental munificence, related to relative presence or absence of resources available to the firm) in relationship to OA and firm performance. They found compelling evidence that small firms with lack of resources have better financial performance if they engage in a balanced or bipolar form of OA. They also found compelling evidence large firms with good availability of resources have better financial performance if they engage in an orthogonal form of OA. Table 2.13 presents a summary of Cao et al.'s (2009) reliability and validity evidence and Table 2.14 presents a summary of Cao et al.'s (2009) findings.

*Table 2.13. Cao et al.'s (2009) Summary of Reliability and Validity Evidence*

Validity based on Content	(1) Instrument adapted from He and Wong (2004). (2) "Interviewed a few Chinese CEOs" (p. 787). (3) "Used conventional back-translation method to ensure validity of translation from English into Chinese" (p. 787). (4) Administered the survey as a pretest and made additional changes to ensure that the survey was understandable.
Validity based on Internal Structure	(1) Cronbach's alpha for exploration = 0.82. (2) Cronbach's alpha for exploitation = 0.79.
Validity from Factor Analysis (Exploratory = EFA; Confirmatory = CFA)	(1) "CFA used to examine the validity of the performance, exploration, and exploitation scales" (p. 788). (2) "Fit indices showed that the model fit the data reasonably well (chi-square 78.161, $p < 0.05$ . Based on these loadings, the composite reliability for performance (0.89), exploration (0.82), and exploitation (0.76) showed that these measures demonstrate good convergent validity and reliability" (p. 788). (3) (3) Discriminant validity – used CFAs to see chi-square differences for a two-factor model and a one-factor model. "All were significant, suggesting good discriminant validity" (p. 788).
Sample Selection	(1) Random selection of companies. (2) No random assignment to groups; but this was not a comparison study, it was a complex associational study that used multilevel models (MLM) where there are automatically two levels of data.
Reliability Type	(1) Interrater agreement scores between the CEO and CTO were computed, but they did not report the scores nor did they further comment about them. (2) This instrument was adapted from a previous successfully used instrument (He & Wong, 2004).
Single Informant Bias & Common Method Bias	(1) Collected data from two different sources (CEO and CTO). (2) Surveyed additional management team members.
Response Bias	(1) Response rate 61%. (2) Compared early and late respondents in terms of demographics and model variables, "suggesting that nonresponse bias was minimal" (p. 787).
External Validity	(1) Population external validity - random selection of companies, non-random sample of CEO and CTO of each company (Medium level validity). (2) Population ecological validity – use of a questionnaire is "somewhat artificial" (Gliner, Morgan, & Leech, 2009, p. 129), but questionnaires were completed in natural work setting – a high level of validity.
Overall Validity/Overall Reliability	High/High

*Table 2.14. Summary of Findings – Cao et al. (2009)*

Unit of Analysis	Framework	Components of OA, Type, Relationship & Sequence	Independent Variables	Dependent Variable	Effect Size	Significance
Organization	SM	1. EE 2. Subtractive 3. Bipolar 4. Simultaneous	BD	Firm performance	Positive direct effect .444	Beta = 0.306; $p < 0.01$
Business unit	SM	1. EE 2. Multiplicative, 3. Orthogonal 4. Simultaneous	CD	Firm performance	Positive direct effect .465	Beta = 0.233; $p < 0.01$
			BD * CD	Firm performance	Positive direct effect .616	Beta = 0.505, $p < 0.01$

### **OA and Performance in Small Manufacturing Firms (Bierly & Daly, 2007)**

Bierly and Daly (2007) investigated OA as an orthogonal organizational level construct. They proposed EE are complementary knowledge strategies that create synergies when used simultaneously. Knowledge strategies are acutely important to organizations because “they provide the firm with guidelines for developing intellectual capital and therefore creating competitive advantage” (Bierly & Daly, 2007, p. 493). The researchers studied United States’ firms from 18 different Standard Industry Classification (SIC) groups, including food products, lumber and wood products, and electronic equipment, among others. Survey sets were sent to 250 firms to be given to four top management team (TMT) members at each firm. Ninety-eight complete survey sets were returned (response rate 39.2%). This resulted in 294 individual surveys from which data were aggregated to the firm level for a total N of 98.

Bierly and Daly’s (2007) instrument was a five-point Likert-type scale of agreement with items similar to He and Wong’s (2004) instrument. EE were independent variables. Performance was the dependent variable, and control variables were firm age and firm size. Table 2.15 summarizes the study’s key hypotheses and whether or not they were supported by evidence.

*Table 2.15. Bierly and Daly's (2007) Statistical Support for Hypotheses*

Hypothesis 1	“Exploration and exploitation are complementary constructs; that is, measures of organizational exploration are positively correlated with measures of organizational exploitation” (p.497).
Evidence	Correlation between exploration and exploitation strongly positive and significant. Effect size ( $r = 0.465, p < 0.01$ ).
Hypothesis 2	“There is a curvilinear relationship between exploration and performance (inverted U-shape); as exploration increases, performance increases up to a point of optimization, after which performance decreases as exploration increases” (p. 497).
Evidence	Not supported by the evidence. Values for exploration and exploitation not significant and explain only 8% of the variance in performance ( $R^2 = 0.081$ ).
Hypothesis 3	“There is a curvilinear relationship between exploitation and performance (inverted U-shape); as exploitation increases, performance increases up to point of optimization, after which performance decreases as exploitation increases” (p. 497).
Evidence	Curvilinearity was tested by adding the squared term of each. Both exploitation and exploitation-squared items are significant, supporting the concave, nonlinear relationship between exploitation and performance. Effect size ( $r = .398, p < 0.01$ )
Hypothesis 4	“Firms that simultaneously pursue exploration and exploitation will have higher level of performance than those that focus primarily on one or the other of these strategies” (p. 497).
Evidence	Not supported by the evidence. The interaction term of exploration and exploitation is not significant.

Bierly and Daly (2007) found exploitation more strongly predicts performance than exploration in small to medium sized companies. The relationship between exploration and performance is linear and positive and the relationship between exploitation and performances is concave as shown in Figure 2.8.

#### Exploration-Performance and Exploitation-Performance Relationships

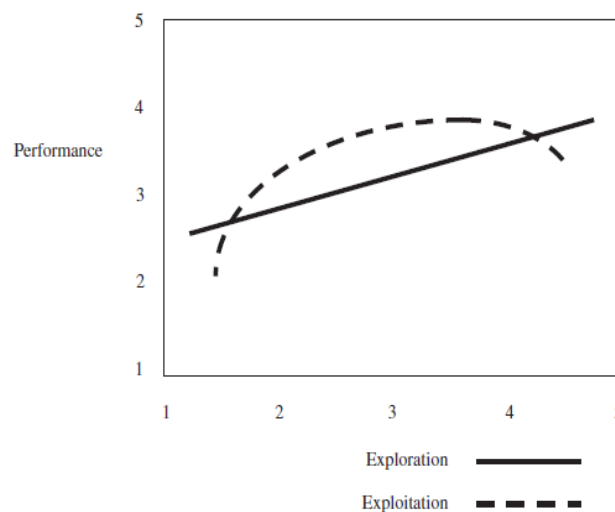


Figure 2.8. Exploration – Performance and Exploitation – Performance Relationships. Reprinted with permission (Appendix A). Bierly and Daly (2007). *Entrepreneurship Theory and Practice*, p. 509.

They also noted exploration strategy in a high-technology industry has a direct positive effect on performance (slope = 1.660,  $p < 0.05$ ;  $r = 0.339$ ), and exploitation in a stable, high-technology environment is associated with higher performance (slope = 2.128,  $p < 0.05$ ,  $r = 0.560$ ).

Additional evidence from the Bierly and Daly (2007) study shows ambidextrous organizations perform well in high-tech industries, but not necessarily in low-tech industries. They elaborate “competition in low-technology industries is typically not driven by technological innovation, but focuses more on marketing (e.g., strength of brand, image), customer service product quality, and operational efficiency” (p. 510).

#### **Exploration in Three Dimensions (Sidhu et al., 2004)**

Using a co-evolution framework, Sidhu et al. (2004) studied exploration without mentioning exploitation or ambidexterity. They modeled exploration as an organization-level construct resulting from a “joint function of environmental effects and managerial intentions” (p. 914). Interestingly, Sidhu et al. (2004) situated exploration within an information-acquisition domain where its key attributes were supply-side information acquisition (SSIA), demand-side information acquisition (DSIA), and geographic information-acquisition (GIA). The authors operationalized the exploration construct from an information-acquisition perspective because information acquisition is the predecessor of knowledge pursuit, experimentation, novelty creation, and risk-taking; the commonly agreed upon attributes of exploration. Since exploitation was not mentioned in this study, one concludes that Sidhu et al. (2004) believe exploration to be a separate (orthogonal) construct from exploitation.

The Sidhu et al. (2004) sample consisted of randomly selected Dutch metal and electrical engineering firms in the business-to-business market. Sidhu et al. (2004) designed an instrument to incorporate their co-evolutionary model of exploration. Data were collected in two waves. From a list of 1,400 companies, every third company was selected to receive the first round of questionnaires. From the list of remaining companies, the researchers chose the first 850 companies to receive the second round of questionnaires. The cover letter asked that the survey be completed by either a managing director of the firm or a member of the top management team resulting in data from single informants. This resulted in a response rate of 17% for the first round (n = 85) and 18.23% (n = 155) for the second round of questionnaires.

Exploration served as the dependent variable for the study. Dynamism (environmental pressure), organization mission, and prospector orientation (Miles & Snow, 1978), served as independent variables. The variables organization mission and strategic orientation represented managerial intentions. The researchers controlled for organization size. Multiple regression techniques were used to specify a model of exploration and test the relationships between the variables. Table 2.16 summarizes findings of the study.

*Table 2.16. Statistical Support for Hypotheses (Sidhu et al., 2004)*

Hypothesis 1	“The greater the environmental dynamism (degree of unpredictability of change), the greater the exploration orientation of an organization” (p. 918).
Evidence	Supported by the evidence. Effect size $r = 0.556$ , $p < 0.05$
Hypothesis 2	“The stronger the organization mission, the greater the exploration orientation” (p. 919).
Evidence	Supported by the evidence. Effect size $r = 0.556$ , $p < 0.01$
Hypothesis 3	“A greater prospector orientation (strategic innovations and strong experimentations with new opportunities) is positively related to a greater exploration orientation” (p. 919).
Evidence	Supported by the evidence. Effect size $r = 0.556$ , $p < 0.05$

### **Exploration with Exploitation Added (Sidhu et al., 2007)**

Using their 2004 sample, Sidhu et al. extended their study in 2007. The 2007 study includes exploitation with exploration. Exploration-exploitation is defined by the authors “in terms of nonlocal-local search in three-dimensional supply, demand, and geographic space” (p. 20). Sidhu et al. (2007) explain their approach as follows.

Instead of describing exploration-exploitation in general terms through a range of associated concepts, recent work rooted in evolutionary economics has started following a more precise approach based on the notion of search. The operationalization of exploration-exploitation is specifically in terms of nonlocal and local information-or knowledge-search behavior to discover fresh approaches to technologies, products, and businesses; pursue new knowledge; and experiment with new alternatives (p.22).

The independent variable in this study was the exploration-exploitation concept composed of three distinct but related factors of Supply Side Information Acquisition (SSIA), Demand Side Information Acquisition (DSIA), and Geographic Information Acquisition (GIA). Interestingly, the instrument determined only whether there was a greater or lesser level of nonlocal search (exploration). The authors assert this instrument allowed them to establish an exploration or exploitation orientation “because the former is viewed as greater amounts of search in nonlocal domains and the latter as lesser amounts of nonlocal search” (p. 34). This is a bipolar, non-orthogonal view of EE. The dependent variable in this study was innovativeness, defined as the percentage of total sales obtained from products introduced in the past three years. The authors controlled for organizational size, age, organizational slack, and level of formalization. Table 2.17 summarizes selected findings of this study.

*Table 2.17. Statistical Support for Hypotheses (Sidhu et al., 2007)*

Hypothesis 1	“Supply-side, demand-side, and geographic search are three distinct search dimensions, each of which captures unique elements that set it apart from the others” (p. 24).
Evidence	This was supported by the evidence. Chi square statistics indicated that the three dimensions were not perfectly correlated but were “distinct and meaningful” (p. 29).
Hypothesis 2	“Each of the conceptualized supply-side, demand-side, and geographic search dimensions contributes to the overall exploration-exploitation construct” (p. 24).
Evidence	This was supported by convergent validity evidence of the correlations among the three dimensions. The coefficients were $r_{sss,dss} = 0.68$ ; $r_{sss,gs} = 0.69$ , and $r_{dss,gs} = 0.80$ , $p < 0.01$ .
Hypothesis 3	“All else being the same, the amounts of nonlocal supply-side, demand-side, and geographic search exhibit a positive relationship with innovativeness” (p. 24).
Evidence	This hypothesis was supported by the evidence with a beta slope of 0.35, $p < 0.01$ , effect size $r = .500$ of the interaction term in the regression equation. The interaction term was specified as Exploration–Exploitation (supply-side and demand-side and geographic search).
Hypothesis 4	Firms that simultaneously pursue exploration and exploitation will have higher level of performance than those that focus primarily on one or the other of these strategies.
Evidence	Not supported by the evidence. The interaction term of exploration and exploitation is not significant.

### **Market Orientation and OA (Atuahene-Gima, 2005)**

Atuahene-Gima (2005) asserts the benefits of exploitation crowd out benefits of exploration. This happens because successes of exploration are uncertain and more distant than those associated with exploitation (Atuahene-Gima, 2005). Atuahene-Gima (2005) uses the resource-based view (RBV) of the firm and marketing theory to specify relationships between market orientation, EE, and incremental and/or radical innovations. Atuahene-Gima (2005) depicts market orientation as consisting of customer orientation and competitor orientation. These two features prevent exploitation focus from overwhelming exploration focus and allow simultaneous enactment of incremental and radical innovations. In Atuahene-Gima’s (2005) study, EE are two separate orthogonal constructs and are antecedents to EE competence.

The Atuahene-Gima (2005) sampling frame consisted of 1,650 electronics firms in the Guangdong province of China, resulting in a random sample size of 500 firms. Appointments were scheduled with two key informants in each firm. At the appointment, the interviewer presented the questionnaire to the informants and collected it after

completion. This process resulted in 227 usable surveys; a response rate of 45.4% (Atuahene-Gima, 2005). Table 2.18 displays selected results from the study's findings.

*Table 2.18. Statistical Support for Selected Hypotheses (Atuahene-Gima, 2005)*

Hypothesis 1	“Customer orientation is positively related to (a) competence exploitation and (b) competence exploration” (p. 64).
Evidence	Supported by the evidence. For competence exploitation, $\beta = 0.13$ , $p < 0.05$ , effect size .529. For competence exploration, $\beta = 0.26$ , $p < 0.001$ , effect size .655.
Hypothesis 2	“Competitor orientation is positively related to (a) competence exploitation and (b) competence exploration” (p. 64).
Evidence	Supported by the evidence. For competence exploitation, $\beta = 0.16$ , $p < 0.05$ , effect size .529. For competence exploration, $\beta = 0.16$ , $p < 0.001$ , effect size .655.
Hypothesis 3	“Competence exploitation is (a) positively related to incremental innovation performance and (b) negatively related to radical innovation performance” (p. 65).
Evidence	Supported by the evidence. For incremental innovation performance, $\beta = 0.16$ , $p < 0.05$ , effect size = 0.591. For radical innovation performance, $\beta = -0.14$ , $p < 0.05$ , effect size = .640.
Hypothesis 4	“Competence exploration is (a) negatively related to incremental innovation performance and (b) positively related to radical innovation performance” (p. 65).
Evidence	Supported by the evidence. For negative relation to incremental innovation performance, $\beta = -0.14$ , $p < 0.01$ , effect size .591. For positive relation to radical innovation, $\beta = 0.14$ , $p < 0.05$ , effect size .640.

### **OA and Customer Capital (Cegarra-Navarro & Dewhurst, 2007)**

Cegarra-Navarro and Dewhurst (2007) studied the relationship of EE as antecedents to ambidexterity, and relationship of ambidexterity to customer capital. They define customer capital as “the contributions to current and future revenues that result from an organization’s relationship with its customers” (p. 1720). They view EE as “neither independent nor autonomous, but they are continually interacting” (p. 1722). The study sample consisted of 885 small and medium-sized companies in the optometry and telecommunications industry sectors in Spain. Their survey instrument had high reliabilities and validities. A total of 269 usable surveys were completed; a response rate of 30%. Structural equation modeling methods were used to specify models that best fit the data. Findings from their study are presented in Table 2.19.



*Table 2.19. Statistical Support for Hypotheses (Cegarra-Navarro & Dewhurst, 2007).*

Hypothesis 1	“Knowledge exploitation is positively related to ambidexterity context (AC)” (p. 1723).
Evidence	Supported by the evidence. Significantly positively related at $p < 0.10$ .
Hypothesis 2	“Knowledge exploration is positively related to AC” (p. 1723).
Evidence	Supported by the evidence. Significantly positively related at $p < 0.01$ .
Hypothesis 3	“Size is positively related to AC” (p. 1723).
Evidence	Not supported by the evidence. Size was insignificantly related to AC.
Hypothesis 4	“Sector is positively related to AC” (p. 1723).
Evidence	Supported by the evidence. Significantly positively related to AC at $p < 0.05$ .
Hypothesis 5	“Ambidexterity context (AC) is positively related to customer capital” (p. 1723).
Evidence	Supported by the evidence. Significantly positively related to customer capital at $p < 0.01$ .

### **OA and Behavioral Integration of Top Leaders (Lubatkin et al., 2006)**

Lubatkin et al. (2006) theorize the firm’s level of OA is directly related to behavioral integration of its TMT. TMT behavioral integration consists of collaborative behavior, communication, and joint decision making. Lubatkin et al. (2006) investigate relationships between TMT behavioral integration and firms’ OA levels. Next, they explore relationships of firm level OA to firm performance. The researchers believe EE are orthogonal constructs because they “entail contradictory knowledge processes” (p. 648). Lubatkin et al. (2006) uniquely explain EE, declaring “exploitation entails largely formalized interactions between levels of management, exploration entails intensely sociopolitical interactions that, because they are influenced by where managers reside in the organization’s hierarchy, may cause managers to perceive the need to adapt differently” (p. 649).

Lubatkin et al.’s (2006) sampling frame consisted of 795 small-to-medium-sized (SME) firms in one area of New England. Survey instruments were given to firms’ CEOs. The CEOs were asked to distribute the survey to all the firm’s TMT members. The final research sample included 154 firms and 405 of the firms’ TMT members. The

sample contained manufacturing, scientific and technical services, and construction companies. Lubatkin et al. (2006) proposed two hypotheses and used structural equation modeling to specify models that best fit the data. Findings from their study are presented in Table 2.20.

*Table 2.20. Statistical Support for Research Hypotheses (Lubatkin et al., 2006)*

Hypothesis 1	“The level of behavioral integration of TMTs in SMEs is positively associated with the extent to which they pursue an ambidextrous orientation” (p. 652).
Evidence	Significantly supported by the evidence.
Hypothesis 2	“The extent to which SMEs pursue an ambidextrous orientation is positively associated with their subsequent relative performance” (p. 653).
Evidence	Significantly supported by the evidence.

### **OA and Interorganizational Relationships (Im & Rai, 2008)**

Im and Rai (2008) studied OA in long-term interorganizational relationships (IOR). They proposed a model whereby ‘contextual ambidexterity’ (organization design) and ‘ontological commitment’ (information technology design) are the antecedents for exploratory knowledge sharing (KS) and exploitative KS. Exploratory and exploitative KS are positively and directly related to relationship performance. Table 2.21 presents definitions of these constructs. Figure 2.9 presents a modified version of Im and Rai’s (2008) model of Knowledge Sharing Ambidexterity in Long-Term IORs.

*Table 2.21. Definitions for Im and Rai's (2008) Constructs*

Relationship Performance	“The extent to which the partners consider their relationship worthwhile, equitable, productive, and satisfying” (p. 1282).
Relational Performance in a Long-term partnership	“A composite of aspects of efficiency, effectiveness, and service quality: reduction in operational costs, adherence to service levels for operations revenue gains, and speed with which orders are fulfilled and new products are introduced” (pp. 1282-1283).
Exploratory KS	“The exchange of knowledge between firms in a long-term relationship to seek long-run rewards, focusing on the survival of the system as a whole, and pursuing risk-taking behaviors” (p. 1283).
Exploitative KS	“The exchange of knowledge between firms in a long-term relationship to seek short-run rewards, focusing on the survival of the components of the system and pursuing risk-averse behaviors” (p. 1283).
Contextual Ambidexterity	“The behavioral capacity of a long-term relationship to allow for the simultaneous pursuit of alignment and adaptability” (p. 1284).
Ontological Commitment	“The reliance of partnering firms on digital boundary objects to span their knowledge boundaries. An example of this is “the industry standards that were developed for electronic business interfaces (SEBI) to enhance the exchange of collaborative information between supply chain partners” (p. 1285).

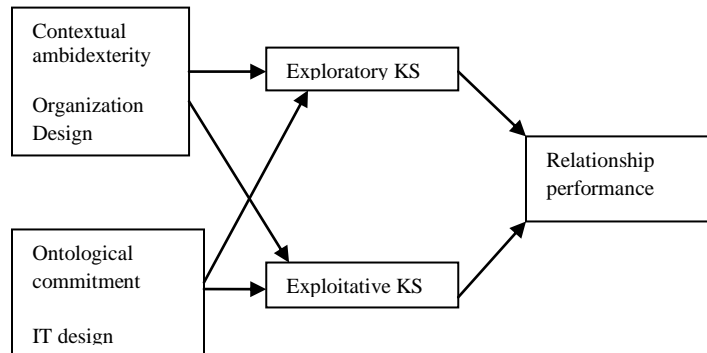


Figure 2.9. Knowledge Sharing Ambidexterity in Long-Term Interorganizational Relationships. Reprinted with permission (Appendix A). Im, G., & Rai, A. (2008). Knowledge sharing ambidexterity in long-term interorganizational relationships. *Management Science*, 54(7), p. 1283.

Im and Rai (2008) conducted their study in the United States’ logistics industry. The unit of analysis was a business unit of a supply chain solutions vendor and its long-term customers. An online survey was used to collect data. The researchers obtained a response rate of 10% from customers, with a final usable sample of 238 completed

customer surveys. They obtained a response rate of 47% from the supply chain vendor, with a final usable sample of 76 completed vendor surveys. This was a complex study because variables were operationalized with many reflective and formative measures. Findings from the study indicated support for some relationships on the vendor side that were not supported on the customer side. Selected findings of Im and Rai's (2008) study are presented in Table 2.22.

*Table 2.22. Findings from Im and Rai's (2008) Study*

Hypothesis 1	"The greater the exploratory KS in a long-term IOR, the greater the relationship performance." (p. 1283).
Evidence	Supported at the customer level, not supported at the vendor level.
Hypothesis 2	"The greater the exploitative KS in a long-term IOR, the greater the relationship performance" (p. 1283).
Evidence	Supported at both customer and vendor level.
Hypothesis 5	"Long-term relationships with a simultaneous emphasis on explorative KS and exploitative KS exhibit smaller intragroup variation in relationship performance, relative to their mean values of performance, than relationships with an emphasis on explorative KS" (p. 1284).
Evidence	Supported at the customer level, not tested at vendor level.
Hypothesis 6	"Long-term relationships with an emphasis on explorative KS exhibit larger intragroup variation in relationship performance, relative to their mean values of performance, than relationships with an emphasis on exploitative KS" (p. 1284).
Evidence	Supported at the customer level, not tested at vendor level.
Hypothesis 7	"The greater the contextual ambidexterity in an IOR, the greater the exploratory KS in the relationship" (p. 1284).
Evidence	Supported at both customer and vendor level.
Hypothesis 8	"The greater the contextual ambidexterity in an IOR, the greater the exploitative KS in the relationship" (p. 1284).
Evidence	Supported at both customer and vendor level.
Hypothesis 9	"The greater the ontological commitment in an IOR, the greater the explorative KS in the relationship" (p. 1285).
Evidence	Supported at the customer level, not supported at the vendor level.
Hypothesis 10	"The greater the ontological commitment in an IOR, the greater the exploitative KS in the relationship" (p. 1285).
Evidence	Supported at both customer and vendor level.

### **OA and Alliance Formation (Lavie & Rosenkopf, 2006)**

Lavie and Rosenkopf (2006) studied how companies balanced EE in alliance formation decisions. Whereas previous OA studies explored EE in a single domain, Lavie and Rosenkopf (2006) added three more domains of EE: function, structure, and attribute. The function domain is the value chain. The structure domain is the network

position of partners. The attribute domain is the network profile of partners. EE is described according to each domain in Table 2.23.

*Table 2.23. Description of EE According to Lavie and Rosenkopf's (2006) Three Domains*

Structure Exploration	“Alliances formed with new partner” (p. 799).
Structure Exploitation	“Recurrent alliances between firms” (p. 799).
Function Exploration	“Firms that engage partners in research and development (R&D) that may lead to innovative technologies and applications” (p. 799).
Function Exploitation	“Firms that rely on alliances for commercializing and using existing technologies or employing complementary partner capabilities” (p. 799).
Attribute Exploration	“Deviation from a systematic pattern of alliance formation with partners that share certain organizational attributes” (p. 800).
Attribute Exploitation	“Persistent formation of alliances with partners similar to its prior partners, allowing repetition-based improvement, experiential learning, and specialization” (p. 800).

Lavie and Rosenkopf (2006) designed their study to be a pooled time series longitudinal analysis of alliances formed by United States software firms. The time frame for the study stretched from 1990 to 2001 with a five-year look-back to 1985 for historic alliance evidence. “The sample size ranged between 972 and 1,942 firm-year observations due to operationalization of measures and missing values” (Lavie & Rosenkopf, 2006, p. 807). Lavie and Rosenkopf (2006) conclude:

At any time within a given domain, a firm may emphasize either exploration or exploitation, yet across domains and over time, balance is maintained. By recognizing the evolutionary dynamics and multiple facets of exploration and exploitation, our study bridges the gap between the normative assumption that firms should strive to balance exploration and exploitation and the observation that in practice firms demonstrate polar temporal tendencies to explore or exploit in certain domains (p. 815).

### **Current State of OA Knowledge Supported by Empirical Evidence**

This chapter has presented reviews of six OA case studies and 15 representative empirical OA studies noted for their foundational influence. What is the state of the

knowledge in this field and what notions of OA are supported by evidence? The answer comes from sorting through studies on the topic and discovering compelling evidence.

We have compelling evidence to contradict March's (1991) initial view of OA as a bipolar construct made up of EE, and his recommendation that firms should find ways to balance the two. We now know OA is made up of EE, two separate constructs, requiring different thinking, practices, and processes. Therefore, they cannot be balanced. Instead, companies should try to practice EE as much as they can at the same time. Whether one business unit in a company practices exploration and another engages in exploitation, as long they do it at the same time it is ambidexterity.

We know that a paradoxical lens is helpful in understanding what OA is and how it works. A paradox by definition is synthesis that occurs when two conflicting ideas are held at the same time. We know organizations are inherently paradoxical and context-laden. This simultaneity of opposites is the taproot of OA. If so, then cyclical, contextual, reciprocal, temporal, and structural versions of OA are incorrect. This is not to say there are no cyclical, contextual, reciprocal, temporal, or structural characteristics and processes that apply to organizations – there are. It's just they are not OA. We have been living in the 'Age of Everything Containing Exploration and Exploitation Must be Some Form of Organizational Ambidexterity.' The data reveal this 'Dark Age' is over. The 'Age of Everything Containing Exploration and Exploitation Need Not be Ambidextrous' has now begun. Welcome to the New Age.

Although March (1991) described OA as a firm-level construct, there is now compelling evidence to support the notion OA occurs at individual, team, and interorganizational levels as well. March (1991) proposed ambidextrous firms ought to

have better financial performance than non-ambidextrous firms, and we now have compelling evidence to support this proposition. We know there is a strong link between ambidexterity and firm performance at both the business unit and organization level of analysis.

Whereas March (1991) did not suggest a way to measure ambidexterity in organizations, we now know how to compute OA scores. Compelling evidence supports the subtractive approach (the absolute difference between the exploration and exploitation scores) as the method with the least explanatory power. The multiplicative method (exploration \* exploitation) has more explanatory power, but the additive method (exploratory + exploitation) has the highest level of explanatory power.

We also know that ambidexterity influences and is influenced by other variables. Organizations must adapt to internal and external environmental influences. For example, we have strong evidence to support the interaction between organization decentralization (internal environment) and a highly dynamic external environment is correlated with OA. We have strong evidence that interaction between exploratory innovation and environmental dynamism is related to financial success. We have strong evidence that interaction between exploitation and environmental competitiveness is also related to financial success. This means that in a dynamic (unpredictable) environment, explorative innovation is more highly related to financial performance than is exploitative innovation. It also means that in a competitive but non-dynamic environment, exploitation is more likely to result in financial success than is exploration. Although there is conflicting evidence over the role organization size plays in relation to OA, we do know both small and large companies who have access to resources have higher levels of

ambidexterity and higher financial performance than firms of any size without those resources.

We know leadership is connected to OA. The Jansen et al. studies and others provide strong evidence that TMT behavioral integration and actions are linked to OA. There is also compelling evidence supporting the linkage between transformational leadership style and OA.

Finally, we know context is important for understanding and achieving business success (Astley, 1985; Bamberger, 2008; Rousseau & Fried, 2001). A supportive organizational context provides an environment where OA can flourish. There is now strong evidence that performance management and social support are linked to OA and OA is linked to financial performance.



## **CHAPTER 3: METHOD**

This study was designed to provide evidence for what OA is and how it works by (1) developing a conceptual framework of what OA is, (2) depicting a theoretical model of how OA works, (3) developing an instrument to measure OA in hospitals, and (4) testing the instrument in a pilot study with two hospitals in Colorado. This chapter presents the paradigmatic basis for this research and details the plan, design, and procedures used in the pilot study. The philosophic foundation guided research design and methods. This in turn helped answer research questions, provided evidence to support study hypotheses, and provided a ‘test run’ of the survey instrument before its use nationally by the researcher.

### **Critical Realist Paradigm**

This study used the critical realist paradigm (Van de Ven, 2007). Van de Ven (2007) defines critical realism as a “philosophical movement characterized by the existence of a mind-independent reality, and the ability of a theory to capture partial aspects of reality” (p. 39). According to Guba (1990), a paradigm is defined as “a basic set of beliefs that guides action” (p. 17). Metaphysics – ontology, epistemology, axiology, methodology, and teleology – form the backbone of any paradigm. Therefore, to understand a paradigm, one must understand its metaphysical components.

### **Ontology**

Ontology is “the study of the origin, nature, and constitution of reality” (Van de Ven, 2007, p. 299). Critical realists have an objectivist probability worldview (Denzin &

Lincoln, 2005; Van de Ven, 2007). “Critical realism views science as a process of constructing models that represent or map intended aspects of the world, and comparing them with rival plausible alternative models” (Van de Ven, 2007, p. 14). This perspective’s ontology may be summarized as “there is a real world out there (consisting of material, mental, and emergent products), but our individual understanding of it is limited” (Van de Ven, 2007, pp. 37-38).

### **Epistemology**

Epistemology is defined by Van de Ven (2007) as “the study of nature and scope of knowledge or the theory of knowledge” (p. 298). The epistemology of the critical realist paradigm is subjectivist. Whether explicit or implicit, “all facts, observations and data are theory-laden – social sciences have no absolute, universal, error-free truths or laws as any scientific knowledge” (Van de Ven, 2007, p. 38). In this vein, “there is no predefined or predetermined methodology or criteria to judge the veracity of our knowledge” (Van de Ven, 2007, p. 39).

### **Axiology**

Heron and Reason (1997) define the axiological question as “what is intrinsically worthwhile, what is it about the human condition that is valuable as an end in itself” (p. 286). Lincoln and Lynham (2009) define axiology as “how we ought to act in acquiring, accumulating, and applying knowledge” (p. 5). In a critical realist paradigm “no form of inquiry can be value-free and impartial; each is value-full” (Van de Ven, 2007, p. 38).

## **Methodology**

Lincoln and Lynham (2009) define methodology as “how knowledge is acquired and accumulated” (p. 5). From the critical realist perspective, it is wise to use multiple perspectives to know or come to know a complex reality (Van de Ven, 2007).

## **Teleology**

Lincoln and Lynham (2009) define the teleological question as “to what end ought we to apply knowledge” (p. 5). A critical realist perspective foregrounds the accumulation of knowledge to provide better and more comprehensive solutions to problems (Van de Ven, 2007). Problem solving is the goal of science. Chermack (2008) argues that a problem (rather than ideology) orientation is useful in an applied field like HRD.

### **Theory-Building Research Design and Rationale**

Building upon the literature review discussed in Chapter Two, inductive reasoning methods were used to specify a theory of OA. The rationale for these methods was provided by Lynham’s (2002) *general method* (Figure 1.3, p. 10). The *general method* is widely discussed and well-accepted in the literature and inductive reasoning is consistent with the critical realist paradigm, the HRD perspective, and the *general method*. This allowed the researcher to classify and describe the elements of the theory. As noted by Van de Ven (2007) “concept formation and theory formation in science go hand in hand” (p. 116). The theory of OA tells ‘what OA is’; and the theoretical model of OA explains ‘how OA works.’

## Conceptual Development: Answers to Research Questions 1 - 4

### Key Elements of Proposed OA Theory

#### 1. Exploration

- a. **Definition.** A strategic focus on needs of future customers.
- b. **Description.** Implies variation rather than reliability, novel search and expansive environmental scanning rather than close search and restricted environmental scanning, production of new knowledge rather than extension of current knowledge, radical or discontinuous innovation as opposed to continuous change, and alternative possible futures versus a known outcome.

#### 2. Exploitation

- a. **Definition.** A strategic focus on needs of current customers.
- b. **Description.** Implies reliability over variation, close search and restricted environmental scanning as opposed to expansive search and environmental scanning, extension of what is currently known rather than what could be known, continuous change over radical innovation, and one known outcome as opposed to multiple alternate futures.

#### 3. Paradox

- a. **Definition.** Two opposites occurring simultaneously.
- b. **Description.** Implies temptation to resolve the paradox by choosing one opposite over another or trying to balance different degrees of both opposites as if on a see-saw. Here it means the holding together of the two opposites simultaneously, allowing the tension of doing so to spill over into creativity, insight, innovation, and increased energy.

#### 4. Organizational Ambidexterity (OA)

- a. **Definition.** The simultaneous pursuit of exploration and exploitation (EE), within or between individuals and business units at the micro level and/or within or between organizations (intra/inter) at the macro level. OA is thus a multi-level paradoxical construct that results in

greater creativity, insight, quality, innovation, energy, and problem-solving for any organizational level that engages in it.

- b. **Description.** The paradoxical nature of OA occurs from simultaneous bonding together of strategic components EE. This results in flows or wellsprings of knowledge across multiple contradictory structures, processes, individual and group competencies and behaviors, social contexts, and organization culture within or between those units and/or organizations.
- c. **Examples:** OA occurs when one business unit in the same organization is explorative and another is exploitative at the same time. Or, when one organization is explorative and another exploitative within the same organization system at the same time, the result is OA. OA occurs in teams when one part of the team is explorative and the other part is exploitative. OA occurs in different combinations and structures.

## 5. Wellsprings of Knowledge

- a. **Definition.** Knowledge is the main engine for the creation, growth, and development of new products, processes, and services (Leonard, 1995). Wellsprings reflect the different sources of knowledge that are selected, accessed, championed, channeled, and directed to all parts of an organization to catalyze and sustain such growth.
- b. **Description.** According to Leonard (1995):
  - ...a wellspring, the source of a stream, sustains life within and beyond the riverbanks or, by becoming dammed up or polluted, denies its existence....As flows of water from such wellsprings feed the biological systems around them, so in the same way, flows of appropriate knowledge into and within companies enable them to develop competitively advantageous capabilities (p. xiii).

## 6. Mental Models

a. **Definition.** Mental models are referred to as ‘mindsets’ (Pfeffer, 2005). Mindset derives its history from the combination of the noun ‘mind’ and the verb ‘set’ (Online Etymology Dictionary, n.d.). Historically, mindset was known as “habits of mind formed by previous experience (Online Etymology Dictionary, n.d.). A more current definition of mindset includes the notions of attitude, disposition, mood, intention, or inclination” (Dictionary.com, n.d.).

b. **Description.** According to Chermack (2004):

.... mental models are the lenses through which we see the world. Mental models incorporate our experiences, learning, biases, values, and beliefs about how the world works. Mental models embody how individuals see the world, how individuals know and think about the world, and how individuals act in the world. Furthermore, as a result of action and learning, mental models are altered, leading to different ways of seeing the world, knowing and thinking about the world, and again, acting in the world. Mental models are constantly being adjusted, refined, and re-created in dynamic and ever-changing environments (p. 306).

### How the Key Elements of Proposed OA Theory Inter-relate

Exploration and exploitation are two separate strategic intents bonded together in creative tension to form OA in organizations. These paradoxical intents inform companies’ customer orientation so they may focus on needs of current customers while simultaneously planning for needs of future customers. This relationship is clear – if revenue streams are not generated by today’s customers a company will not survive long enough to worry about the future. However, companies must avoid falling into the rigidity trap (Leonard, 1995) of complacency.

Today’s global environment is a showcase of chaos, turbulence, and volatility which carry over into the business environment. Today’s successes become tomorrow’s failures if companies do not enlarge their products, services, and processes. A reactionary

stance toward current market pressures contributes to low levels of OA. Low levels of innovation decrease OA and produce a vicious cycle, defined as a “reinforcing loop of failure” (Akkermans et al., 1999, p. 570). Companies that focus only on current processes and incremental improvement and those that rely solely on radical innovation and long range strategy are examples. They demonstrate low levels of OA which in turn results in poor financial performance and produces poor earnings growth and low sustainability. Poor earnings growth lowers firm sustainability and leads to a further short-term focus at the expense of radical innovation (or a long-term focus at the expense of incremental improvement) and the spiral (vicious cycle) continues downward.

OA offers companies the opportunity to engage in a virtuous cycle. Virtuous cycles occurring within organizations are antonymous to vicious cycles and have been described by Feller (2004), Ranis and Ramirez (2000), and Vlaar, Van den Bosch, and Volberda (2007). A virtuous cycle is a mutually reinforcing upward spiral of events, or a “reinforcing loop of success” (Akkermans et al., 1999, p. 570). The virtuous cycle of OA begins when companies embrace the exploration/exploitation (OA) paradox to create sustainable wellsprings of knowledge that translate into changed mental models, increased organization expertise in satisfying current and future customers, earnings growth, and firm sustainability. Strong earnings growth and firm sustainability in turn produce increases in OA and the cycle begins again.

### **What Explains the Interdependence of the Elements?**

The two elements of OA are not interdependent. They are separate and unequal, requiring different types of thinking and acting. Exploration and exploitation are both necessary; one is yin, the other yang. OA is dependent on the coming together (bonding)

of the two opposite elements. OA leads to wellsprings of knowledge that stream throughout the organization to grow fruits of incremental improvement and novel innovations, enabling the firm to generate short and long term financial success.

### **General Limitations or Conditions for the Proposed OA Theory**

The only requirement for formation of OA as defined in this research is that exploration and exploitation occur simultaneously. Exploration can be practiced independent of exploitation and vice versa, but such practice is not OA. Exploration can occur before or after exploitation and vice versa, but this is also not OA. Notions of structural OA, contextual OA, knowledge-sharing OA, reciprocal OA – these and others of similar ilk represent different concepts attesting to confusion in the field. These notions were not applicable to elements of OA theory described here and were beyond the scope of this research.



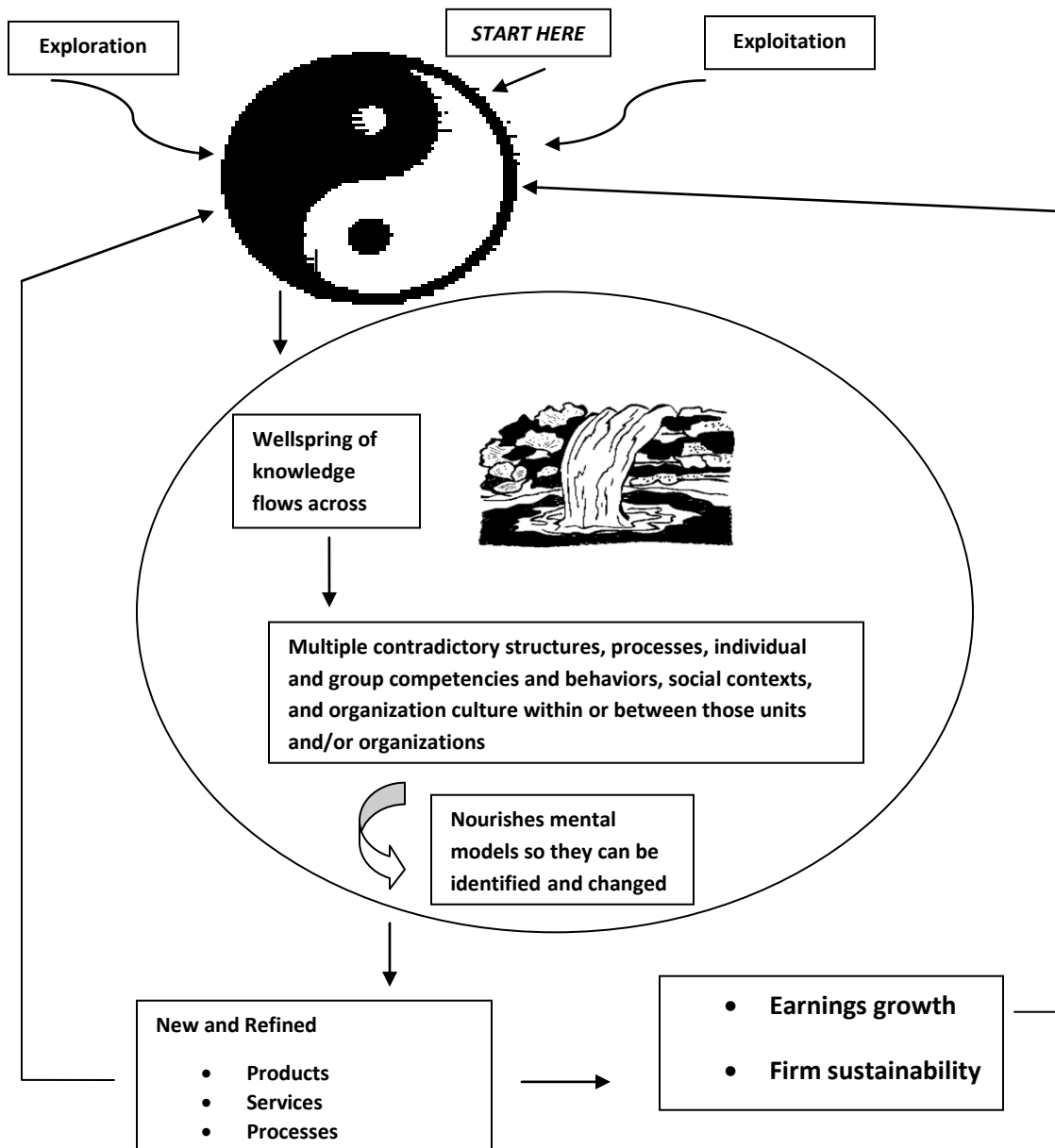


Figure 3.1. Theoretical Model of Organizational Ambidexterity

- A. The yin and yang of exploration and exploitation bond together simultaneously to form the paradoxical OA symbol.
- B. OA enables wellsprings of knowledge flows, leading to
- C. identification and changing of mental models, leading to
- D. new and refined products, processes, services, resulting in
- E. earnings growth and firm sustainability.
- F. New and refined products, processes, and services re-energize firms to increase OA, creating a virtuous cycle.
- G. Earnings growth and firm sustainability re-energize firms to increase OA, creating a virtuous cycle.

## **Operationalization: Answer to Research Question 1**

According to Lynham's (2002) *general method*, the operationalization phase of theory building research occurs when key elements and relationships specified in the conceptual development phase are used to form a theoretical framework or model of the phenomenon. Figure 3.1 depicts this model. Key elements and their relationships became the basis for the survey questionnaire items, in accordance with Hair, Black, Babin, and Anderson's (2010) observation that "a researcher operationalizes a construct by selecting its measurement scale items and scale type" (p. 637).

### **Instrument Development**

#### **Interviews**

Theory building research does not occur in a vacuum (Van de Ven, 2007). To develop a survey instrument that would measure OA, two hospital industry experts were interviewed. One expert was a national hospital consultant and the other a national hospital association executive. Both interviews were transcribed and analyzed for codes and themes (Miles & Huberman, 1994). Interview data were kept anonymous and member-checking techniques were used as needed for any questions regarding authenticity or trustworthiness of the data (Miles & Huberman, 1994). A telephone protocol developed by the researcher was used to guide the interview process (Appendix C). Each interview was conducted by the researcher, in accordance with Colorado State University (CSU) IRB approval (IRB ID 087-09H). See Appendix D.

The interviews consisted of each expert reviewing and evaluating currently used OA survey instruments. Each instrument had been published in major peer-reviewed journals. The industry experts reviewed the OA instruments of Atuahene-Gima, 2005;

Bierly and Daly, 2007; Cao et al., 2009; Gibson and Birkinshaw, 2004; He and Wong, 2004; Jansen et al., 2008, 2009; and Lubatkin et al., 2006 (Appendices E - K). Both experts agreed that language changes were needed. The changes they suggested were helpful in adapting the survey instruments above to increase their relevance in a hospital setting. Additionally, key concepts referring to hospitals' operating contexts emerged from interview data. These operational aspects - cost, quality, access to care, and revenue enhancement - were incorporated into survey development and added content validity to the project.

### **Survey Items**

Interviews culminated in the development of a new 24-item OA Hospital Survey. A one-to-five Likert-type rating scale of agreement was used. The items consisted of adaptations of survey items used by Bierly and Daly (2007), Gibson and Birkinshaw (2004), He and Wong (2004), Lubatkin et al. (2006), and Jansen et al. (2009). See Appendix L. The OA Hospital survey consisted of eight items for the explanatory variable exploration and seven items for the explanatory variable exploitation. An additional eight items provide self-reported data on financial performance, the outcome variable. Inductive and hypothetico-deductive reasoning methods were used to ensure each statement on the survey linked well to each research question and hypothesis. These reasoning methods are consistent with the critical realist paradigm, which specifies one method is not better than another in research studies. See Appendix M for a researcher-coded copy of the OA Survey.

## **Survey Length**

An important factor for success in survey research is length of the survey. Time is especially important to busy hospital executives. Short surveys translate to high response rates. To test how long the survey would take for respondents to complete, surveys with similar but not identical survey items were administered to 11 members of the Academy of Human Research Development (AHRD) present at the February 2010 National AHRD Conference in Knoxville, Tennessee. This was done after obtaining CSU IRB approval (IRB ID 008-10H). See Appendix N. After each participant was given the consent form and survey, on-site observations revealed it took each of them no longer than ten minutes to complete.

## **Validity**

Validity is the term used by many to answer the question of whether a survey or test instrument measures the things it intends to measure. Validity is defined by the AERA Research Standards (1999, p. 9) as “the degree to which evidence and theory support the interpretations of test scores” (cited in Gliner, Morgan, & Leech, 2009, p. 166). The Standards (1999) give the nod to evidence categories that support validity. Three categories used by the researcher were (1) evidence based on content; (2) evidence based on response processes; and (3) evidence based on internal structure.

### **Content Validity**

Strong evidence for content validity was obtained by interviewing two hospital industry experts to ensure the wording of the survey items would be understandable to hospital executives. This process was used to contextualize the survey instrument. The wording and descriptors they suggested were incorporated into the Hospital OA Survey

Questionnaire. There was a small space on the survey questionnaire for respondents to note their questions or comments. There were no comments indicating respondents misunderstood any of the terms on the survey. Additionally, the survey took only a short time to complete where the opposite would be expected if respondents were having trouble understanding terms.

### **Response Process Validity**

Evidence based on response processes were obtained by ensuring completely anonymous responses to surveys. Each Hospital ‘A’ respondent answered the survey on their own computer station which encrypted their answers and sent them electronically to the researcher. Each Hospital ‘B’ respondent answered their paper survey individually in their own offices. There were 37 respondents which made it impossible to link a particular survey to a specific person. Privacy, respondent autonomy, and presence of electronic encryption protected against social desirability response influence.

### **Internal Structure Validity**

#### **Factor Analysis**

Gliner, Morgan, and Leech (2009) explain “factor analysis can provide evidence based on internal structure when a construct is complex and several aspects (or factors) are measured” (p. 168). Factor analysis is defined as a group of analytic statistical methods that sort measured or observed scores into latent or unobservable variables. There are a variety of factor analysis methods available to analyze data. Choice of method depends on the purpose of the research. In this case the survey questionnaire was constructed from prior theory and research in conjunction with interview data from two industry experts. Survey items focused on measured scores (summated scales). These

scores indicated variables exploitation, exploration, OA, financial performance, and quality.

In contrast to factor analytic methods used for purposes of data reduction, factor analysis was used here to evaluate validity of measured scores on an already-developed instrument, which is appropriate according to Thompson (2004). Thompson (2004, p. 5) cites Gorsuch (1983, p. 350) who noted “a prime use of factor analysis has been in the development of both the operational constructs for an area and the operational representatives for the theoretical constructs.” In this way, ‘factorial validity’ is able to address questions of construct validity, defined as the extent to which “variables actually measure the constructs of interest” (Vogt, 2005, p. 58).

### **Products of Exploratory Factor Analysis (EFA)**

EFA produces both pattern and structure coefficients which should be examined in all studies (Thompson, 1997). Distinguishing between the two, Thompson (2004) explains that pattern coefficients are the weights applied to the measured variables to obtain latent score values. Floyd and Widaman (1995) describe these factor ‘loadings’ as “regression weights for predicting the measured variables from the latent variables” (p. 287). Thompson (1997) notes further that “pattern coefficients are not necessarily correlation coefficients and need not range only between -1 and +1” (p. 7). Courville and Thompson (2001) define a structure coefficient ( $r$ ) as “the bivariate correlation between a given predictor variable and the synthetic variable, predicted Y or E(Y)” (p. 231). This is usually reported as a matrix of associations composed of the Pearson product-moment bivariate correlation between measured variables and composite or latent factors. Edwards and Bagozzi (2000) propose the “nature and direction of relationships between

constructs and measures have been discussed in the literature on construct validity” (p. 155). They explain further:

In this literature, constructs are usually viewed as causes of measures, meaning that variation in a construct leads to variation in its measures (Bollen, 1989). Such measures are termed reflective because they represent reflections, or manifestations, of a construct (Fornell & Bookstein, 1982). Reflective measurement underlies classical test theory (Lord & Novick, 1968), reliability estimation (Nunnally, 1978), and factor analysis (Harman, 1976; Kim & Mueller, 1978), each of which treats a measure as a function of a latent variable (i.e., a construct) plus error (p. 155).

### **Principal Components Analysis (PCA)**

Thompson (2004) asserts there are many ways to extract factors via EFA, but two methods are most common; principal components method and principal axes methods. Thompson (2004) further describes the past 30 years of polarized debate on the subject as resulting in no consensus as to whether the principal components method is better than the principal axes method or vice versa. Thompson (2004) does note the two methods are ‘increasingly similar.’ Exploratory Factor Analysis (EFA) expresses the variance shared among  $n$  observed variables as a function of  $p$  underlying common factors, whereas “component analysis represents the total variance of a set of observed variables in an economical reduced-dimensional form” (Widaman, 1993, p. 268). Tabachnick and Fidell (2007) posit PCA differs from factor analysis mathematically with respect to the variance that is analyzed, noting “PCA analyzes variance; factor analysis analyzes covariance (communality) (p. 635).”

PCA was used in this study because it “comprises the most commonly used set of procedures in analyses of data in published research” (Widaman, 1993, p. 306). Hair et al. (2010) confirm factor loadings have much larger standard errors than do typical correlations. As a result they recommended evaluation of loadings be held to stricter

levels. To this end Hair et al. (2010) proposed guidelines for identifying significant factor loadings taking into account (1) higher standard error values, (2) the need for a high power level (80%), and (3) the need for a .05 level of significance ( $p < .05$ ). This is shown in Table 3.1. Zwick and Velicer (1986) contend “a minimum of at least three significant loadings are required for factor identification” (p. 432).

*Table 3.1. Guidelines for Identifying Significant Factors*

Factor Loading	Sample Size Needed for Significance
0.30	350
0.35	250
0.40	200
0.45	150
0.50	120
0.55	100
0.60	85
0.65	70
0.70	60
0.75	50

Factor Loadings Based on Sample Size.  
 Reprinted with permission from Hair et al. (2010), p 117.

## Factor Rotation

PCA also allows for rotation of factors. Hair et al. (2010) explain:

Unrotated factor solutions extract factors in the order of their importance, with the first factor being a general factor with almost every variable loading significantly and accounting for the largest amount of variance. The second and subsequent factors are based on the residual amount of variance, with each accounting for successively smaller portions of variance (p. 149).

Rotation “tends to redistribute the location of variance within the solution” (Thompson, 2004, p. 41). Factor rotation yields a ‘simple structure’ or one that is interpretable (Cureton & D’Agostino, 1983). “Orthogonal rotations constrain factors to be uncorrelated” (Fabrigar, Wegener, MacCallum, & Strahan (1999, p. 281). Varimax orthogonal rotation is the most commonly used method in published research and was the



rotation method used in this study (Hair et al., 2010). Tabachnick and Fidell (2007) indicate the benefits of rotation are to improve the interpretability of the solution rather than to assess the fit of a particular model. They explain:

The goal of varimax rotation is to simplify factors by maximizing the variance of the loadings within factors, across variables. The spread in loadings is maximized – loadings that are high after extraction become higher after rotation and loadings that are low become lower. (p. 638)

## **Eigenvalues**

PCA provides eigenvalues for each component to help determine which factors should be retained (eigenvalue > one guide). Thompson (2004) defines eigenvalues as “statistics that characterize the amount of information presented in an unrotated given factor or function” (p. 179). Although the eigenvalue > one guide is the most commonly used benchmark to extract factors, Hair et al. (2010) caution “if the number of variables is less than 20, the tendency is for this method to extract a conservative number of factors (too few)” (p. 109). MacCallum (2009) agrees the eigenvalue > one guide “performs poorly as a rule of thumb (p. 129) and recommends that if errors are going to be made in retaining factors it is best to err on the side of retaining more rather than less. Thompson (2004) adds the following key facts pertaining to eigenvalues.

1. The number of eigenvalues equals the number of measured variables being analyzed.
2. The sum of the eigenvalues equals the number of measured variables.
3. An eigenvalue divided by the number of measured variables indicates the proportion of information in the matrix of associations being analyzed that a given factor reproduces.
4. The sum of the eigenvalues for the extracted factors divided by the number of measured variables indicates the proportion of the information in the matrix being analyzed that the factors as a set reproduce. (p. 21).

## **Communality Coefficients**

PCA also provides communality coefficients for each unrotated principal component. A communality is defined by Thompson (2004) as “a statistic in a squared metric indicating how much of the variance in a measured variable the factors as a set can reproduce” (p. 179). Assessing communality values help the researcher determine how many factors to retain. Thompson (2004) explains “the communality coefficient for a variable is a ‘lower bound’ estimate of the reliability of the scores on the variable” (p. 20). If the communality coefficient is .40 (40%), reliability of scores on the variable are no lower than .40 (40%) and may be higher (Thompson, 2004). As a rule of thumb, Hair et al. (2010) recommend communality coefficients be greater than 0.50 for retained factors.

## **Confirmatory Factor Analysis (CFA)**

CFA is a theory-guided technique in which relationships and constructs specified by the researcher (based upon theory) are used to construct a model. CFA uses maximum likelihood to estimate parameter values. As such, CFA tests the fit of models to data (Thompson, 2004). It is one of the first steps in structural equation modeling (SEM), a topic that is beyond the scope of this research. Because no model can perfectly fit the data, it is recommended to test the fit of several different models in a CFA to determine which of them fit the data best. A larger sample size is required for CFA than EFA. Other differences between CFA and EFA are described by Hair et al. (2010).

EFA is a technique that searches for structure among variables by defining factors in terms of sets of variables. As a result, every variable has a loading on every factor. SEM (CFA) is the opposite of an exploratory technique, It requires that the researcher specify which variables are associated with each construct, and then loadings are estimated only where variables are associated with constructs (typically there are no cross-loadings). Exploratory factor analysis requires no

specification on the part of the researcher. In contrast, SEM (CFA) requires complete specification of the measurement model (p. 623).

Bandalos and Finney (2010) compare and contrast EFA and CFA.

Although these two methods both model the observed covariation among variables as a function of latent constructs, in EFA the purpose of such models is typically to identify the latent constructs or to generate hypotheses about their possible structures, whereas the purpose of CFA is to evaluate hypothesized structures of the latent constructs and/or to develop a better understanding of such structure (p. 93).

### **CFA Model Fit Statistics**

Thompson (2004) recommends four fit statistics be used to evaluate models and notes the statistics should corroborate each other. The first statistic to evaluate is the significance level of the chi-square test. Contrary to other statistical methods, a chi-square statistic that is not significant illustrates good fit of the model. Tabachnick and Fidell (2007) assert the ratio of the chi-square statistic divided by chi-square degrees of freedom should as a ‘rule of thumb’ be below 2.00 (p. 715). The second statistic is the Bentler and Bonnett *normed fit index* (NFI). Here, “models with NFIs of 0.95 or more may be deemed to fit reasonably well” (Thompson, 2004, p. 129). The third statistic is the *comparative fit index* (CFI). Thompson (2004) argues “statistics around 0.95 indicate reasonable model fit (p. 130). The last statistic to determine adequacy of model fit is the root-mean-square error of approximation (RMSEA). Values of the RMSEA should be small. Thompson (2004) explains “values of roughly 0.06 or less are generally taken to indicate reasonable model fit” (p. 130). Of note, these fit statistics were developed to evaluate models built with maximum likelihood (ML) estimators (Nye & Drasgow, 2010). ML estimation was used in the multilevel analysis discussed in Chapters Four and Five. The pilot study used ordinary least squares (OLS) estimation.

## **External Validity**

The pilot study adhered to Gliner et al.'s (2009) guidance for attaining external validity. They contend "external validity consists of population external validity and ecological external validity" (2009, p. 131). External validity is also a result of sampling techniques used and refers to how the study can be generalized to a larger population.

### **External Ecological Validity**

The following factors affect a study's ecological external validity: "(1) naturalness of setting/conditions, (2) adequacy of rapport with testers/observers, (3) naturalness of procedures/tasks, (4) appropriateness of timing and length of treatment, and (5) extent to which results are restricted to a specific time in history" (Gliner et al., 2009, p. 129). The pilot study of OA demonstrated high ecological external validity for the following reasons. First, executives completed surveys in their own hospital environment which provided a naturalness of setting. Second, healthcare executives are used to taking surveys, and last, the survey instrument is brief and takes no longer than ten minutes to complete. For the pilot study Hospital 'A' executives completed surveys electronically and Hospital 'B' executives completed surveys and brought them to the hospital CEO's executive assistant. These methods of administration provided survey respondents with ease of completion.

### **External Population Validity**

The key question regarding population external validity is whether the actual sample participants are representative of the target population (Gliner et al., 2009). The pilot study had good representativeness because the respondents were hospital executives, but the sample was not random.

**Reliability**

Reliability is a form of consistency (Gliner, Morgan, & Leech, 2009). Cronbach's alpha is a correlation coefficient. It is measured by computing "the intercorrelations of items on a Likert-type scale and estimating the proportion of the variance in all the items that is accounted for by a common factor" (Vogt, 2005, p 71). Importantly, Cronbach's alpha here reflects the reliability of the population using the survey instrument; it is not an indicator of reliability of the instrument. Gliner et al. (2009) suggest that scores of .80 and above are acceptable for research, but that "it is common to see published journal articles in which one or a few reliability coefficients are below .70 but usually .60 or above" (p. 156). Table 3.2 is a summary of the validity and reliability of the Hospital OA Survey used in the pilot study.

**Table 3.2. Hospital OA Survey Instrument: Summary of Validity and Reliability**

Validity based on Content	(1) Instrument adapted from Bierly and Daly (2007), Gibson and Birkinshaw (2004), He and Wong (2004), Lubatkin et al., (2006), and Jansen et al. (2009). (2) Interviewed two hospital industry experts for their expertise in ensuring the survey contained terms hospital executives would understand.
Validity based on Internal Structure	(1) Cronbach's alpha for exploration = 0.851. (2) Cronbach's alpha for exploitation = 0.809. These alphas are consistent with the alphas obtained in all other empirical studies discussed in Chapter 2.
Validity from Factor Analysis (Exploratory = EFA; Confirmatory = CFA)	(1) EFA (PCA) was used to examine the validity of the financial performance, exploration, and exploitation scales. (2) A variety of different factor solutions were requested and compared . (3) CFAs were computed to check best fit of two different models (5-factor and 7-factor) to the data. (4) A variety of goodness-of-fit indices were used to evaluate the CFA models. (5) Two separate one way ANOVAs were run to evaluate the relationship between the explanatory variable OA and the outcome variables quality and finance. The ANOVAs found a direct positive relationship between OA and financial performance, and between OA and quality. Effect sizes for both equations were strong. Two multilevel models were run and also indicated direct positive relationships between OA and financial performance and OA and quality, albeit with smaller standard errors.
Sample Selection	(1) Respondents were hospital executives, representative of other hospital executives in other states. (2) Non-random selection of hospitals. (3) No random assignment to groups.
Reliability Type	(1) This instrument was adapted from previous successfully used instruments (see above). (2) Cronbach's alphas were high for each measured construct and corresponded well to Cronbach's alphas obtained in other OA studies.
Single Informant Bias & Common Method Bias	(1) Collected data from different sources at each hospital (strategy, quality, human resource directors).
Response Bias	(1) Response rate for this survey was high, indicating minimal response bias.
External Validity	(1) Population external validity - hospital executives functioned as respondents, similar and representative to hospital executives to be surveyed in the final study. (High validity) (2) There was non- random selection of hospitals and non-random assignment to groups (Low level validity). Population ecological validity – use of a questionnaire is “somewhat artificial” (Gliner, Morgan, & Leech, 2009, p. 129), but questionnaires were completed in natural work setting – a High level of validity.
Overall Validity/Overall Reliability	High/High

### **Relationship between Theoretical Constructs: Basic Regression**

If the newly developed Hospital OA Survey was to be useful, it had to detect the relationship between OA and financial performance, just as previous OA instruments had. The researcher also looked for a relationship between OA and quality. Regression analysis was the statistical method chosen to specify these relationships. The researcher ran two basic regression analyses on the pilot study data to determine beta weights for (1) the relationship between OA and quality (Y = Quality, X = OA); and (2) the relationship

between OA and finance ( $Y = \text{Finance}$ ,  $X = \text{OA}$ ). This was done to explain the data rather than to infer generalizations from the data to a larger population.

## **Background**

Regression is a set of procedures oriented toward finding the best straight line relationship to describe or explain how variation in an outcome (response, dependent) variable depends on variation in predictor (independent, regressor, or explanatory) variables. As such, regression is derived from the straight line equation  $Y = b + aX$ . Agresti and Finlay (2009) posit this equation gives us a deterministic model, where each value of  $X$  corresponds to a single value of  $Y$  (p. 314). But this equation is not enough to help in the social sciences where focus is usually people and processes. So we use a probabilistic model as the foundation of regression because it allows for variability in the values of  $Y$  at each value of  $X$ . This is fundamental to understanding what regression can actually do. Because these methods are not deterministic, causality cannot ever be proved. Regression can confirm or disconfirm an effect. By confirming an effect, regression provides compelling evidence to support causality but does not prove the truth of a claim.

The probabilistic equation is  $E(Y) = a + bX$ , which provides the mean or expected value of  $Y$  for all subjects in the population having a fixed value of  $X$ . The probabilistic model tells what the mean variation in  $Y$  is, conditioned on the value or function of  $X$ . This is conditional variability as opposed to marginal variability. It is the contrast between asking how much a specific factor in a sample or population varies (marginal) as opposed to asking how that factor varies conditioned or conditional on another factor.

Conditional distributions have less spread than marginal distributions. Exploring conditional variability is the “magic” of regression models.

Models are approximations of reality, not perfect representations. Some researchers go as far as to say “All models are wrong” (Box, cited in Berk, 2004, p.126). But the real test of a model is whether it is useful or not, whether it advances policy or scientific discourse (Berk, 2004). The goal of this research is to abide by Berk’s (2004) guidance: “to develop the simplest model that adequately characterizes the data. An ‘overparameterized’ model is to be avoided because it is complicated, fragile, and inelegant, even if that overparameterized model is formally correct” (p. 126).

In regression, the explanatory values are on the x axis and the outcome value is on the Y axis. A straight line is then imposed upon the relationship between independent and outcome variables via the ordinary least squares (OLS) method, which produces a “prediction line.” A prediction line is not perfect, and there will be differences between actual and predicted values of the response variable. These differences are called residuals,  $Y$  minus  $\hat{Y}$ . Although the computer does this, it is easy to see on an applet that the computer produces a line minimizing the sum of squared residuals of the mean. The minimization process results in a tight or narrow (best fit) pattern of the path of means around the line. The OLS prediction line is simply a line where observed points fall closer to the prediction line than other possible lines.

### **Slopes and Intercepts**

The OLS method gives a slope and intercept for the line in computer output. The intercept may or may not be useful in the probabilistic model, but the slope is very important to understanding the data and constructing the story from data. In bivariate



regression, the slope is conditional variability, the real backbone of the story. The slope is the direction of the relationship between explanatory variable and outcome variables, specifically the change in the mean of Y for a one-unit change in X (Berk, 2004). For multivariate regression, two or more slopes are obtained, known as partial regression coefficients. If slopes are positive, then dependent variables increase when predictor variables increase. If slopes are negative, then outcome variables decrease as explanatory values increase (an inverse relationship).

The slope does not tell strength of association between variables, but the Pearson Correlation (correlation coefficient) denoted by  $r$  or  $R$  (bivariate, multivariate) does (Agresti & Finlay, 2009). It is possible to have a high correlation coefficient ( $r$ ) and a small slope, and vice versa. We need the slope to compute the  $r$ . It is simply the ratio of the standard deviation of X to the standard deviation of Y multiplied by the slope. Higher  $r$  values indicate stronger associations between variables than lower values. OLS also provides an  $r$  ( $R$ ) square, which is the square of Pearson's  $r$ . The  $r$  square is the coefficient of determination and  $R$  square is the coefficient of multiple determination. The  $R$  square refers to proportional reduction in error (PRE) using predictions of the least squares line instead of assuming everyone is average, as occurs when the sample mean is used. In short,  $\hat{Y}$  has less error than  $\bar{Y}$ . The  $r$  square gives us amount of variability expressed as a percent explained by the model.

### **Pilot-Testing**

Hair et al. (2010) contend pilot testing (pretesting) is “particularly important when scales are applied in specific contexts or in contexts outside their normal use” (p. 637). Pilot testing of the Hospital OA Survey was important since previous settings of OA

studies did not include the hospital industry. Pilot testing of the survey with local hospitals who wished to participate began on March 31, 2010 and concluded May 30 2010 in accordance with CSU IRB approval (IRB ID 016-10H). See Appendix O.

In keeping with Hair et al.'s (2010) recommendations, statistical tests used to analyze the pilot data were as similar as possible to those used in the final model or study. The objectives for the pilot study were to obtain descriptive statistics, factor analyses, correlations, internal consistency reliabilities (Cronbach's alpha) and initial basic regression analyses to see if the empirical research stream that began with He and Wong (2004) could be replicated in a hospital setting. See Figures 3.2, 3.3, and 3.4 for depiction of respondents' demographic data.

### Demographic Data

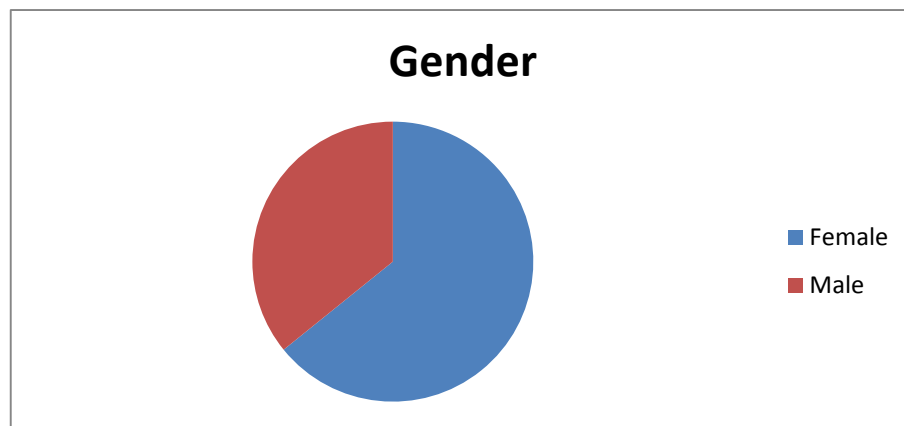


Figure 3.2. Gender Frequency Distribution in Pilot Study, N = 56, Male = 36 %, Female = 64%.

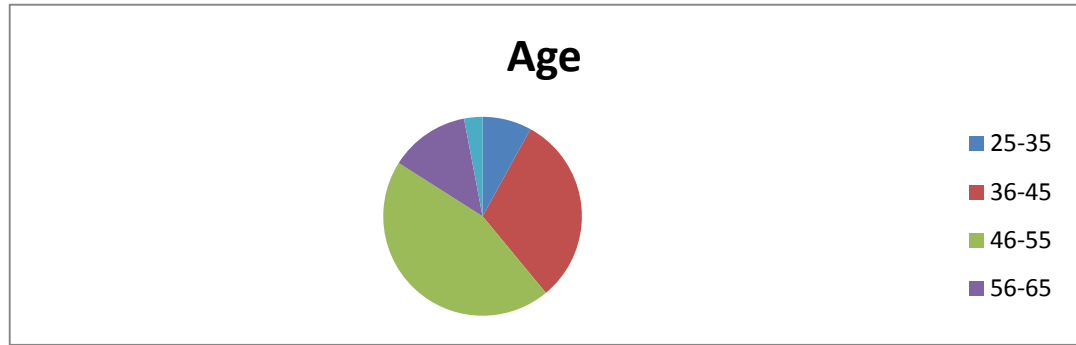


Figure 3.3. Age Frequency Distribution in Pilot Study, N = 62.

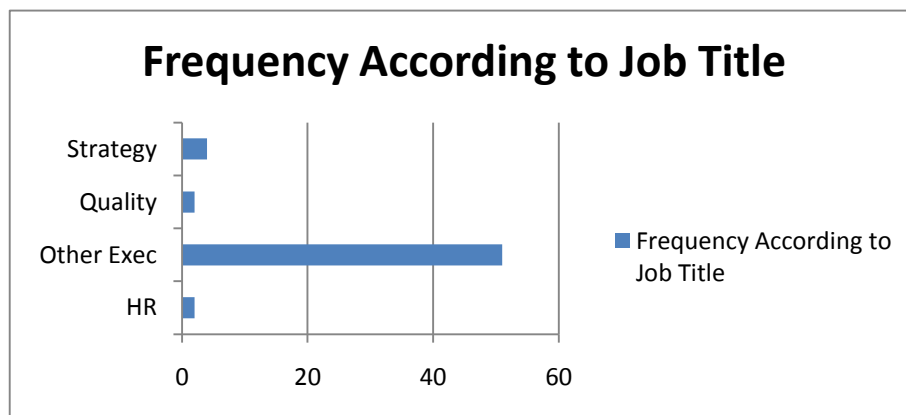


Figure 3.4. Frequency Histogram According to Job Title, N = 59.

### Sample Setting and Characteristics

The sampling frame for the pilot test consisted of all Hospital Chief Executive Officers (CEOs) in Colorado Springs, Aurora, and Denver Colorado. The researcher approached the hospitals' CEOs personally via each of their Executive Assistants. The researcher explained the notion of OA and asked whether the CEO would approve the hospitals' top management teams' participation in the pilot study. Two hospital CEOs responded positively. This resulted in a non-random sample. The sample setting consisted of one hospital in Colorado Springs, Colorado (Hospital 'A') and one hospital in Aurora, Colorado (Hospital 'B'). The researcher delivered hard copies of the surveys

to Hospital ‘B’, while Hospital ‘A’ indicated they preferred to take the survey online. The researcher put the OA Hospital Survey link online via Survey Monkey according to Hospital A’s preference. Links were sent electronically by the Executive Assistant to 50 top management team members.

### **Response Rate**

Twenty-six surveys were completed at Hospital ‘A’ for a 52% response rate. Surveys were delivered to Hospital ‘B’s management team via the Executive Assistant. Forty one surveys were administered and 37 were completed resulting in a 90.2% response rate for Hospital ‘B’. See Table 3.3 for a depiction of sample sizes and response rates.

*Table 3.3. Pilot Study Sample Sizes and Response Rates*

<b>Survey Setting</b>	<b>Number Surveys Delivered</b>	<b>Number Completed</b>	<b>Response Rate %</b>
Hospital A	50	26	52.0
Hospital B	41	37	90.2
Hospital A + Hospital B (Total)	91	63	71.1

### **Software Package**

All data were entered into a Microsoft Excel file and imported to a SAS 9.2 file where SAS procedures were implemented. The survey items were grouped into thirds (exploration, exploitation, and financials). Finance and quality were looked at as outcome variables.

## Descriptive Statistics

In SAS, the ‘proc means’ procedure produced a summary of means and standard deviations for all survey scores as depicted in Table 3.4.

*Table 3.4. Pilot Study Descriptive Statistics*

Survey Item	N	Mean	Standard Deviation	Minimum	Maximum
1	63	4.41	0.85	2.00	5.00
2	63	3.49	0.10	1.00	5.00
3	63	4.26	0.88	1.00	5.00
4	63	4.25	0.86	2.00	5.00
5	63	4.49	0.69	2.00	5.00
6	63	4.30	0.71	2.00	5.00
7	63	3.84	0.99	2.00	5.00
8	63	3.79	0.92	2.00	5.00
9	63	4.21	0.72	2.00	5.00
10	63	3.59	0.89	1.00	5.00
11	63	4.09	0.66	2.00	5.00
12	63	4.00	0.91	2.00	5.00
13	62	4.03	0.70	2.00	5.00
14	63	4.09	0.73	2.00	5.00
15	63	4.41	0.71	3.00	5.00
16	62	4.00	0.89	2.00	5.00
17	63	4.46	0.84	2.00	5.00
18	63	4.22	1.11	1.00	5.00
19	62	4.43	0.74	2.00	5.00
20	63	3.33	1.03	1.00	5.00
21	62	3.03	0.70	2.00	5.00
22	63	3.11	0.90	1.00	5.00
23	62	2.97	0.65	1.00	4.00
24	62	3.02	0.73	1.00	5.00

## Factor Analytic Method and Rotation

An exploratory factor analysis (EFA) was conducted in SAS 9.2 using the ‘proc factor’ procedure. The researcher requested three-factor, four-factor, and five-factor solutions to see which was best. Hair et al.’s (2010) guidelines for identifying significant factor loadings based on sample size were used. Accordingly, since the pilot study sample size was 63, loadings of .70 and above were considered significant (Hair et al., 2010) and are bolded to identify evaluation of the factors. Factor solutions are shown in

Appendix P. Table 3.5 is the correlation matrix of the factors. Confirmatory Factor Analyses (CFA) using five and seven factors were also computed and compared for best fit (Appendix P). Best fit indices for each CFA are shown in Appendix P. Cronbach's alphas are displayed in Table 3.6. Regression models are shown in Table 3.7.

### **Correlation Tables**

The AERA Standards for Reporting on Empirical Social Science Research requires correlation tables be published in reports with multiple regression and factor analysis. A correlation matrix is a “symmetric matrix whose off-diagonal entries are the Pearson product-correlation coefficients ( $r_{xy}$ ). Because the bivariate correlation between a variable and itself is always one, the diagonal entries of the correlation matrix are all ones” (Zientek & Thompson, 2009, p. 343). Zientek and Thompson (2009) posit “the correlation matrix serves as the foundation for all analytic models, as suggested by the concept called the *general linear model* (GLM)” (p. 343).

*Table 3.5. Pilot Study Correlation Matrix (Structure Coefficients)*

	<b>OA</b>	<b>Explore</b>	<b>Exploitation</b>	<b>Quality</b>	<b>Finance</b>	<b>Financial Tools</b>	<b>Financial No Tools</b>
<b>OA</b>	1.000	0.941	0.915	0.469	0.526	0.557	0.345
		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.005
		63	63	62	63	63	63
<b>Explore</b>		1.000	0.724	0.403	0.505	0.463	0.371
			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0028
			63	62	63	63	63
<b>Exploitation</b>			1.000	0.474	0.470	0.581	0.262
				< 0.0001	< 0.0001	< 0.0001	< 0.0381
				62	63	63	63
<b>Quality</b>				1.000	0.213	0.089	0.222
						NS	< 0.0828
					62	62	62
<b>Finance</b>					1.000	0.623	0.895
						< 0.0001	< 0.0001
						63	63
<b>Financial Tools</b>						1.000	0.209
							NS
							63
<b>Financial No Tools</b>							1.000

### **Internal Consistency Reliabilities – Cronbach’s Alpha**

Syntax was entered into SAS 9.2 under the proc corr command to compute the Cronbach’s alpha for each of the pilot study’s latent variables (exploration, exploitation, OA, quality, and financial performance). See Table 3.6.

*Table 3.6. Pilot Study Cronbach’s Alpha*

<b>Variables</b>	<b>Reliability Coefficients</b>	
	Raw	Standardized
Exploration	0.85	0.86
Exploitation	0.81	0.82
OA	0.90	0.90
Finance	0.76	0.78
Quality	0.80	0.80

### **Basic Regression**

The researcher ran two basic regression analyses on pilot study data to determine beta weights for the relationship between (1) OA and quality ( $Y = \text{Quality}$ ,  $X = \text{OA}$ ); and (2) OA and finance ( $Y = \text{Finance}$ ,  $X = \text{OA}$ ). This was done to explain rather than make inferences from the non-random pilot sample to a larger population. Each model converged well and had statistically significant results. The Maximum Likelihood (ML) estimator was used instead of OLS because that is what SAS 9.2 uses to compute regression lines. Table 3.7 depicts the parameterized model and fit statistics for  $Y = \text{Quality}$ ,  $X = \text{OA}$  and  $Y = \text{Finance}$ ,  $X = \text{OA}$ .



*Table 3.7. Model Summary with Fit Statistics*

Y = Quality, X = OA											
Effect	Estimate	Std. Error	DF	T	<i>p</i>	F	<i>p</i>	AIC	BIC	Effect Size	R2
OA	0.308	0.093	59	3.31	< 0.001	10.95	< 0.001	147.1	144.5	.469	.219
Y = Finance, X = OA											
Effect	Estimate	Std. Error	DF	T	<i>p</i>	F	<i>p</i>	AIC	BIC	Effect Size	R2
OA	0.273	0.056	60	4.84	< 0.001	23.39	< 0.001	89.5	88.2	.526	.277

### **Pilot Study: Results, Analysis and Discussion**

Results of the pilot study were mixed. Reliability is needed in order to have validity. Overall reliability of the survey instrument was high, demonstrated by high Cronbach’s alpha measurements consistent with other studies. Overall validity of the survey instrument was high. See Table 3.2 for a summary of instrument validity and reliability.

A ‘not as clear as expected’ picture was generated by the EFA in three-factor, four-factor, and five-factor solutions. This may be due to the small sample size. Hair et al.’s (2010) guidelines for significance of factor weightings per sample size (.70) were used. EFAs showed many items did not load significantly on any factor but if the significance level was less stringent (i.e., .40) more than a few survey items would load on more than one factor, indicating a possible overlap between constructs. Gliner, Morgan, and Leech (2009) state this is “common but undesirable” (p. 221). These findings contradicted those of other researchers (discussed in Chapter Two) who obtained ‘clean’ factor weights using a two-factor structure. Correlation analysis of sample size

and industry also showed high correlation between the constructs of exploration and exploitation ( $r = 0.724$ ) which would not be expected if the constructs were independent and orthogonal.

Interestingly, each (one-level) regression analysis showed a direct positive relationship between OA and finance, ( $b = 0.273, p < .05$ ), and OA and quality ( $b = 0.308, p < .05$ ). These results were consistent with other studies. Each regression model had good fit statistics and strong effect sizes. The effect size ( $r$ ) for OA and finance was 0.506 and the model explained 27.7% of the variance. The effect size ( $r$ ) for OA and quality was 0.469 the model explained 21.9% of the variance.

Inference beyond this sample was not done because it is not appropriate for a pilot study in which regression assumptions were violated. Specifically, regression is not robust against non random samples with dependencies among respondents (i.e., the sample had two levels but was treated as one level). The pilot study's small sample size affected EFA and CFA results, making them hard to interpret. Results indicated a larger sample size and multilevel regression might help solve the data analysis issues identified in the pilot study.

## **The Main Study**

### **Survey Questionnaire Revisions**

After review of pilot data, the researcher modified the Hospital OA Survey to make the wording less redundant on survey items #17 and #18. The changes are depicted in Table 3.8. No other changes were made to the study plan or design. See Appendix Q for a copy of the survey mailed to participants.

*Table 3.8. Revised Survey items*

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Survey Question #17:	I am regularly provided with information regarding my hospital's financial performance.
Revised Survey Question #17:	I have received training on how to read my hospital's financial reports.
Survey Question #18:	I receive and review my hospital's income statement every month.
Revised Survey question #18:	I review my hospital's income statement every month.

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### **Statistical Design**

Multilevel modeling (MLM) was used in the main study to address data analysis issues identified in the pilot study. MLM is known as hierarchical linear modeling (HLM), a regression technique based on general linear modeling theory (Bickel, 2007; Leavitt, Mitchell, & Peterson, 2010; Raudenbush & Bryk, 2002). To understand MLM it is important to understand basic linear regression, discussed previously.

MLM developed over the past 25 years. It is useful in analyzing different levels of data where one level is “nested” or contained within another level, creating a natural hierarchy. Examples are students, nested within classrooms, which are nested within schools, or employees, nested within departments, which are nested within organizations. Multilevel models allow more nuanced answers to research questions and hypotheses than do traditional statistical methods of ANOVA, Ordinary Least Squares (OLS) regression, and factor analysis (Luke, 2005). In MLM, slopes (betas) remain an important part of the story told by the data.

#### **Nested Data**

Just what does MLM provide that other methods don't? Goldstein (1995) answers this question with the following example.

A well known and influential study of elementary school children carried out in the 1970's (Bennett, 1976) claimed that children exposed to so-called 'formal' styles of teaching reading exhibited more progress than those who were not. The data were analyzed using traditional multiple regression techniques which recognized only the individual children as the units of analysis and ignored their groupings within teachers and into classes. The results were statistically significant. Subsequently, Aitkin et al. (1981) demonstrated that when the analysis accounted properly for the grouping of children into classes, the significant differences disappeared and the "formally" taught children could not be shown to differ from the others (p. 1).

The reason for differing results found in the two analyses above was the fact Bennett (1976) did not bring the phenomenon of nesting into his research. Nesting is important in this case because children within any one classroom were taught together and were therefore similar in their performance. Data analyzed in a non-nesting way provides considerably less valid and reliable information than data obtained from the same number of students taught separately by different teachers. When groups are clustered within other groups or nested "two observations chosen randomly from within this particular source are generally not independent, and it is important to model this dependency" (Goldstein, Browne, & Rasbash, 2002, p. 223).

With respect to results obtained by Bennett (1976) proven inaccurate by subsequent MLM research, Goldstein (1995, p. 1) concludes "The basic unit for purposes of comparison should have been the teacher not the student." This is referred to as 'frog-pond' theory, "which refers to the idea a specific individual frog may either be a small frog in a large pond or a large frog in a small pond" (Hox, 1995, p.3).

Similarly,

applied to education, this metaphor points out that the effect of an explanatory variable such as 'intelligence' on school career may depend a lot on the average intelligence in the school. A moderately intelligent pupil in a highly intelligent context may become de-motivated and thus become an underachiever, while the same pupil in a considerably less intelligent context may gain confidence and

become an overachiever. Thus, the effect of an individual pupil's intelligence depends on the average intelligence of the other pupils (Hox, 1995, pp. 6-7).

MLM is a way to solve the 'frog-pond' dilemma as to what type of frog is in what type of pond. Draper (1995) believes prediction is the primary strength of multilevel models, explaining "multilevel models provide a natural technical framework for generating predictive distributions that can help to validate or falsify theories" (p.142).

### **Importance of MLM to Study of OA**

MLM methods are important to the study of OA because they provide a way to investigate variables that span multiple levels of analysis. Prior to development of MLM, effects of variables at different levels were studied as separate problems not easily linked. Many authors, including Bennett (1976) in the above-referenced study committed the 'fallacy of composition' (Vogt, 2005), or 'atomistic fallacy' (Luke, 2004) where information about individuals is thought true for groups, or the 'ecological fallacy' where group phenomena are treated as true for individuals (Hox, 2002; Vogt, 2005, 2007). Both fallacies result in "biased estimation of model parameters" (Zvoch & Stevens, 2006, p. 349) and "decreased power and loss of information" (Tabachnick & Fidell, 2007, p., 782). MLM mitigates such biases.

### **Two Levels of Analysis: Implications for Sample Selection**

MLM specifies how relationships within and between individuals affect an outcome(s) of interest. Basic research design usually demands a simple random sample, where a researcher draws a probability sample from a finite population to make inferences from the sample to the larger finite population. This is called design-based inference (Snijders & Bosker, 1999). This is contrary to MLM, where the units are dependent rather than independent as in random sampling.

Multi-stage sampling (MSS) methods are recommended for MLM (Hox, 2002). This means for more than one level of analysis more than one sample size is needed (Bickel, 2007; Bingenheimer & Raudenbush, 2004; de Leeuw, 2004). Using the student/school nested model, the chance of selecting a particular student is associated with the chance of selecting a particular school; hence the dependency of observations (scores) and need for MLM.

Sample size for each level of a multilevel model is “a complex and under-researched issue” (Bickel, 2007, p. 47). Scherbaum and Ferrerter (2009) point out “the literature that has been developed for power in single-level designs cannot be directly translated to multilevel designs” (p. 347). Nevertheless, there is widespread agreement that sample size is determined by the higher level units (Bickel, 2007; Scherbaum & Ferrerter, 2009; Snijders & Bosker, 1993, 1999). Bickel (2007) believes “approximately 50 level-two cases are needed to justify claims as to the absence of bias in standard error estimates for level-two slopes” (p. 275). Importantly, increasing the number of level-one participants will not improve statistical power at level-two and “it is entirely possible to have an enormous total sample, but still have too few group-level (level-two) observations to obtain creditable coefficient estimates – or any estimates at all – for the group level” (Bickel, 2007, p. 282).

### **Sample Setting and Sample Selection**

This study was conducted in the United States. The theoretical population for level one analysis consisted of all directors who worked in medical-surgical hospitals. The theoretical population for level two analysis consisted of all medical-surgical hospitals in the United States (approximately 6,000 according to AHA.org). The

sampling frame consisted of all American Hospital Association (AHA) -identified medical-surgical hospitals in the United States. From the sampling frame, a randomized list of 2,000 AHA –identified medical-surgical hospitals (Appendix R) was created using randomization methodology explained in Appendix S. This became the target sample, with level one N = 6,000 (3 directors from each hospital) and level two N = 2,000 (randomized hospitals). Specialty hospitals (psychiatric facilities, cancer hospitals, rehabilitation hospitals, long-term hospitals) were excluded from the sample.

### **Randomization Method Used to Obtain Level-Two Sampling Units**

The American Hospital Association (AHA) created a randomized list of United States (U.S.) hospitals and exported them to an Excel spreadsheet purchased by the researcher. AHA deleted the following data prior to purchase: (1) non-general acute medical-surgical hospitals; (2) psychiatric facilities, cancer hospitals, and rehabilitation hospitals, and (3) hospitals located in Puerto Rico, Guam, American Samoa, the Marshall Islands, the North Mariana Islands, and the U.S. Virgin Islands. See Appendix S for a certified letter describing randomization methods used by the AHA.

## **Data Collection**

### **Mail Surveys**

Surveys were pre-coded prior to mailing. Each survey was labeled with its name (AHA identification number), bed size (number of licensed beds), and ownership status (not-for-profit, investor-owned, etc.). Demographic data collected in the main survey were identical to the pilot study - - age, gender, and position in the organization (Strategy, Quality, Human Resources). One mailer was sent to each hospital on the list. Reminders were not sent due to the financial constraints associated with such a large sample.

Each mailer had a 'Memo to the Executive Assistant' asking for help in delivering the surveys to top strategy, quality, and human resources executives in the hospital. See Appendix T. Each mailer also contained three self-addressed-stamped envelopes for directors/executives in positions of strategic planning, quality, and HR to return their completed surveys. Inside each envelope was a 'Cover Letter to Survey Respondent,' a copy of the 'Informed Consent' and the pre-coded survey. Each survey was also coded '1,' '2,' or '3' to indicate which of the three respondents had completed it. The contents of the mailers are shown in Appendix U and V.

### **Summary**

Chapter Three showed why this specific research was necessary and how it was done. First, it was important to narrow the widely focused and conceptually underdeveloped OA literature by constructing and testing a theoretical model of OA. To accomplish this, Lynham's (2002) *general method* was used to describe elements comprising a theory of OA and discuss inter-relationships among elements. The thread of knowledge and learning were embedded within each element of theory, reflecting an HRD orientation. The OA theory also contained elements of strategic intent and customer focus, reflecting a strategic management and marketing orientation. The theoretical model depicted how each element interacted with knowledge and learning to identify and change or modify mental models. New and/or modified mental models help firms create new processes, services, and products, and, in turn, create an increase in rents and enhances sustainability of the firm. Increased revenues and new products, processes, and products re-energize the company creating a virtuous cycle where OA is again approached to re-start the cycle. This model stresses the importance of



simultaneous exploration and exploitation. Although other combinations and types of exploration and exploitation have been described in the literature, only the simultaneous type was considered to be OA. As such, a more narrowly focused model emerged.

Three elements of the theory were operationalized into measured variables which became part of three summated one-to-five Likert agreement scales reflecting the latent (composite) constructs exploration, exploitation, OA, quality, and financial performance. These variables were chosen to start the confirmation/disconfirmation phase of the OA theory because they had been used in previous research. Review and operationalization of mental models and wellsprings of knowledge were thus beyond the scope of this research. Evidence for reliability and validity of the instrument were summarized and the survey was piloted at two Colorado hospitals from March 31, 2010, to May 30, 2010. Pilot data were analyzed. Results were mixed due to small sample size and use of a non-random sample. Two items on the survey were shortened to avoid redundancy, but no other changes were made to the research and statistical design of the study.

Data collection ran from July 15, 2010, to September 29, 2010. One mailer was sent to each of the 2,000 hospitals on the AHA random list. Each mailer contained three surveys with other information in three separate self-addressed-stamped envelopes designed to obtain 6,000 survey responses. Analyses used in the pilot study were repeated in the main study with a more meaningful and comprehensive analysis permitted due to the large random sample size.

## **CHAPTER 4: RESULTS**

Building upon the pilot study, the researcher conducted a national mail survey to answer the research questions and find evidence to support or negate the research hypotheses discussed in Chapter One. Research design and statistical tests have been explained in Chapter Three. This chapter presents the findings of the national study.

### **Demographic Data of Respondents**

#### **Overall Response Rate**

Six thousand surveys were mailed and 1,497 usable surveys were returned to the researcher, an approximate 25% response rate. Mailers were sent to 2,000 hospitals with 893 hospitals mailing back completed surveys, an approximate 45% response rate. See Appendix W. These high Ns in the Level one and Level two responses were more than adequate for statistical tests chosen for this research design - MLM, EFA, and CFA.

Gender response percentages were similar to those obtained in the pilot study. Sixty-two percent of respondents were female, 38% were male (Appendix W). Most of the respondents were aged 46 – 55 years (37%), followed by those aged 56 – 65 years (33%), and those aged 36 – 45 years (22%). Respondents at the younger end of the age continuum (25 – 35 years) were six percent of the sample, while those at the senior end of the continuum (66-75 years) were two percent of the sample (Appendix W).

Responses were distributed among three different job titles. HR directors completed 285 surveys (28%), quality directors provided 343 surveys (34%), and strategy directors contributed 388 surveys (38%). See Appendix W.

Forty-nine of 50 states participated in the survey. Wyoming was the only state from which responses were not received. Completed surveys were sorted according to the nine AHA regions – New England, Mid-Atlantic, South-Atlantic, East North Central, East South Central, West North Central, West South Central, Mountain, and Pacific. Response distributions by region are shown in Appendix W.

### **Descriptive Statistics**

In SAS, the ‘proc means’ procedure produced a summary of means and standard deviations for each variable as depicted in Table 4.1.

*Table 4.1. Descriptive Statistics*

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
OA	1,488	8.20	0.98	4.41	10.00
Exploration	1,488	4.15	0.54	1.87	5.00
Exploitation	1,488	4.05	0.52	1.85	5.00
Quality	1,480	4.22	0.80	1.00	5.00
Finance	1,486	3.58	0.78	1.00	5.00
Financial Tools	1,486	4.22	0.85	1.00	5.00
Financial No Tools	1,478	3.20	1.02	1.00	5.00

### **Comments Received**

The Hospital OA Survey had a blank space labeled “Comments” after survey item #24. This provided a space where respondents could add personal comments. Responses reflected how the poor state of the national economy is affecting hospitals. Appendix X depicts unedited and verbatim comments regarding the survey itself and/or specific survey items. It also lists unedited and verbatim general comments. Analyses of respondent comments are beyond the scope of this research.

## **Estimation Method**

Scholars have highlighted the need to choose appropriate estimation technique and test statistics given the sample size and possible violations of the normality and independence assumptions underlying general linear model theory (Agresti & Finlay, 2009; Hair et al., 2010; Tabachnick & Fidell, 2007). Tabachnick and Fidell (2007) state “Maximum Likelihood (ML) ... is a good choice with medium to large samples and evidence of the plausibility of the normality and independence assumptions” (p. 715).

## **Exploratory Statistics – Normality and Shape**

Exploratory statistics were computed to gain evidence of normality and independence. Normal distributions are symmetrical around the mean. Skewness means the distribution shape has ‘tails’ indicating more scores on the left (negative, skewed left) or more scores on the right (positive, skewed right). Kurtosis is information relating to how flat or peaked the distribution is. Hair et al. (2010) explain “negative kurtosis values indicate a platykurtic (flatter) distribution, whereas positive values denote a leptokurtic (peaked) distribution” (p. 71). No distribution is completely normal. Tabachnick and Fidell (2007) recommend evaluating the statistical output along with graphs of the actual distribution shapes to evaluate whether the assumptions of general linear modeling are met. They explain:

In a large sample, a variable with statistically significant skewness often does not deviate enough from normality to make a substantive difference in the analysis. In other words, with large samples, the significance level of skewness is not as important as its actual size (worse the farther from zero) and the visual appearance of the distribution. In a large sample, the impact of departure from zero kurtosis also diminishes. For example, underestimates of variance associated with positive kurtosis (distributions with short, thick tails) disappear with samples of 100 or more cases; with negative kurtosis, underestimation of variance disappears with samples of 200 or more (p. 80).

### **Frequency Histograms, Box Plots, Normal Probability Plots**

Table 4.2 shows descriptive and spread statistics related to variables exploration, exploitation, and OA. Appendices Y, Z, and A1 show frequency histograms, box plots, and normal probability plots for these variables.

Table 4.3 shows descriptive and spread statistics for variables quality (survey item 16), finance no tools (survey items 20-24), finance (survey items 17-24), and financial tools (survey items 17-19). Appendices A2, A3, A4, and A5 present frequency histograms, box plots, and normal probability plots.

*Table 4.2. Exploratory Statistics*

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<b>Explore – Survey Items 1-8</b>	
N	1,488
Mean	4.156
Median	4.250
Mode	4.500
Standard Deviation	0.543
Variance	0.295
Range	3.125
Interquartile Range	0.750
Skewness	-0.709
Kurtosis	0.507
<b>Exploitation – Survey Items 9-15</b>	
N	1,488
Mean	4.051
Median	4.142
Mode	4.000
Standard Deviation	0.522
Variance	0.273
Range	3.14
Interquartile Range	0.714
Skewness	-0.546
Kurtosis	0.651
<b>OA – Survey Items 1-15</b>	
N	1,488
Mean	8.207
Median	8.267
Mode	8.928
Standard Deviation	0.981
Variance	0.962
Range	5.589
Interquartile Range	1.315
Skewness	-0.625
Kurtosis	0.653

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*Table 4.3. Exploratory Statistics*

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<b>Quality – Survey Question 16</b>	
N	1,480
Mean	4.223
Median	4.000
Mode	5.000
Standard Deviation	0.804
Variance	0.647
Range	4.000
Interquartile Range	1.000
Skewness	-0.902
Kurtosis	0.504
<b>Finance No Tools – Survey items 20-24</b>	
N	1,478
Mean	3.204
Median	3.200
Mode	3.000
Standard Deviation	1.028
Variance	1.058
Range	4.000
Interquartile Range	1.600
Skewness	-0.122
Kurtosis	-0.608
<b>Financial Tools – Survey items 17-19</b>	
N	1,486
Mean	4.226
Median	4.333
Mode	5.000
Standard Deviation	0.858
Variance	0.737
Range	4.000
Interquartile Range	1.000
Skewness	-1.383
Kurtosis	1.840
<b>Finance – Survey items 20-24</b>	
N	1,486
Mean	3.588
Median	3.625
Mode	3.500
Standard Deviation	0.787
Variance	0.619
Range	4.000
Interquartile Range	1.125
Skewness	-0.251
Kurtosis	-0.378

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## **Factor Analysis**

Exploratory factor analysis (EFA) was conducted in SAS 9.2 using the ‘proc factor’ procedure. The researcher requested two-factor, three-factor, four-factor, and five-factor solutions to determine the best one. Tabachnick and Fidell (2007) assert

sample sizes of over 1,000 are “excellent” for reliable factor estimation. Hair et al.’s (2010) guidelines for identifying significant factor loadings based on sample size were used. Factor loadings of .30 and above were considered significant with a sample size of 1,480 (Hair et al., 2010). These are bolded to enhance evaluation of the factors (Appendix A6).

### **Principal Components Analysis (PCA)**

PCAs were conducted as described in Chapter Three. Although a variety of factor solutions were requested, the three-factor solution worked best. All correlations and goodness-of-fit indices are shown in Appendix A6.

### **PCA – Oblique Variance Rotation**

Hair et al. (2010) explain “In many situations the factors need not be uncorrelated and may even be conceptually linked, which requires correlation between the factors. The researcher should always consider applying a non-orthogonal rotation method and assess its comparability to the orthogonal results” (p. 139). Because the three-factor solution was the best fitting EFA orthogonally rotated solution, a three-factor oblique varimax rotation was requested. The oblique varimax rotation corroborated the same factor patterns as the orthogonal rotation. Brown (2006) adds:

If the factors are in fact uncorrelated, oblique rotation will produce a solution that is virtually the same as one produced by orthogonal rotation. If the factors are interrelated, however, oblique rotation will yield a more accurate representation of the magnitude of these relationships. (p. 32).

### **Correlations**

Correlations were performed as defined in Chapter Three. Appendix A6 shows one correlation matrix of factors based upon individual level (level one) responses and



another based upon the hospital level (level two) responses. Goodness-of-fit indices are also shown in Appendix A6.

### **Confirmatory Factor Analysis (CFA)**

The sample size was more than adequate to perform CFAs. Models with two, three, four, five, and seven factors were computed and are shown in Appendix A7. The seven-factor CFA model had the best fit.

### **Q-Type Factor Analysis and Correlations**

Similar to an R-type (regular) factor analysis, a Q-type factor analysis uses a correlation matrix as the basic data input (Hair et al., 2010). However, correlations are between similar individuals rather than similar variables. A Q-type factor analysis allows the researcher to “identify groups or clusters of individuals that demonstrate a similar pattern on the variables included in the analysis” (Hair et al., 2010, p. 101). Thompson (2004) describes the Q-technique as an analysis that identifies “people factors” (p. 84). This is done by “placing variables on the rows of the data matrix and using columns to represent different people” (Thompson, 2004, p. 84). A Q-type factor analysis was computed to detect similarities in responses according to job category.

Table 4.4 shows means, standard deviations, and range of scores for respondents who listed their job as ‘strategy’ and/or ‘quality.’ A Q-type correlation matrix showing relationships between responses of strategy and quality directors is in Table 4.5. Table 4.6 shows means, standard deviations, and range of scores for respondents who listed their job as ‘Quality’ and/or ‘HR.’ A Q-type correlation matrix showing relationships between responses of quality and HR directors is depicted in Table 4.7. Table 4.8 shows means, standard deviations, and range of scores for respondents who listed their job as

‘Strategy’ and/or ‘HR.’ A Q-type correlation matrix showing relationships between responses of strategy and HR directors is in Table 4.9.

*Table 4.4. Descriptive Statistics: Responses to Constructs by Strategy and Quality Directors*

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Quality – Exploration	350	4.08	0.58	2.00	5.00
Quality – Exploitation	350	3.95	0.58	1.85	5.00
Quality – OA	350	8.03	1.08	4.42	10.00
Quality – Quality	349	4.27	0.81	1.00	5.00
Quality – Finance	350	3.36	0.77	1.37	5.00
Quality - Financial tools	350	3.93	0.95	1.00	5.00
Quality - Finance No tools	349	3.02	0.99	1.00	5.00
Strategy – Exploration	409	4.21	0.47	2.75	5.00
Strategy – Exploitation	409	4.13	0.44	2.85	5.00
Strategy – OA	409	8.34	0.81	5.60	10.00
Strategy – Quality	405	4.19	0.80	2.00	5.00
Strategy – Finance	409	3.82	0.72	1.62	5.00
Strategy - Financial Tools	409	4.58	0.54	2.00	5.00
Strategy – Fin/ No Tools	407	3.37	1.03	1.00	5.00

*Table 4.5. Q-type Correlation Matrix: Similarity of Responses between Strategy and Quality Directors, n = 154*

<b>S = Strategy director</b> <b>Q = Quality director</b>	<b>S</b> Explore	<b>S</b> Exploit	<b>S</b> OA	<b>S</b> Quality	<b>S</b> Finance	<b>S</b> Financial Tools	<b>S</b> Finance No Tools
<b>Q Explore</b>	0.350 < 0.0001	0.195 < 0.0149	0.309 < 0.0001	0.248 0.0019	0.182 0.0236	0.102 0.2071	0.166 0.0386
<b>Q Exploit</b>	0.323 < 0.0001	0.264 < 0.0009	0.329 < 0.0001	0.288 0.0003	0.163 0.0432	0.084 0.2952	0.152 0.0590
<b>Q – OA</b>	0.359 < 0.0001	0.245 0.0022	0.340 < 0.0001	0.285 0.0003	0.184 0.0220	0.099 0.2170	0.170 0.034
<b>Q Quality</b>	0.223 0.0054	0.214 0.0076	0.244 0.0023	0.374 < 0.001	0.060 0.4554	0.019 0.8114	0.063 0.431
<b>Q Finance</b>	0.349 < 0.0001	0.222 0.0056	0.322 < 0.0001	0.263 0.001	0.627 < 0.0001	0.266 0.0008	0.611 < 0.0001
<b>Q Financial Tools</b>	0.104 0.1964	0.006 0.9342	0.064 0.4250	0.103 0.2033	0.121 0.1347	0.160 0.0466	0.080 0.3224
<b>Q Finance No Tools</b>	0.361 < 0.0001	0.260 0.0011	0.349 < 0.0001	0.262 0.0010	0.685 < 0.0001	0.235 0.0033	0.686 < 0.0001

*Table 4.6. Descriptive Statistics: Responses to Constructs by HR and Quality Directors*

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Quality - Exploration	350	4.08	0.58	2.00	5.00
Quality - Exploitation	350	3.95	0.58	1.85	5.00
Quality – OA	350	8.03	1.08	4.42	10.00
Quality – Quality	349	4.27	0.81	1.00	5.00
Quality – Finance	350	3.36	0.77	1.37	5.00
Quality - Financial tools	350	3.93	0.95	1.00	5.00
Quality - Finance No tools	349	3.02	0.99	1.00	5.00
HR – Exploration	289	4.14	0.51	2.62	5.00
HR – Exploitation	289	4.03	0.48	2.57	5.00
HR – OA	289	8.17	0.92	5.32	10.00
HR – Quality	289	4.21	0.71	2.00	5.00
HR – Finance	288	3.52	0.78	1.00	5.00
HR - Financial Tools	288	4.09	0.83	1.00	5.00
HR - Finance No Tools	288	3.17	1.02	1.00	5.00

*Table 4.7. Response Correlation Matrix: Human Resources and Quality Directors*

	<b>H</b> Explore	<b>H</b> Exploit	<b>H</b> OA	<b>H</b> Quality	<b>H</b> Finance	<b>H</b> Financial Tools	<b>H</b> Finance No Tools
<b>Q</b> Explore	0.466 < 0.0001 121	0.338 < 0.0149 121	0.439 < 0.0001 121	0.303 0.0007 121	0.393 0.0236 120	0.246 0.00670 120	0.367 < 0.0001 120
<b>Q</b> Exploit	0.322 < 0.0003 121	0.297 < 0.0009 121	0.335 < 0.0002 121	0.208 0.0214 121	0.295 0.001 120	0.201 0.02700 120	0.267 0.0032 120
<b>Q</b> – OA	0.421 < 0.0001 121	0.341 < 0.0001 121	0.415 < 0.0001 121	0.274 0.0023 121	0.368 < 0.0001 120	0.240 0.00820 120	0.339 0.0001 120
<b>Q</b> Quality	0.389 < 0.0001 121	0.351 < 0.0001 121	0.401 < 0.0001 121	0.255 0.0047 121	0.337 0.0002 120	0.383 < 0.0001 120	0.226 0.0131 120
<b>Q</b> Finance	0.243 0.0071 121	0.277 0.002 121	0.280 0.0018 121	0.128 0.1607 121	0.582 < 0.0001 120	0.297 0.00100 120	0.578 < 0.0001 120
<b>Q</b> Financial Tools	0.257 0.0043 121	0.222 0.0141 121	0.261 0.0038 121	0.061 0.5028 121	0.321 0.0003 120	0.372 < 0.0001 120	0.211 0.0202 120
<b>Q</b> Finance No Tools	0.143 0.1163 121	0.206 0.0231 121	0.187 0.0397 121	0.117 0.1976 121	0.523 < 0.0001 120	0.142 0.12030 120	0.585 < 0.0001 120

*Table 4.8. Descriptive Statistics: Responses to Constructs by HR and Strategy Directors*

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Strategy - Exploration	409	4.21	0.47	2.75	5.00
Strategy - Exploitation	409	4.13	0.44	2.85	5.00
Strategy – OA	409	8.34	0.81	5.60	10.00
Strategy – Quality	405	4.19	0.80	2.00	5.00
Strategy – Finance	409	3.82	0.72	1.62	5.00
Strategy - Financial Tools	409	4.58	0.54	2.00	5.00
Strategy - Finance No Tools	407	3.37	1.03	1.00	5.00
HR – Exploration	289	4.14	0.51	2.62	5.00
HR – Exploitation	289	4.03	0.48	2.57	5.00
HR – OA	289	8.17	0.92	5.32	10.00
HR – Quality	289	4.21	0.71	2.00	5.00
HR – Finance	288	3.52	0.78	1.00	5.00
HR - Financial Tools	288	4.09	0.83	1.00	5.00
HR - Finance No Tools	288	3.17	1.02	1.00	5.00

*Table 4.9. Response Correlation Matrix: Strategy and Human Resources Directors*

	<b>H</b> Explore	<b>H</b> Exploit	<b>H</b> OA	<b>H</b> Quality	<b>H</b> Finance	<b>H</b> Financial Tools	<b>H</b> Finance No Tools
<b>H</b> = HR director <b>S</b> = Strategy director							
<b>S</b> Explore	0.396 < 0.0001 125	0.264 0.0029 125	0.355 < 0.0001 125	0.252 0.0044 125	0.427 < 0.0001 125	0.277 0.0017 125	0.399 < 0.0001 125
<b>S</b> Exploit	0.183 0.0405 125	0.230 0.0096 125	0.221 0.0131 125	0.176 0.0495 125	0.260 0.0034 125	0.125 0.1646 125	0.263 0.0030 125
<b>S</b> – OA	0.324 0.0002 125	0.275 0.0018 125	0.322 0.0002 125	0.239 0.0071 125	0.384 < 0.0001 125	0.225 0.01140 125	0.370 < 0.0001 125
<b>S</b> Quality	0.218 0.0147 124	0.134 0.1372 124	0.190 0.0342 124	0.237 0.0078 124	0.191 0.0335 124	0.099 0.27150 124	0.189 0.0350 124
<b>S</b> Finance	0.409 < 0.0001 125	0.399 < 0.0001 125	0.433 < 0.0001 125	0.314 0.0004 125	0.655 < 0.0001 125	0.296 0.00080 125	0.672 < 0.0001 125
<b>S</b> Financial Tools	0.042 0.6367 125	0.006 0.9418 125	0.026 0.7664 125	0.119 0.1828 125	0.098 0.2767 125	0.084 0.3506 125	0.081 0.3658 125
<b>S</b> Finance No Tools	0.434 < 0.0001 124	0.435 < 0.0001 124	0.466 < 0.0001 124	0.306 0.0005 124	0.684 < 0.0001 124	0.305 0.00060 124	0.706 < 0.0001 124

### **Intraclass Correlations**

Tabachnick and Fidell (2007) explain the need for MLM depends partially on size of the intraclass correlations. They note “intraclass correlation (ICC), the term conventionally used, is a misnomer; this really is a squared correlation or strength of association (effect size) measure” (p. 822). The ICC indicates proportion of variance in

the outcome variable due to the higher level (level-two) variable (Vogt, 2005). For a two-level regression model, the formula for the ICC is level-two variance divided by the sum of level-one level-two variances (Tabachnick & Fidell, 2007). In this case, the ICC is the ratio between hospital variance divided by hospital variance plus individual variance. Tabachnick and Fidell (2007) explain

high values of the ICC imply that the assumption of independence of errors is violated and that errors are correlated – that is, that the grouping level matters... if the ICC is trivial, there is no meaningful average difference among groups on the dependent variable, and data may be analyzed at the individual (first) level (p. 822).

The ICCs calculated for each variable are displayed in Table 4.10.

*Table 4.10. Intraclass Coefficients (ICC)*

<b>Variable</b>	<b>Values</b>	<b># Iterations to Converge</b>	<b>ICC</b>
Explore	.1062/(.1062+.1879)	2	0.361
Exploitation	.07245/(.07245+.2005)	2	0.265
OA	.3221/(.3221+.6376)	2	0.335
Quality	.1833/(.1833+.4667)	2	0.282
Finance	.3404/(.3404+.2756)	3	0.552
Financial Tools	.1409/(.1409+.6029)	2	0.189
Finance No Tools	.6767/(.6767+.3729)	3	0.644

### **Covariance Parameter Estimates – Differences by Hospital Ownership**

Covariance parameter estimates were computed to determine if there were significant differences in response patterns according to hospital ownership. Table 4.11 shows the differences in means between not-for-profit and investor-owned hospitals. Table 4.12 shows the intraclass correlation (ICC) of each variable with respect to hospital ownership.



Table 4.11. NFP = Not-for-Profit, FP = For-Profit, NS = Not Significant

Ownership	Variable	Mean	Standard Error	t Value	Pr > t
NFP	OA	8.32	0.03	0.36	NS
FP		8.35	0.08		
Differences in Means: FP & NFP		0.032	0.09		
NFP	Quality	4.31	0.02	0.87	NS
FP		4.38	0.06		
Differences in Means: FP & NFP		0.06	0.07		
NFP	Finance	3.65	0.03	0.30	NS
FP		3.67	0.07		
Differences in Means: FP & NFP		0.023	0.07		
NFP	Financial Tools	4.32	0.03	-2.91	0.003
FP		4.09	0.07		
Differences in Means: FP & NFP		-0.22	0.07		
NFP	Finance No Tools	3.24	0.04	1.62	NS
FP		3.41	0.09		
Differences in Means: FP & NFP		0.16	0.31		

Table 4.12. Intraclass Coefficient (ICC) Variance Related to General Ownership Status

Variable	Values	# Iterations to Converge	ICC
Explore	.09872/(.09872+.1851)	2	0.347
Exploitation	.06424/(.06424+.1977)	2	0.245
OA	.2897/(.6251+.2897)	2	0.316
Quality	.1583/(.1583+.4687)	3	0.252
Finance	.3364/(.3364+.2749)	3	0.550
Financial Tools	.1298/(.1298+.6004)	2	0.177
Finance No Tools	.6700/(.6700+.3738)	3	0.641

## Covariance Parameter Estimates – Differences by Number of Hospital Beds

A multilevel regression of  $Y = OA$  and  $X = \text{Bed size}$  was performed. Bed sizes were covariances looked at in the model. Hospitals were coded ‘1’ for 1 – 100 beds, ‘2’ for 101-200 beds, ‘3’ for 201-300 beds, and ‘4’ for 301 or more beds. Table 4.13 displays least squares means, standard errors, and  $p$  values for different size hospitals. Table 4.14 displays differences between means and significance level of the differences.

*Table 4.13. OA Means According to Bed Size*

Variable	N	OA Mean	Standard Error
Size 1 (1 - 100 beds)	429	8.10	0.03
Size 2 (101-200 beds)	156	8.29	0.06
Size 3 (201 - 300 beds)	95	8.27	0.08
Size 4 (= to or > 301 beds)	118	8.38	0.07

*Table 4.14. Comparisons of OA Means and Significance Levels According to Bed Size. NS = Not Statistically Significant*

Variable	Difference	Standard Error	t value	$p > t$
Size 1 and 2	-0.1899	0.07795	-2.44	0.0151
Size 1 and 3	-0.1693	0.09409	-1.80	NS
Size 1 and 4	-0.2738	0.08202	-3.34	0.0009
Size 2 and 3	-.02057	0.10890	0.19	NS
Size 2 and 4	-0.8392	0.09868	-0.85	NS
Size 3 and 4	-0.1045	0.11190	-0.93	NS

## Cronbach’s Alpha

Cronbach’s alphas for each variable were computed. See Table 4.15.

*Table 4.15. Cronbach's Alpha For Each Survey Item*

Variables/Survey Items	Reliability Coefficients	
	Raw	Standardized
Exploration	0.821	0.823
Exploitation	0.812	0.816
OA (1-15)	0.886	0.888
Finance Tools (17-19)	0.854	0.855
Finance (17-24)	0.871	0.866
Finance No Tools (20-24)	0.940	0.941
Quality		

## Analysis of Variance

A one way analysis of variance (ANOVA) was computed to check hypotheses four and five using level two sample data ( $N = 833$ ). ANOVA is mathematically identical to regression which has been explained previously. Hypothesis four stated hospitals with high quality will have higher levels of OA. Results indicate support for this hypothesis ( $\beta = .407$ ,  $p < 0.0001$ , effect size  $r = 0.506$ ) and are displayed in Table 4.16. Hypothesis five stated hospitals with high levels of OA will have higher amounts of net income than those with lower OA scores. Results indicated support for this ( $\beta = .440$ ,  $p < 0.0001$ , effect size  $r = 0.525$ ) and are shown in Table 4.17.

*Table 4.16. ANOVA,  $Y = \text{Quality}$ ,  $X = \text{OA}$*

N	829
F value	284.9
$p > F$	< .0001
Beta (standard error)	0.407 (0.024)
t value	16.88
$p > t$	<.0001
R-Square	0.256
Effect Size ( $r$ )	0.506

*Table 4.17. ANOVA,  $Y = \text{Finance}$ ,  $X = \text{OA}$*

N	833
F value	315.81
$p > F$	< .0001
Beta (standard error)	0.440 (0.025)
t value	17.77
$p > t$	<.0001
R-Square	0.275
Effect Size ( $r$ )	0.525

## MLM

Two MLMs were computed. The first one ( $Y = \text{Quality}$ ,  $X = \text{OA}$ ) is shown in Table 4.18. This model used the level one  $N$  of 1,488 and the level two  $N$  of 834. The model converged well after two iterations. According to Raudenbush and Bryk (2002),

"... the rate of convergence for the estimator method (EM), as indicated by the number of iterations, is itself diagnostic. If the data are highly informative, the EM algorithm will converge rapidly (e.g., in less than 10 iterations)" (p. 257). Exploratory statistics showing a plot of residuals and the shape characteristics of this equation are shown in Appendix A8 and A9.

The second MLM was  $Y = \text{Finance}$ ,  $X = \text{OA}$  shown in Table 4.19. This model used a level one N of 1,486 a level two N of 834 and converged after three iterations. Exploratory statistics including a plot of residuals and shape characteristics of this equation are shown in Appendices A10 and A11.

*Table 4.18. MLM, Y = Quality, X = OA*

Level 1 N	834
Level 2 N	1,480
Beta	0.383
Standard Error	0.019
t value	20.17
p value	< 0.0001
F value	406.97
p > F	< 0.0001
AIC	3148.5
BIC	3157.9

*Table 4.19. MLM, Y = Finance, X = OA*

Level 1 N	834
Level 2 N	1,486
Beta	0.347
Standard Error	0.017
t value	19.8
p value	< 0.0001
F value	392.23
p > F	< 0.0001
AIC	2922
BIC	2931.4

## **Empirical Data Analysis**

### **Research Hypothesis 1: Statistical Evidence**

Hypothesis one stated exploration and exploitation are two independent constructs which are additive and complementary in nature. The additivity nature of constructs would mean higher scores on each result in higher levels of OA in the organization. To test this hypothesis descriptive statistics (table of means), PCA and CFA factor analyses, and correlation matrices were analyzed.

### **Research Hypothesis 1: Two-Factor PCA Solution**

The two factor rotated solution showed survey items #1-19 loaded on a single factor with high loadings (Hair et al., 2010) and low cross loadings. Survey items 20-24 loaded on the second factor. Items one through eight and nine through 15 were summated scales designed to reflect exploration and exploitation. The two factor solution included all exploration and exploration items on one factor plus three items reflecting finance content. Survey items 20-24 were used as a summated scale designed to reflect finance. They loaded on one factor with very high loadings and low cross loadings on other factors. Using the eigenvalue > one guide, five factors should be retained. No factor loadings had significant communalities except for items 20-24; the finance components of the summated scale.

### **Research Hypothesis 1: Three-Factor PCA Solution**

The three-factor rotated solution showed survey items 1-6 loaded on the same factor with high values (Hair et al., 2010) and small values for cross loadings. This solution showed the finance construct (summated scale of items 17-24) consisted of two different dimensions or were two different constructs. Items 17-19 formed one construct

related to financial tools and items 20-24 formed a separate construct related to finance in general. Using the eigenvalue  $>$  one guide, five factors should be retained. Items 17-24 all had high communality values of greater than .500, but only two of the other components had communalities greater than .500.

#### **Research Hypothesis 1: Four-Factor PCA Solution**

The four-factor rotated solution was problematic. Some principal components did not load on any factor and others split across several factors. This solution again showed survey items 17-19 loading with high values on one factor and items 20-24 loading with high values on another factor indicating two separate constructs. Using the eigenvalue  $>$  one guide, five factors should be retained. Communalities greater than .500 were found in all except eight components.

#### **Research Hypothesis 1: Five-Factor PCA Solution**

The five-factor rotated solution was also problematic. Here, different components demonstrated significant loadings on more than one factor. Remaining constant in this solution were items 17 – 19 loading on one factor and items 20-24 loading on a different factor with low cross loadings on all other factors. Using the eigenvalue  $>$  one guide, five factors should be retained. All items except for four had communalities  $>$  .500.

#### **Research Hypothesis 1: Review of PCA Solutions**

After reviewing four PCA factor solutions, the three-factor orthogonally rotated solution presented the clearest picture. Hair et al. (2010) and Tabachnick and Fidell (2007) recommend additional rotations be selected to provide further evidence a solution is adequate. Accordingly, a three-factor oblique (varimax) rotation was requested. This rotation depicted an even more distinct picture of factors. Items 1-16 (reflecting

exploration, exploitation, and quality) loaded on a single factor with very low cross loadings. Again, items 17-19 loaded on a single factor as did items 20-24.

### **PCA Correlations**

Two correlation matrices were run. One displayed individual-level data (Appendix A6) and the other hospital-level data (Appendix A6). According to the three-factor solution, the two components of OA (exploration and exploitation) were highly correlated. Additionally, quality was highly correlated with exploration and exploitation. Correlation matrices bore this out. At the individual response level, there was a 0.923 correlation ( $r$ ) between explore and OA, and a 0.917 correlation ( $r$ ) between exploitation and OA. Correlation between quality and OA was 0.485. Effect sizes will not be qualified as to small, medium, or large in accordance with recommendations of Thompson (2006) who asserted effect sizes should be compared to the context of the study and results of other studies. At the hospital response level, there was a 0.926 correlation ( $r$ ) between explore and OA, and a 0.916 correlation ( $r$ ) between exploitation and OA. Correlation between quality and OA was 0.506.

### **CFA Models**

CFA models were requested to build support for adequacy of the factor solutions. The goodness-of-fit test statistics for the two-factor, three-factor, four-factor, and five-factor models were inadequate, indicating poor fit of data to models. The seven-factor CFA model showed a general good fit of data to the model. The chi-square/DF ratio was twice what it should be but was not nearly as high as it was in other models. The NFI, CFI, and RMSEA all showed good fit. The seven factors reflected exploration, exploitation, OA, quality, financial tools, finance no tools, and finance.

### **Research Hypothesis 1: Statistical Significance**

In accordance with recommendations of Hair et al., (2010), Tabachnick and Fidell (2007), and Thompson (2006), a number of statistical tests were computed to determine the nature of exploration, exploitation, and finance. Results of these tests indicated exploration and exploitation were not two different independent constructs but two latent factors of a second-order construct, OA specifically. High correlation between two factors provides evidence the two factors are additive and complementary but not separate.

This hypothesis is best understood by dividing it into three sub-hypotheses. Hypothesis 1a stated exploration and exploitation are two independent constructs. Evidence from factor analyses did not support the hypothesis they are two independent constructs. Hypothesis 1b stated exploration and exploitation were additive and complementary in nature. Noting high correlations between the factors and OA and high correlations of the factors with each other (loading on one factor), this hypothesis was supported by factor analysis evidence. Hypothesis 1c stated higher scores on each variable, exploration and exploitation, resulted in higher levels of OA in the organization. A review of variable means (see Table 4.9) supported this hypothesis. Mean of exploration added to the mean of exploitation resulted in OA. Higher mean values of each factor produced a higher level on the second-order OA construct.

### **Practical Relevance**

Thompson (2006) notes “practical significance focuses on how much difference an intervention makes or how related various variables are (e.g., how much longer, on average, will you tend to live if you do not smoke; how related are different amounts of



obesity to various blood pressures)” (p. 134). Here, the virtuous cycle theory of OA presented in this study informs the data interpretation. Statistically, the study undergirded the theory and confirmed its usefulness.

Theoretically, OA is one construct and can be described as analogous to a molecule of water. If two atoms of hydrogen are chemically bonded with one atom of oxygen it is the molecule water, not hydrogen and oxygen. Gillespie and Popelier (2001) point out “Whenever two or more atoms are held strongly together to form an aggregate that we call a molecule, we say that there are chemical bonds between them” (p. 1). This theoretical approach to understanding the data previews its practical relevance. The loadings of exploration and exploitation onto just one factor (a ‘chemical bonding’) reiterate the importance of this finding. This is the only study to report a ‘chemical bonding’ of exploration and exploitation as one factor. Other studies (He & Wong, 2004; Gibson & Birkenshaw, 2004; Jansen et al., 2008) report exploration and exploitation loading on two separate factors. These studies also differ from this one with respect to the definition, assumptions, and theoretical model of OA used to inform interpretation of their data. The ‘chemical bonding’ aspect makes the virtuous cycle model of OA easy to understand and actually implement in firms. OA is one molecule rather than two separate atoms (exploration and exploitation).

## **Research Hypothesis 2**

### **Statistical Significance**

It is important to re-visit the notion of statistical significance. Statistical tests based on the general linear method are not deterministic models. They cannot prove or disprove an effect (Pedhazur, 1997). Statistical significance “only provides information

about whether the relationship exists at all.... the level of statistical significance reflects the sample size, incidental features of the design, the sampling of cases, and the nature of the measurement of the dependent variable” (Pedhazur, 1997, p. 5). On the one hand it is possible to find statistical significance with no substantive meaning. Conversely, there may be findings of non-statistical significance that are nevertheless interesting.

Thompson (2006) states “the literature is prejudiced against statistically non-significant results” (p. 208).

This hypothesis stated investor owned hospitals (for-profit) have higher OA levels than not-for-profit hospitals. This is an alternative hypothesis ( $H_a$ ) to the null hypothesis which would claim no difference in OA levels between for-profit and not-for-profit ownership. Table 4.11 compared differences between these hospital ownerships with a student’s t-test for each variable. The difference in means between for-profit and not-for-profit hospitals was extremely low (0.03), with a high standard error (0.09), and a t value of 0.36 (statistically non-significant). Therefore, according to null hypothesis testing theory (NHTT) the findings support no difference in OA levels between for-profit and not-for-profit hospitals. The alternate hypothesis is rejected and the null hypothesis is not. However, the problems with NHTT are vast and well-reported in the literature (Cohen, 1994; Thompson, 2006). Cohen (1994) asserts that a quantitative science cannot be built upon null-hypothesis testing and use of *p*-values and Thompson (2006) notes the importance of reporting confidence intervals (CI) and comparing them across different studies. In this study, the 95% CI for the mean of not-for-profit hospitals was 8.26 to 8.38. The 95% CI for the mean of for-profit hospitals was 8.19 to 8.51. Again, Thompson (2006) urges “do not confuse 95% probability with 100% certainty” (p. 203).

## **Practical Relevance**

Problems with NHTT have led experts to require effect size reporting in lieu of or in addition to significance testing. Thompson (2006) points out very small effect sizes (or other statistics) may be highly important while seemingly very large effect sizes can be of little practical value. Interestingly, the finding of no statistically significant difference in OA levels between for-profit and not-for-profit hospitals is important, because differences between not-for-profit and for-profit hospitals have been widely studied and there are a variety of opinions on how alike or different these two entities are. This is the first study to examine differences in OA levels according to ownership status so there are no findings to compare to this study's findings. However, hospital ownership has been found to affect some things and not others. For example, McClellan and Staiger (2000) argued "factors other than for-profit status per se may be the main determinants of quality of care in hospitals" (p. 95). Shortell and Hughes (1988) and Sloan, Picone, Taylor, and Chou (2001) found no differences in patient mortality rates (deaths) related to ownership status. Horwitz (2005) found "for-profit hospitals were more responsive to changes in service profitability" (p. 790) than were not-for-profit hospitals. The findings that for-profit and not-for-profit hospitals have similar OA levels adds to the growing literature on the similarities, differences, benefits, and burdens of each hospital ownership type.

## **Research Hypothesis 3**

### **Statistical Significance**

Hypothesis three stated large sized hospitals have higher levels of OA than small and/or medium size hospitals. To test this hypothesis, a multilevel regression was computed using explanatory variables labeled 'size 1,' 'size 2,' 'size 3,' and 'size 4.' The

outcome variable was OA. These were described as hospitals with one to 100 beds (size 1); hospitals with 101-200 beds (size 2); hospitals with 201-300 beds (size 3); and hospitals with 301 or more beds (size 4). These variables represented small (size 1), medium (sizes 2 and 3) and large (size 4) hospitals. Table 4.13 presented OA regression means and significance levels of size one through size four hospitals. Table 4.14 presented differences between means. Differences in means between small and large hospitals (-0.27, standard error 0.08) were statistically significant ( $p < 0.0009$ ) while differences between large and medium hospitals were statistically non-significant. It is important again here to invoke Thompson (2006), who cautions “statistical significance testing does *not* evaluate result importance. . . . a  $p$  value does not contain *any* information about the value of results” (p. 182). Thompson (2006, p. 188) cites Good and Hardin’s (2003) explanation:

The  $p$  value is a random variable that varies from sample to sample. . . . Consequently, it is not appropriate to compare the  $p$  values from two distinct experiments, or from tests on two variables measured in the same experiment, and declare that one is more significant than the other (p. 100).

With another nod to statistical significance theory, one could say although the observed differences could be zero, it does not mean the differences actually are zero. The 95 percent CI for means of small hospitals was 8.041 to 8.158. The 95 percent CI for large hospitals was 8.242 to 8.517. The findings obtained here provide evidence large hospitals have more OA than small hospitals but not than medium sized hospitals. Along with this evidence is the caveat many things impact these results including sampling distribution error, sample size, categorization of hospital size, and measurement error to name a few.

### **Practical Relevance**

The question then is, are these findings meaningful in any way? It is quite likely they are. A 27% higher OA level in large hospitals may be a competitive advantage over smaller ones. Large hospitals do not occupy the same competitive space as small or rural hospitals, but they may offer some overlapping service lines with which they do compete with the smaller ones for. OA theory informs this interpretation of the data. It lends support to the idea a 27% higher OA level (OA has a potential range of 2 to 10) in large hospitals would provide them with capabilities in innovation and new products, processes, and services unavailable to small hospitals.

The classic theory of organizational slack highlights the relevance of this finding. Organizational slack theory advances the notion large organizations have more ‘slack,’ defined as resources useful for innovating, improving, and creating current and future products and services (Bourgeois, 1981; Cyert & March, 1992) and are able to adapt more efficiently in the market space as a result. One could say higher OA levels in large hospitals convey higher amounts of ‘slack,’ which positions such hospitals preferentially as market leaders. One could also say that large hospitals have more slack than small ones do (more employees, more doctors, more services, and more patients) and it is this slack that conveys higher OA levels.

It is beyond the scope of this research to say which of these answers is ‘true.’ Both interpretations however (and there may be other explanations) are fruitful in discussions of how hospitals can improve current processes and create innovations customers (patients) will demand. These theoretical explanations allow the derivation of substantive meaning from data patterns observed in this study. Because this study was the

first of its kind in a hospital setting more work is needed to determine if the statistically significant difference in means of large and small hospitals is as practically significant as it seems or if the analysis was appropriately designed.

#### **Research Hypothesis 4**

##### **Statistical Significance**

This hypothesis stated hospital quality is positively related to hospitals' level of OA. Two methods were used to test this hypothesis. First, a one-way analysis of variance (ANOVA) was run using the hospital level (level two) data. The explanatory variable was OA and the outcome variable was quality. Results displayed in Table 4.16 show a statistically significant positive relationship ( $\beta = 0.406$ ,  $p < 0.0001$ ) between quality and OA and an effect size  $r = 0.506$  which explains approximately 25% of the variance. The finding that for every one point increase in OA score, there is a .406 increase in quality is an important one.

Second, a multilevel model was computed using OA as the explanatory value and quality as the outcome variable. The level-one N was 1,488 and the level-two N was 834. Exploratory data analysis using scatter plots, box plots, and histograms were conducted. Table 4.18 displays the results of the MLM which provide compelling evidence ( $\beta = 0.382$ ,  $p < 0.0001$ ) to support the idea there is a direct positive relationship between perceived hospital quality and OA. Specifically, for every one point increase in OA score, perception of hospital quality increases by 0.382. In MLM, the beta value becomes the effect size. Although this is not as high a level of slope increase as seen in the one-level regression, it still merits attention for reasons previously specified.

## **Practical Relevance**

Hospitals are highly reliable organizations (Weick & Sutcliffe, 2001). This means that standardization, routinization, redundancy, and attention to detail are important and lack of such may lead to danger and death. For example, if hospitals don't follow proper surgical procedures such as marking the particular extremity to be operated on surgeons may operate on the wrong extremity or amputate the wrong limb. These are known as 'never events' because highly reliable organizations strive to implement routines and procedures to prevent these events from happening. Unfortunately, 'never events' do still happen. The level of quality hospitals and patients need has not yet been attained. Therefore any method or tool to increase quality is extremely important. Quality actually saves lives. Quality improvement is increasingly important to hospitals' financial lives because of the proliferation of 'pay for performance' models. Hospitals with higher quality scores will be paid more than those with low scores. It is reasonable to interpret the positive relationship between OA and quality as clinically and financially significant and practically relevant.

## **Research Hypothesis 5**

### **Statistical Significance**

Hypothesis five stated hospitals with high OA levels will have higher levels of net income than hospitals with lower levels of OA. Net income was measured through respondents' self-reported answers to an eight-item summated scale. MLM was again used to test this hypothesis. Depicted in Table 4.19, OA was the explanatory variable and finance the outcome variable. Results showed hospitals with higher OA levels have higher levels of net income. Specifically, the beta was 0.346; standard error 0.017,  $p <$

0.0001, meaning for every one point increase in a hospital's OA score there will be a 0.346 increase in its financial performance. This finding supports the relationship stated by hypothesis 5 and is similar to the empirical findings of others. Specifically, Gibson and Birkinshaw (2004) found that OA is positively related to financial performance (beta = 0.47,  $p < 0.01$ , effect size .866). He and Wong (2004) found a positive interaction effect between exploration and exploitation on firm performance (beta = 4.539,  $p < 0.035$ ; effect size .418). The findings of this study contradict those of Bierly and Daly (2007) who found a statistically non-significant relationship of firm OA levels to firm performance.

### **Practical Relevance**

Because OA has been defined and measured so differently throughout the literature, it is difficult to determine empirically if OA levels definitively impact financial performance. If they do, this is extremely important for the hospital industry because hospitals are running out of ways to enhance their revenue streams. As they enter the age of national healthcare reform, ways and methods for hospitals to become ambidextrous are needed. HRD and organizational development interventions could help hospitals transform themselves. The bottom line is the bottom line. Any method of providing a 34 percent increase in financial performance would be highly sought after by the hospital industry.

### **Surprises**

#### **Finance**

An interesting finding was finance was not one construct but two. As discussed previously, eight survey items related to finance and sorted consistently on two different



factors. The researcher determined this to be reflective of two different constructs. The first construct consisted of responses to three questions (17-19) related to having tools to read and understand hospital financial reports (financials). The researcher labeled this variable ‘financial tools.’ The second construct consisted of responses to questions 20-24 and related to awareness of the hospital’s financial performance, revenue growth, and position in competitive space. This variable was labeled ‘finance no tools.’ Survey items used to operationalize this second construct were taken almost verbatim from previously used tools. The composite construct (comprised of all questions related to finance) was labeled ‘finance.’ Finance was the outcome variable used for MLM (Table 4.19).

### **ICCs Related to Finance**

The researcher looked at the finance responses closely. ICCs were computed. The ICC of variable ‘financial tools’ was low (0.189). The ICC of ‘finance’ was higher at 0.552. The ICC of ‘finance no tools’ (survey items 20-24) was highest at 0.644. This meant variance of ‘financial tools’ was due mostly to variance at the individual response level. The ICC of ‘finance’ demonstrated that the variance in this variable was fairly equally divided between hospital and individual level responses. The ICC of ‘finance no tools’ showed most variance occurred at the hospital rather than individual level. See Table 4.20.

*Table 4.20. Finance Variables: ICCs*

<b>Variable</b>	<b>ICC Value</b>	<b>Meaning of Variance</b>
‘financial tools’	0.189	Most of variance at the individual level.
‘finance’	0.552	Variance approximately equal between hospital level and individual level.
‘finance no tools’	0.644	Variance due mostly to hospital level responses than individual responses.

### **Finance Variables: Correlations at the Individual Level**

The researcher ran correlation matrices to evaluate similarity of responses between different job categories with respect to all three finance variables. The correlation between quality and strategy directors on the variable ‘finance’ was not significant. Correlation between quality and strategy directors on the ‘financial tools’ variable was significant at 0.160 ( $p < 0.005$ ) and on the ‘finance no tools’ variable at 0.686 ( $p < 0.0001$ ). Correlation between HR and quality directors on the ‘finance’ variable was significant at 0.582 ( $p < 0.0001$ ), on the ‘financial tools’ variable at 0.372 ( $p < 0.0001$ ), and on the ‘finance no tools’ variable at 0.585 ( $p < 0.0001$ ). Correlation between HR and strategy directors on the ‘finance’ variable was significant at 0.655 ( $p < 0.0001$ ) and on the ‘finance no tools’ variable at 0.706 ( $p < 0.0001$ ). Correlation between HR and strategy directors on the ‘financial tools’ variable was not significant.

### **HR Directors’ Responses Compared to Other Job Title Responses**

Table 4.21 demonstrated the relationship of job title to levels of OA and the two financial constructs reported. Strategy directors reported the highest levels of OA, ‘finance,’ ‘financial tools,’ and ‘finance no tools’ in their hospitals. HR directors were in the middle. Their self-reported levels of OA, finance, financial tools, and finance no tools were not as high as strategy directors were but not as low as quality directors. Quality directors reported the lowest levels of OA and financial variables in the group. See Table 4.21.

*Table 4.21. Mean Levels Reported by Job Title*

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<b>Job Title</b>	<b>OA Mean</b>
Strategy	8.34
HR	8.17
Quality	8.03

<b>Job Title</b>	<b>Finance Mean</b>
Strategy	3.82
HR	3.52
Quality	3.36

<b>Job Title</b>	<b>Financial Tools Mean</b>
Strategy	4.58
HR	4.09
Quality	3.93

<b>Job Title</b>	<b>Financial No Tools Mean</b>
Strategy	3.37
HR	3.17
Quality	3.02

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## **CHAPTER 5: DISCUSSION**

This chapter ties together information presented in previous chapters. Results of data and findings of statistical tests are discussed. Research questions are answered and evidence to support hypotheses is provided. Relevance and implications of the study to core HRD theory and practice are reviewed. A research agenda of the future is offered.

### **Theory-Building Research Questions**

Lack of clarity in the OA field discussed previously led the researcher (in accord with Lynham's (2002) recommendations) to query (1) what are the key elements of an OA theory (Research Question 1), (2) how theoretical elements were inter-related (Research Question 2), (3) what would explain inter-dependence of elements (Research Question 3), and (4) what general conditions the OA theory would operate within (Research Question 4). Answers to these questions were developed from a review of the literature. How should the OA theoretical model developed be evaluated? Scholars have several good suggestions.

### **Evaluation Criteria**

Lave and March (1975) believe models are art and should be beautiful. Their evaluation criteria for beautiful models are simplicity, fertility (capable of generating new predictions), and unpredictability (capable of surprising the reader with new ways of seeing things). Speaking from a positivist perspective similar to the critical realist paradigm grounding this study, Bacharach (1989) states "the two primary criteria upon

which any theory may be evaluated are (a) falsifiability and (b) utility. Weick (1989) differs from this perspective and argues for diversity of theoretical conjectures. Diversity is fostered by “dialectical oppositions,” “cultivation of paradox,” “conceptualization at more than one level of analysis,” and “micro-macro linkages” (Weick, 1989, p. 522). Whetten (1989) lists seven questions whose answers help judge the worth of a theory, Table 5.1. Eight formal criteria for evaluating a theory have been proposed by Patterson and Watkins (1996), Table 5.2. Swanson (2007) uses a six-component model for evaluating theories, Table 5.3.

Swanson’s (2007) criteria will be used first to evaluate the theory of OA because one of the purposes of the study was to pose implications for HRD theory, research, and practice. See Figures 5.1. Whetten’s (1989) criteria will be used next to evaluate the theory of OA. See Table 5.4. Finally, the researcher used Patterson and Watkins’ (1996) criteria to evaluate the theory/model of OA proposed here, Table 5.5.

*Table 5.1. Seven Criteria for Evaluating a Theory (Whetten, 1989)*

<b>Criteria</b>	<b>Description</b>
1. <i>What's new</i>	"Does the theory/model make a significant, value-added contribution to current thinking (p. 494)?"
2. <i>So what?</i>	"Will the theory likely change the practice of organizational science in this area (p. 494)?"
3. <i>Why so?</i>	"Are the underlying logic and supporting evidence compelling (p. 494)?"
4. <i>Well done?</i>	"Does the paper reflect seasoned thinking, conveying completeness and thoroughness? Are multiple theoretical elements (What, How, Why, When-Where-Who) covered, giving the paper a conceptually well-rounded, rather than a superficial quality (p. 494)?"
5. <i>Done well?</i>	"Is the paper well-written? Does it flow logically? Are the central ideas easily accessed (p. 494)?"
6. <i>Why now?</i>	"Is this topic of contemporary interest to scholars in this area? Will it likely advance current discussions, stimulate new discussions, or revitalize old discussions (p. 494)?"
7. <i>Who cares?</i>	"What percentage of academic readers are interested in this topic (p. 495)?"

Reprinted with permission from Whetten, D.A. (1989). What constitutes a theoretical contribution? *Academy of Management Review*, 14(4), pp. 494-495.

*Table 5.2. Selected Formal Criteria for Evaluating a Theory (Patterson & Watkins, 1996)*

<b>Criteria</b>	<b>Description</b>
1. Importance	It should have some relevance to life or to real behavior. Importance is very difficult to evaluate... if a theory meets other formal criteria, it is probably important.
2. Preciseness and clarity	Should be understandable, internally consistent, and free from ambiguities.
3. Parsimony or simplicity	....the theory contains a minimum of complexity and few assumptions.
4. Comprehensiveness	A theory should be complete, covering the area of interest and including all known data in the field. The area of interest, however, can be restricted.
5. Operationality	....should be capable of being reduced to procedures for testing its propositions or predictions. Concepts must be precise enough to be measurable.
6. Empirical validity or verifiability	... a theory must be supported by experience and experiments that confirm it. .... In addition to its consistency with or ability to account for what is already known, it must generate new knowledge.
7. Fruitfulness	The capacity of a theory to lead to predictions that can be tested, thus leading to the development of new knowledge.
8. Practicality	It should be useful to practitioners in organizing their thinking and practice by providing a conceptual framework for practice.

Reprinted with permission from Watkins, C.H., and Watkins, CE. Jr. (1996). *Theories of Psychotherapy*, pp. 2-3.

Table 5.3. Six-Component Theory for Applied Disciplines (Swanson, 2007, pp. 328-329)

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**Component and Description**

*Boundary of the theory of an applied discipline.* The boundary of the theory of an applied discipline is established by specifying its name, definition, and purpose along with assumptions or beliefs that conceptually frame the theory and practice of that discipline.

*Contributing theories for an applied discipline.* The contributing theories are selected theories that fundamentally address the definition, purpose, and assumptions undergirding applied disciplines.

*Core theory for an applied discipline.* The core theory of an applied discipline is the intersection and integration of the contributing theories that operationalize the definition, purpose, and assumptions of an applied discipline.

*Useful theory for an applied discipline.* The theory of a phenomenon that is outside the core theory of an applied discipline and within the intersection of two contributing theories that has utility in explaining an important realm of practice within the discipline.

*Novel theory for an applied discipline.* The theory of a narrow phenomenon that is related to an aspect of the applied discipline under consideration that could logically provide an unusual explanation of how the phenomenon works.

*Irrelevant theory for an applied discipline.* Any theory that falls outside the theory boundary, contributing theories, core theory, and useful theory of the applied discipline under consideration with no compelling evidence as to its usefulness or logic supporting its potential for a novel contribution.

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Reprinted with permission from Swanson (2007). Theory framework for applied disciplines: boundaries, contributing, core, useful, novel, and irrelevant components. *Human Resource Development Review*, 6(3), 321-329.

**Swanson's (2007) Evaluation Criteria**

**Boundary of OA Theory**

**Name:** Theory of Organizational Ambidexterity

**Definition:** The simultaneous pursuit of exploration and exploitation (EE), within or between individuals and business units at the micro level and/or within or between organizations (intra/inter) at the macro level.

**Purpose:** The purpose of the theoretical model proposed here is to help organizations focus expertise along the now-future continuum to improve quality and financial performance and energize the firm to keep growing.

## **Assumption #1**

### **OA: The First Step of a Theoretical Model**

All models are built on assumptions and a good model explicitly states what these assumptions are. This researcher has presented a model of OA built upon a few simple assumptions. Simplicity is an evaluation criteria important to Bacharach (1989), Lave and March (1975), Patterson and Watkins (1996), and Whetten (1989). If assumptions are simple it is more likely the model will be simple.

The first assumption is OA is a unitary paradoxical construct consisting of exploration and exploitation. This is the first step in an OA theoretical framework. This differs from other notions of OA that begin with exploration and exploitation as antecedents or intermediaries to OA. These notions propose exploration and exploitation to be the first or second steps in a model that then proceed to OA. In other words, these models treat exploration and exploitation as two independent constructs or as latent factors of a second-order construct – OA. The model proposed here treats exploration and exploitation as “separate indicators of a single latent factor” (Lubatkin et al., 2006, p. 657). The latent factor is OA, a view similar but not identical to ideas discussed by Lubatkin et al. (2006).

## **Assumption #2**

### **OA: Like Water**

The second assumption of this OA model is that OA, as a single latent construct occurs in one way. That is, OA is paradoxical because it forms when exploration and exploitation are bonded together, depicted in the model as the yin/yang symbol. Just as two atoms of hydrogen must chemically bond with an atom of oxygen to form a molecule



of water, exploration and exploitation bond to form OA (Gillespie & Popelier, 2001). If the atoms hydrogen and oxygen separate, there is no water. If exploration and exploitation separate, there is no OA. OA represents molecular rather than atomistic thinking.

### **Assumption #3**

#### **Boundaries of OA: One Type, No Typologies**

The third assumption is there is one single type of OA. The researcher acknowledges compelling evidence supports theories of contextual OA (Gibson & Birkinshaw, 2004), structural OA (Tushman & O'Reilly, 1996), and various other typologies of OA (Simsek et al., 2009). However, this researcher avoids the complexity pitfalls associated with extant OA typologies that are not easy to understand, even for OA scholars. In this way, the model of OA presented here refrains from aligning OA conceptualizations, antecedents, and outcomes (Simsek et al., 2009) and excludes them from the scope of the OA theory. The boundaries therefore are simple. OA is the simultaneous holding together of exploration and exploitation. It is possible for exploration and exploitation to be temporally separated, but that is outside the boundary set here. It is also possible that exploration and exploitation can be sequential, reciprocal, or can occur in any other combination researchers can imagine. However, those combinations are also outside the boundary set here.

### **Assumption #4**

#### **OA Levels of Analysis and Conditions of Operation**

The fourth assumption of this model refers to conditions and levels in which the theory of OA operates. OA is a multi-level theory operating at individual, team,

organization, and inter-organization levels. OA occurs within human beings who exist in the world (individual level of analysis). Gilley and Kerns (2010) explain that dyads and groups are working units in organizations (team level of analysis). The organization level is composed of “assemblages of interacting human beings” (March & Simon, 1958, p. 4).

This study focused on individuals as employees of organizations, members of teams (quality, strategy, and human resource directors) and part of the organization as a whole. March and Simon (1958) assert organizations function as a whole (organization level of analysis). Specifically, this research explored the organization level (hospitals) in which mission, vision, identity, and structure facilitate OA. A mission refers to a firm’s essence and contributes to a firm’s identity. A hospital’s mission is to care for the ill. A vision is like a magnet, pulling an organization forward. A hospital’s vision might be to expand their ability to care for the ill, a futurist orientation alluding to growth. Hospitals have both missions and visions, illustrating they think concurrently about current and future patients (customers). Hospitals are governed by a board of directors consisting of various committees. Some committees oversee quality, defined as continuous improvement (a ‘now’ orientation). Other committees oversee strategic planning (a ‘future’ orientation). Committees of the board report to the board, ensuring it meets its overall fiduciary obligations. These obligations occur simultaneously as the board is responsible for overall current hospital business and clinical operations while stretching forward to assure future sustainability of the hospital.

OA also occurs at the interorganization level which was not explored in this study. Organizations interact with each other frequently in the global environment to improve current products, processes, and/or services and invent new ones

(interorganization level of analysis). This level is made up of mergers and acquisitions, business-to-business entities, supply chain relationships, and international trade.

Examples of interorganizational OA are companies that acquire other new companies, which provide competencies not present in the acquiring base company. The base company continues doing what it has been doing at the same time the acquired company is doing things the base company has never done, an example of OA.

Additionally, companies may work with their supply chain partners to improve current inventory practice and venture into new merchandise types. Walmart is known for this type of interorganizational ambidexterity (Porter & Kramer, 2011).

Finally, it is not uncommon for organizations today to maintain operations in the United States as well as Mexico, China, and/or India, among others. Each company serves different functions. New ideas may be developed in the United States based organization and implemented by workers in India or vice-versa. Developers from the United States may work in concert with Indian employees to improve products, processes, and services. Expanding from a national to an international focus helps companies enhance current revenue ('now' focus) while growing market share ('future' focus); an example of interorganizational OA.

#### **Assumption #5**

##### **OA Produces Wellsprings of Knowledge and Expands Mental Models**

OA is a process for developing open minds. It forces people to think of the 'now' and 'future' aspects of their work. OA fosters wellsprings of knowledge that nourish the company and allow individuals to expand their thinking and revise their mental models. This is the antecedent to changes, revisions, and improvements in current processes,

products, services, and routines, and for novel invention, innovation, and strategic future thinking, planning, and production. Improvements in such outcomes as current products and developing new outcomes such as future products results in increased financial performance for the firm.

### **Assumption #6**

#### **OA is a Virtuous Cycle**

The theory of OA presented here is a virtuous cycle process theory. Energy results from improving current products, processes, and services and developing new ones. As financial performance improves all levels of the company are re-energized to begin new OA processes or to continue ones already in place. The OA process then repeats itself.

#### **Where Does OA Fall within Swanson's (2007) Framework?**

OA is a useful theory according to Swanson's (2007) framework. Using elements of economics theory (financial performance) and systems theory (organizations are systems), OA intersects Core HRD theory indicating its relevance to the HRD discipline (Figure 5.1). OA is depicted using Swanson's (2007) six-component framework in Figure 5.2.

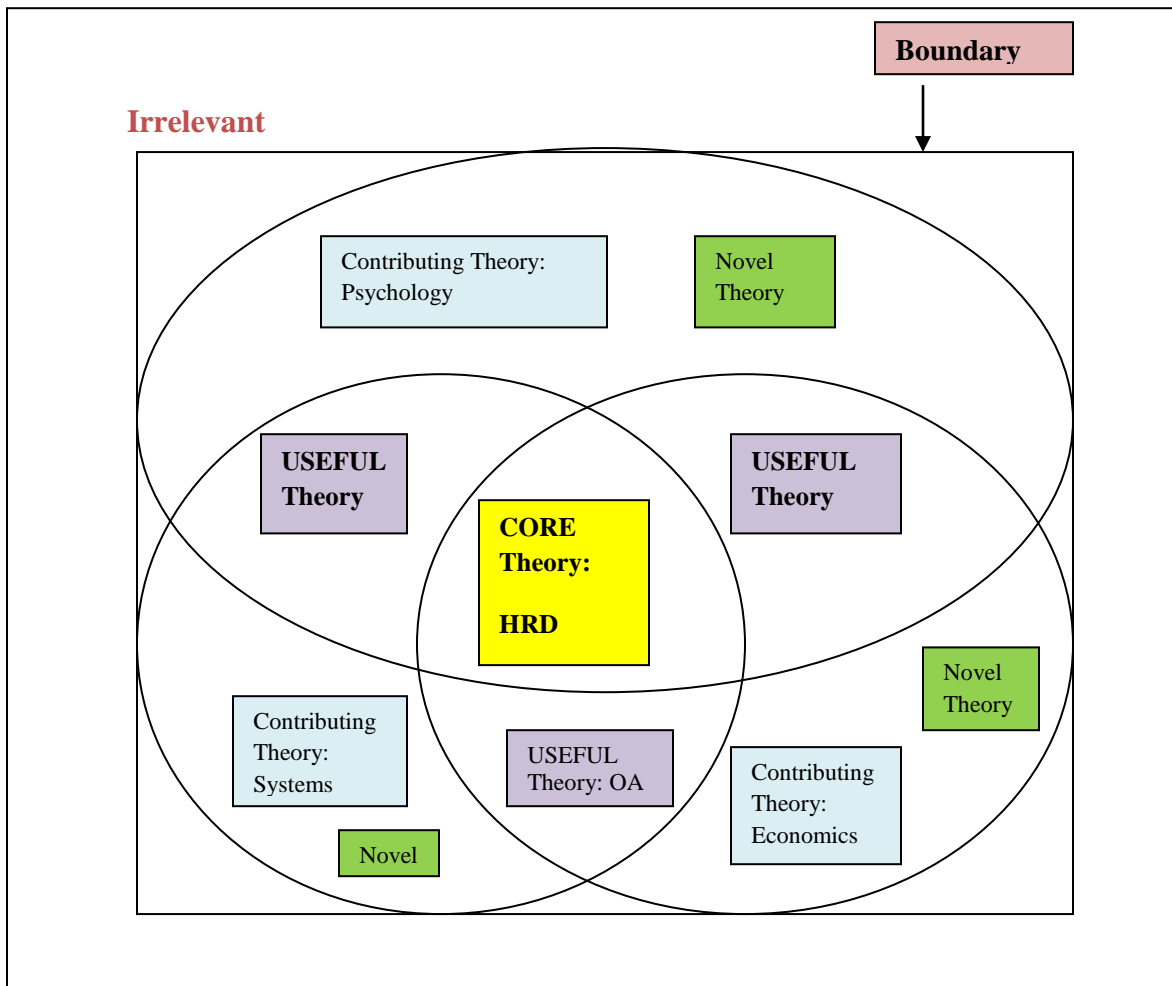


Figure 5.1. Swanson's (2007) Six-Component Theoretical Components of a Core Discipline. Adapted from Swanson, R.S. (2007). Theory framework for applied disciplines: boundaries, contributing, core, useful, novel, and irrelevant components. *Human Resources Development Review*, 6(3), p. 328.

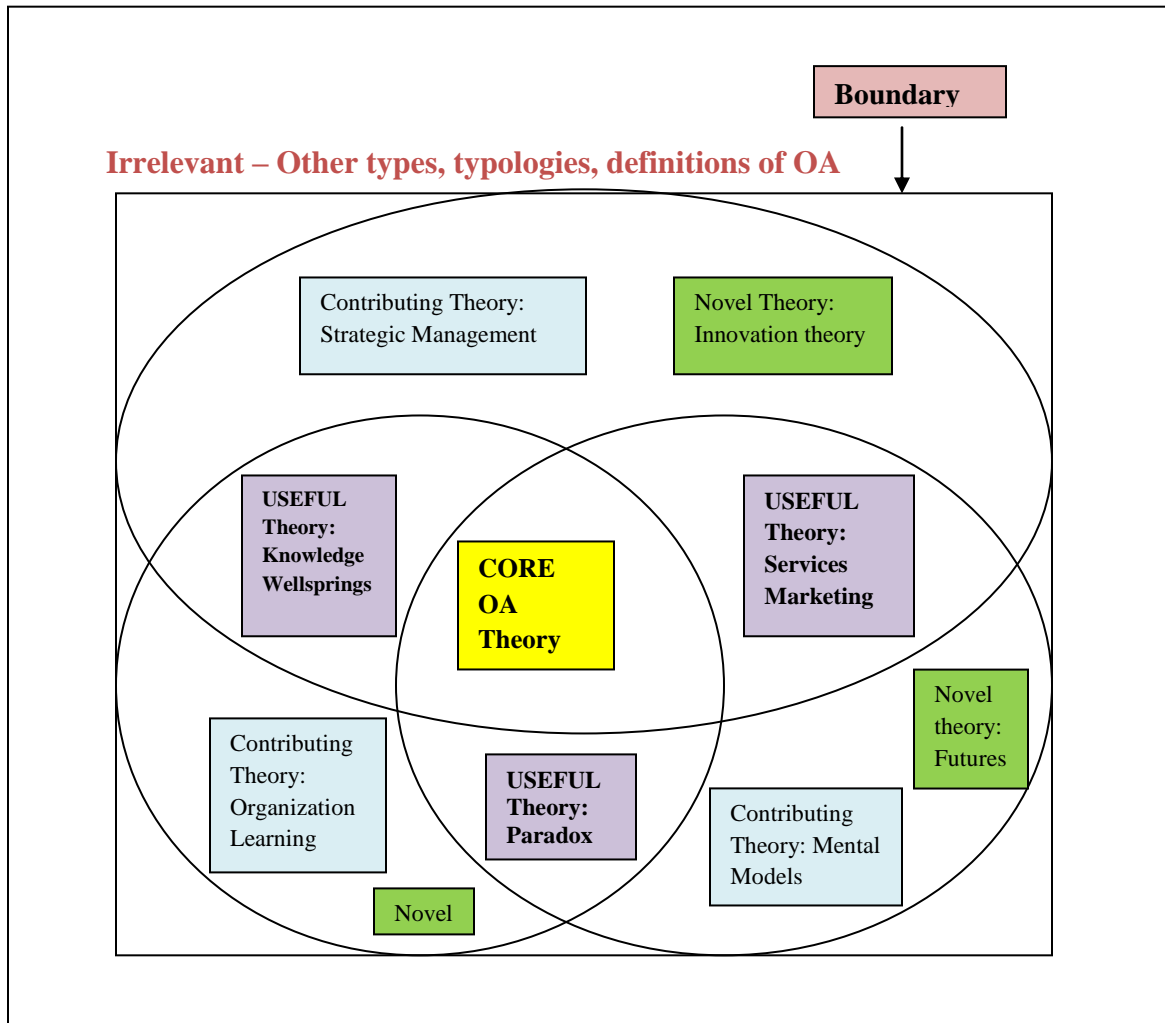


Figure 5.2. Swanson's (2007) Six-Component Theoretical Components of a Core Discipline. Adapted from Swanson, R.S. (2007). Theory framework for applied disciplines: boundaries, contributing, core, useful, novel, and irrelevant components. *Human Resources Development Review*, 6(3), p. 328.

## Whetten's (1989) Criteria for Evaluating OA Theory

*Table 5.4. Seven Criteria for Evaluating a Theory (Whetten, 1989)*

<b>Criteria</b>	<b>Description</b>
1. <i>What's new</i>	The OA theory/model is different from currently extant theories. The research has shown (using Swanson's 2007 framework) that OA is a value-added contribution to current HRD thinking. What's new is the definition of OA, the contributing and useful theories to OA, and the extension of OA research to hospital settings.
2. <i>So what?</i>	This OA theory will likely add to the theory, research, and practice base of HRD and Organization Development.
3. <i>Why so?</i>	The model proposed here is much simpler than other models and parsimony is a valued concept when applying research to practice. Well known theory streams support this theory.
4. <i>Well done?</i>	The theoretical model of OA presented here contains multiple theoretical elements, reflecting the seasoned thinking, completeness, and thoroughness recommended by Whetten (1989).
5. <i>Done well?</i>	Central ideas of the OA theory have been presented in text format in addition to tables and figures.
6. <i>Why now?</i>	OA is a burgeoning area of interest to HRD, management, and organization science scholars. Scholarly papers on the topic are presented in high quality professional journals on a monthly basis. The theory of OA proposed here will likely advance current discussions because it is a much simpler model than others have proposed.
7. <i>Who cares?</i>	Over the past two years specifically, papers on OA have been published in <i>Organization Science</i> , <i>Academy of Management Annals</i> , <i>Academy of Management Journal</i> , <i>Technological Forecasting and Social Change</i> , and <i>Advances in Developing Human Resources</i> . This indicates a large amount of interdisciplinary interest in this topic. It is a topic that has stimulated the imagination of scholars world-wide.

Adapted with permission from Whetten, D.A. (1989). What constitutes a theoretical contribution? *Academy of Management Review*, 14(4), pp. 494-495.

*Table 5.5. Criteria Selected Formal Criteria for Evaluating a Theory (Patterson & Watkins, 1996)*

<b>Criteria</b>	<b>Description</b>
1. Importance	OA is inherently relevant to organizations at a variety of levels. A definition of OA has been presented as well as its' theoretical elements. Practicing OA is related to financial performance and firm sustainability; these are life and death issues for today's companies.
2. Preciseness and clarity	The theoretical model of OA presented here is more parsimonious than other proposed models.
3. Parsimony or simplicity	The definition of OA is simple and there are six assumptions undergirding the theory.
4. Comprehensiveness	The core theory of OA has been developed using contributing theories, useful theories, novel theories, and boundary conditions, Figure 5.1.
5. Operationality	The OA theory was operationalized into variables measured by summated scales on a survey instrument.
6. Empirical validity or verifiability	Statistical tests and procedures discussed next show that OA theory is supported by evidence. New knowledge is produced because the theory has been empirically studied here using a variety of statistical techniques in a new research setting for the field (hospitals).
7. Fruitfulness	The theory led to research questions and hypotheses that were tested empirically. These are discussed in the next section.
8. Practicality	This OA theory should be useful to practitioners by providing a parsimonious conceptual framework for practice.

Adapted with permission from Watkins, C.H., and Watkins, CE. Jr. (1996). *Theories of Psychotherapy*, pp. 2-3.

### **Comparison of Research Findings with Previous Findings**

This research expanded upon previous OA studies in several ways. First, this appears to be the largest random study conducted with respect to number of individual and group-level responses. As a result this study possessed more power and significance than smaller sized surveys. Second, this study of OA was one of the first to be conducted in hospitals. We now have empirical evidence to show OA happens in hospitals as in other industries previously studied. Further, this study replicated findings of other studies that OA is positively related to financial performance. Importantly, this study produced new findings that in hospitals, OA is positively related to quality.



Another important contribution of this study was the theoretical framework of OA presented. OA was described as a virtuous cycle process in which OA resulted in wellsprings of knowledge that improved mental models and opened minds, so that new products, processes, and service were created, leading to improved financial performance and firm sustainability. There were strong boundaries or scope conditions placed on the OA definition so OA is seen as a tool of practice rather than a complex research topic. This approach differentiated this study from other OA studies. This research acknowledged exploration and exploitation can and do occur in other ways but these were considered beyond the scope of this study. Lavie, Stettner, and Tushman (2010) agree and suggest “ambidexterity is only one approach for simultaneously exploring and exploiting” (p. 127).

Similar to other studies, this research found that larger hospitals had higher levels of OA than small hospitals. Conversely, large hospitals and medium sized hospitals had no statistically significant difference in reported OA levels. An interesting finding of the study was lack of a statistically significant difference in OA level between for-profit and not-for-profit hospitals. Interpreted within a real-world context this finding is important because all hospitals are federally regulated even though they are locally distinct entities.

Another interesting finding was that exploration and exploitation are highly correlated, loading on a single factor. This provides support for March’s (1991) original belief that OA consists of exploration and exploitation as two ends of a single continuum which must be balanced for firm success. The findings contradicted other studies that exploration and exploitation are separate and orthogonal constructs. The conclusion drawn is that exploration and exploitation are two latent factors of a single second-order

construct (Lubatkin et al., 2006), OA. Lavie et al. (2010) suggest exploration may not be much different from exploitation. They state “Distinguishing exploration from exploitation becomes more challenging given the multidimensionality of knowledge, debates concerning the amount of learning that each activity entails, and the tendency to attribute either activity to distinctive value-chain functions” (p. 113). Consistent with other findings however, high levels of simultaneous exploration and exploitation in organizations are related to improvements in financial performance and quality.

A final note of interest in this study concerned issues of finance. Finance was originally operationalized as one construct (labeled as one variable measured by eight survey items). It was a surprise to find factorial evidence disputing this. Consistent factor analytic techniques demonstrated that one construct represented tools one would need to read and interpret financial statements. The second construct represented a completely different set of ideas, including actual financial performance, revenue growth, and competitive position. This was demonstrated in the three-factor obliquely rotated PCA solution. The third construct was used in analyses of the first two. Although separate, these variables remained highly correlated. According to level-one data (individual responses) correlation between finance and financial tools was significant at 0.609 ( $p < 0.0001$ ). Correlation between finance and financial no tools was also significant at 0.917 ( $p < 0.0001$ ). These correlations were almost identical to correlations found in the level-two data (hospital-level responses).

### **OA: Implications for HRD Research, Theory, and Practice**

This study situated the notion of OA as a ‘useful theory’ for HRD research, theory, and practice (Swanson, 2007). Lynham’s (2002) *general method* was used to

construct a theoretical framework of OA. Definition and purpose of the theory was presented and assumptions were provided. Contributing, useful, and novel theories of importance to OA were specified. Irrelevant theories with respect to OA were also mentioned (Swanson, 2007).

This was one of the first attempts at theorizing the importance of OA for HRD in hospitals. A benefit of the proposed theory is its parsimony and application to practice. Once put into HRD professional practice, the OA theory can enter the “theory-research-development-practice cycle’ specified by Swanson (2007, p. 324). This will help refine and improve the theory via the lenses of theory, research, and practice. Refinement of the model is also recommended by Lynham’s (2002) *general method*.

Specific areas of future research for OA theory in the HRD setting concern how individuals, teams, and organizations actually practice the simultaneous exploration and exploitation that is OA. Documentation of these methods in practice would be helpful. This research provided compelling evidence OA is related to financial performance and quality. An agenda item for research would be to differentiate short-term financial performance from long-term financial performance and firm sustainability. In line with this, the HRD professional role is to improve organizational financial performance by training and development and organization development (Swanson, 2009). Research on specific training methods and organizational practices for enabling OA in organizations is needed, along with the roles HRD professionals play in choosing and implementing these methods.

Another area of fruitfulness for OA research would be to explore the relationship of OA to other useful theories for HRD, such as scenario planning (Chermack, Bodwell,

& Glick, 2010). Is there a relationship between these methods (theories), and if so, what is it and how does it work? Similarly, what is the scope of OA theory and practice? Lavie et al. (2010) ask whether “exploration-exploitation be narrowly defined in the knowledge domain or broadly in various domains” (p. 142)? This researcher recommends a narrow theory for practice which is easier to implement than is a broad-based theory. Last, March (1991) spoke about the need for firms to simultaneous balance exploration and exploitation. There has been no determination by OA scholars on how this balance is practical. More research is needed here.

A final note regarding OA theory, practice and research concerns the hospital setting. How does OA occur in ‘highly reliable’ organizations like hospitals? Why do hospital HR directors report lower levels of OA than other directors do? Why do hospital HR directors feel they have fewer financial tools than strategy directors do? How can this be rectified? Does this happen in other industries besides hospitals? All of these questions indicate potential areas for research.

### **Limitations of the Study**

This study offered a theory of what OA is and provided a theoretical framework for how OA works. The study limited its focus to elements that had been studied previously. These elements concerned definitions of concepts, reliability and validity of underlying constructs (exploration, exploitation, OA, etc.), and statistical confirmation of proposed relationships between OA and financial performance, and OA and quality. Although a large random sample and variety of theory building and statistical techniques were used, the methods can never prove a theory 100% ‘true’ (Greenland, 2000). This

may impact the generalizability of this study's results to other hospitals and health care organizations, as well as other industry sectors.

### **Summary and Conclusion**

OA was defined as the simultaneous holding together (likened to a chemical bond) of exploration and exploitation. The study depicted a theory of OA to describe what OA is and how it works. This theory was narrow in scope but imaginative in design. Hypotheses derived from the theory were tested. Findings showed exploration and exploitation are not separate orthogonal constructs but two latent factors of a second-order construct; OA, specifically.

High levels of OA exist in hospitals. Levels of OA are similar whether hospitals are investor owned or not-for-profit. Large hospitals have higher levels of OA than small hospitals but not medium sized hospitals. Levels of OA in hospitals are perceived differently by people with different job titles. Specifically, HR directors report lower levels of OA in their hospitals than strategy directors do. HR directors also report possession of fewer financial tools than strategy directors do. This research provided empirical support for the notion OA is positively related to financial performance and quality level in hospitals. The quantitative findings were practically relevant to the field of OA, the HRD profession, and the hospital industry.

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Wendy Bodwell  
Doctoral Student  
Colorado State University  
[wendy\\_bodwell@msn.com](mailto:wendy_bodwell@msn.com)  
Cell: 720.427.5710  
Cell: 720.940.9069

**Bierly and Daly email:**

From: bierlype@jmu.edu  
To: wendy\_bodwell@msn.com; dalyps@jmu.edu  
Date: Sat, 20 Mar 2010 18:29:43 -0400  
Subject: RE: Request Permission to use Five of Your Survey Items

Wendy,

Thank you very much for your interest in our work. Yes, it is fine to use the survey items from our paper - just cite the source. Good luck with your work!

Take care,

Paul Bierly

Zane Showker Prof. of Entrepreneurship

James Madison University

Phone: 540-568-3236

Fax: 540-568-3587

Email: [bierlype@jmu.edu](mailto:bierlype@jmu.edu)

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**From:** wendy bodwell [wendy\_bodwell@msn.com]

**Sent:** Tuesday, March 16, 2010 5:25 PM

**To:** Bierly, Paul - bierlype; Daly, Paula - dalyps; wendy

**Subject:** Request Permission to use Five of Your Survey Items

Dear Drs. Bierly and Daly,

I am requesting permission to use survey items that you published in your article "Alternative Knowledge Strategies, Competitive Environment, and Organizational Performance in Small Manufacturing Firms." This article was published in *Entrepreneurship Theory and Practice*. Specifically I ask your permission to use (without adapting) the 5 items pertaining to performance on p. 511 of the article. I also ask your permission to adapt the other items as needed. I would like to use these items for survey research I am doing for my doctoral dissertation at Colorado State University. Thank you so much for your consideration of my request. Wendy

Wendy Bodwell  
Doctoral Student  
Colorado State University  
[wendy\\_bodwell@msn.com](mailto:wendy_bodwell@msn.com)  
Cell: 720.427.5710  
Cell: 720.940.9069

## APPENDIX B: Jansen's Summary of Reliabilities and Validities

### Summary of Reliability and Validity Evidence (Jansen et al., 2005)

Validity based on Content	<ul style="list-style-type: none"> <li>(1) Instrument adapted from the literature and qualitative interviews.</li> <li>(2) Conducted a literature review.</li> <li>(3) Conducted pretest "involving in-depth interviews with 15 managers regarding the questionnaire. Follow-up interviews then conducted for further improvements in the instrument.</li> </ul>
Validity based on Internal Structure	<ul style="list-style-type: none"> <li>(1) Cronbach's alpha for exploration = 0.85.</li> <li>(2) Cronbach's alpha for exploitation = 0.76.</li> <li>(3) Convergent/Discriminant - Jansen et al. added separate survey measures on OA (exploration and exploitation). Correlations between the EE scores were much stronger than cross-correlations between domains.</li> </ul>
Validity from Factor Analysis (Exploratory = EFA; Confirmatory = CFA)	<ul style="list-style-type: none"> <li>(1) EFA resulted in 2-factor structure (EE); specific factor loadings not provided.</li> <li>(2) CFA performed and authors state "item loadings are as proposed and significant (<math>p &lt; 0.01</math>)" (p. 356).</li> </ul>
Sample Selection	<ul style="list-style-type: none"> <li>(1) No random company sample.</li> <li>(2) Authors surveyed managers of 769 business units within 220 Dutch branches of a financial services company.</li> <li>(3) No random assignment to groups.</li> </ul>
Reliability Type	<ul style="list-style-type: none"> <li>(1) No interrater agreement scores were provided.</li> <li>(2) No intraclass correlations (ICC) were provided.</li> <li>(3) This was the first time this specific survey was used.</li> </ul>
Response Bias	Response rate 47.2%
External Validity	<ul style="list-style-type: none"> <li>(1) Population external validity - no random selection of companies, but some attempt to gain a good sample. ("Medium validity" per Gliner, Morgan, and Leech (GML), 2009).</li> <li>(2) Use of a questionnaire "somewhat artificial" (GLM, 2009, p. 129), but questionnaires took place in natural work setting - "High validity" per GML (2000).</li> </ul>
Overall Validity/Overall Reliability	High/Moderate

## Summary of Reliability and Validity Evidence (Jansen et al., 2006)

Validity based on Content	<ol style="list-style-type: none"> <li>(1) Instrument adapted from Jansen et al. (2005).</li> <li>(2) Conducted a literature review.</li> <li>(3) Conducted pretest "involving in-depth interviews with 15 managers regarding the questionnaire. Follow-up interviews then conducted for further improvements in the instrument.</li> </ol>
Validity based on Internal Structure	<ol style="list-style-type: none"> <li>(1) Cronbach's alpha for exploration = 0.86.</li> <li>(2) Cronbach's alpha for exploitation = 0.80.</li> <li>(3) Convergent/Discriminant - Jansen et al. added separate survey measures on OA (exploration and exploitation). Correlations between the EE scores were much stronger than cross-correlations between domains.</li> </ol>
Validity from Factor Analysis (Exploratory = EFA; Confirmatory = CFA)	<ol style="list-style-type: none"> <li>(1) EFA resulted in 2-factor structure (EE); authors stated "all factor loadings &gt; 0.58 with cross-loadings &lt; 0.29" (p. 1666).</li> </ol>
Sample Selection	<ol style="list-style-type: none"> <li>(1) No random company sample.</li> <li>(2) Authors surveyed managers of 769 business units within 220 Dutch branches of a financial services company.</li> <li>(3) No random assignment to groups.</li> </ol>
Reliability Type	<ol style="list-style-type: none"> <li>(1) Interrater agreement scores were calculated from a follow-up survey. "The median interrater agreements were 0.74 for exploration and 0.78 for exploitation, suggesting adequate agreement" (p. 1665).</li> <li>(2) "Intraclass correlations (ICC) revealed strong level of interrater reliability: Correlations were consistently significant at the 0.0001 levels" (p. 1665).</li> <li>(3) This was the second time this instrument has been used.</li> </ol>
Single Informant Bias & Common Method Bias	<ol style="list-style-type: none"> <li>(1) Temporary separation of the measurement of independent and dependent variables.</li> <li>(2) "Collected data at two different points in time" (p. 1665).</li> </ol>
Response Bias	<ol style="list-style-type: none"> <li>(1) Conducted T-tests to determine differences between respondents and non-respondents for the final sample. No differences found (<math>p &lt; 0.05</math>).</li> <li>(2) "Compared early and late respondents in terms of demographics and model variables revealing no differences (<math>p &lt; 0.05</math>) showing that nonresponse was not a problem" (p. 1665).</li> </ol>
External Validity	<ol style="list-style-type: none"> <li>(1) Population external validity - no random selection of companies, but some attempt to gain a good sample. ("Medium validity" per Gliner, Morgan, and Leech (GML), 2009).</li> <li>(2) Use of a questionnaire "somewhat artificial" (GML, 2009, p. 129), but questionnaires took place in natural work setting - "High validity" per GML (2000).</li> </ol>
Overall Validity/Overall Reliability	High/High

## Summary of Reliability and Validity Evidence (Jansen et al., 2008)

Validity based on Content	(1) Instrument adapted from Jansen et al. (2006). (2) Conducted a literature review. (3) "Branch executives provided information concerning their branch's level of EE innovation" (p. 992).
Validity based on Internal Structure	(1) Cronbach's alpha for exploration = 0.91. (2) Cronbach's alpha for exploitation = 0.88.
Validity from Factor Analysis (Exploratory = EFA; Confirmatory = CFA)	(1) EFA resulted in 2-factor structure (EE); authors stated "all factor loadings > 0.74 with cross-loadings < 0.25" (p. 992).
Sample Selection	(1) No random company sample - the research was conducted at 211 Dutch branches of a large European financial services company. (2) No random assignment to groups.
Reliability Type	(1) Interrater agreement scores were calculated from a survey from a 2nd senior team member in each responding branch" (p. 992). (2) "The mean interrater agreements were 0.80 for exploration and 0.88 for exploitation, suggesting adequate agreement" (p. 992). (3) This was the third time this instrument was used.
Single Informant Bias & Common Method Bias	(1) Temporary separation of the measurement of independent and dependent variables.
Response Bias	(1) Conducted T-tests to determine differences between respondents and non-respondents for the final sample. No differences found ( $p < 0.05$ ). (2) "Compared early and late respondents in terms of demographics and model variables revealing no differences ( $p < 0.05$ ) showing that nonresponse was not a problem" (p. 991).
External Validity	(1) Population external validity - no random selection of companies, but some attempt to gain a good sample. ("Medium validity" per Gliner, Morgan, and Leech (GML), 2009). (2) Cannot generalize to other industry settings. (3) Use of a questionnaire "somewhat artificial" (GLM, 2009, p. 129), but questionnaires took place in natural work setting - "High validity" per GML (2000).
Overall Validity/Overall Reliability	High/High



## Summary of Reliability and Validity Evidence (Jansen et al., 2009)

Validity based on Content	(1) Instrument adapted from Jansen et al. (2006). (2) Conducted a literature review. (3) See previous Jansen et al. tables for additional evidence of validity based on content.
Validity based on Internal Structure	(1) Cronbach's alpha for exploration = 0.86. (2) Cronbach's alpha for exploitation = 0.70. (3) Jansen et al.'s OA scores compared to Zahra's (1996) Innovation scale (alpha = 0.91), had significant positive correlations ( $r = 0.60$ , $p < 0.01$ ). (4) Convergent/discriminant - Jansen et al. added separate survey measures on OA (EE). Correlations between the EE scores were much stronger than the cross-correlations between domains.
Validity from Factor Analysis (Exploratory = EFA; Confirmatory = CFA)	(1) EFA resulted in 2-factor structure (EE); authors stated "all factor loadings $> 0.71$ with cross-loadings $< 0.21$ " (p. 803). (2) CFA - "Item loadings were as proposed and significant ( $p < 0.01$ )" (p. 804).
Sample Selection	(1) Random company sample using database from commercial provider. (2) No random assignment to groups, - but this was not a comparison study; it was a complex associational study.
Reliability Type	(1) Interrater agreement scores from this survey were compared with the Jansen et al. (2006) study. "Scores for exploratory innovation (0.94) and exploitative innovation (0.94) suggests adequate agreement amongst respondents" (p. 803). (2) This is the fourth time Jansen et al. have used essentially the same instrument to test OA.
Response Bias	(1) Conducted T-tests to determine differences between respondents and non-respondents for the final sample. No differences found ( $p < 0.05$ ). (2) "Compared early and late respondents in terms of demographics and model variables revealing no differences ( $p < 0.05$ ) showing that nonresponse was not a problem" (p. 802).
External Validity	(1) Random selection of companies = high external validity.
Overall Validity/Overall Reliability	High/High

## **APPENDIX C: Interview Protocol**

*Interviewer:* Wendy Bodwell

*Interviewees:* Hospital Industry Executives

### **I. Introduction**

1. Introduce myself
  - a. My name
  - b. My organization – CSU
  - c. My topic – OA
  
2. Housekeeping Details
  - a. Review cover letter and informed consent form with the executive.
  - b. Ask them sign and initial each page.
  - c. Ensure that they have with them the page with OA measurement instruments.
  - d. Ask of the executive has any further questions and answer them.
  - e. Ask them to put the completed form in the self-addressed-stamped envelope that I've provided for them and put it in the U.S. mail.

### **II. Present the topic.**

1. Define OA simply. “Wearing the hat of today along with the hat of tomorrow”
  - a. Consists of two components occurring simultaneously.
    - i. Continuous improvement, refinement, taking the knowledge you have now and recombining it in different ways – a new way to do something you're already doing. Goal – Meet today's customers' needs. (Exploitation)
  
    - ii. Innovating, novelty, new strategies. In manufacturing – new products. Goal – Meet future customers' needs. (Exploration)

### **III. Ask for their help.**

1. Most of the studies have been done in high tech, financial services, and manufacturing firms and I need some help in translating what has been done into “hospital” language.

### **IV. Questions**

#### **Exploitation Focus**

1. What specific things have you done in your hospital for continuous improvement? Give some examples.
2. Or – What do you hear in your work with hospital executives with respect to their specific projects in continuous improvement? Give some examples. What are they most proud of?

*Probes:* Some examples might be: improve time from presentation to the ED to entrance to the cardiovascular lab in cases of chest pain; increase in number of VBACs (vaginal birth after caesarian section); infection rates, etc.

#### **Exploration Focus**

1. What specific things have you done for your hospital to prepare for future patients and the services they may need? How do you prepare for the future?

Or – What do you hear in your work with hospital executives with respect to their specific projects to prepare for their future patients or to prepare a strategy to deal with the future? What are you most proud of?

*Probes:* Some examples might be: buying a piece of property to add a Medical Office Building next to your hospital; buying physician practices to enlarge your patient base; establishing a specialty in cardiovascular surgery to add new patients; divesting yourselves of services that threaten the bottom line, i.e., obstetrics, neonatal intensive care, psychiatry, etc.

#### **Critiquing Existing Instruments**

1. Direct the executive to the document containing questions from various instruments.

2. Ask the executive to critique the instruments with the goal of turning them into “hospital-friendly” questions.

*Probes:* What questions would you add? What questions would you keep? What questions would you delete?

### **How do you “do” OA?**

1. How does your hospital (or these hospitals) do both of these things simultaneously? How do you deal with the tensions that the two opposite components provide?

*Probes:* Cross-functional teams; top management team involvement; other type of team-based model; consultants; interdisciplinary teams, involved workforce; professional models, etc.

2. Is your hospital (or the hospitals you hear about) better at one component or another? Why or why not?

### **Communication**

1. How do you communicate the need for OA in your organization?

### **What Type of Concept is OA?**

1. Do you think that the components of OA that we previously talked about – continuous improvement, and planning for the future – are the same thing on two different ends of a continuum or do you feel they are two different things?

### **Importance of OA**

1. Do you think that there is a need for organizational ambidexterity in healthcare, and why or why not? Why does your specific hospital need it? (or those hospitals you’re hearing about?).


**APPENDIX D: IRB 087-09H**



**Research Integrity & Compliance Review Office**  
Office of Vice President for Research  
Fort Collins, CO 80523-2011  
(970) 491-1553  
FAX (970) 491-2293

**DATE:** December 22, 2009

**TO:** Thomas Chermack, Education  
Wendy Bodwell, Education



**FROM:** Janell Barker, IRB Administrator  
Research Integrity & Compliance Review Office

**TITLE:** A Theoretical Model of Organizational Ambidexterity

**IRB ID:** 087-09H                      **Review Date:** December 21, 2009

The Institutional Review Board (IRB) Administrator has reviewed this project and has declared the study exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b)(2): data must be collected in such a manner that the human subjects can't be identified. The IRB determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as proposed in the Exempt application,** including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- **Any modification of this research should be submitted to the IRB through an email to the IRB Administrator, prior to implementing any changes,** to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.

- **Please notify the IRB if any problems or complaints of the research occur.**

Please note that you must submit all research involving human participants for review by the IRB. **Only the IRB may make the determination of exemption**, even if you conduct a similar study in the future.

## APPENDIX E: Atuahene-Gima (2005) OA Instrument

### Atuahene-Gima, 2005 (p. 69)

Adapted from Zahra, Ireland, & Hitt 2000)

Atuahene-Gima, K. (2005). Resolving the capability-rigidity paradox in new product innovation. *Journal of Marketing*, 69, 61-83.

#### • **Exploration**

- *Over the last three years, to what extent has your firm*
- 1. Acquired manufacturing technologies and skills entirely new to the firm?
- 2. Learned product development skills and processes (such as product design, prototyping new products, timing of new product introductions, and customizing products for local markets) entirely new to the industry?
- 3. Acquired entirely new managerial and organizational skills that are important for innovation (such as forecasting technological and customer trends; identifying emerging markets and technologies; coordinating and integrating R&D; marketing, manufacturing, and other functions; managing the product development process)?
- 4. Learned new skills in areas such as funding new technology, staffing R&D function, training and development of R&D, and engineering personnel for the first time?
- 5. Strengthened innovation skills in areas where it had no prior experience?

#### • **Exploitation**

- *Over the last three years, to what extent has your firm*
- 1. Upgraded current knowledge and skills for familiar products and technologies?
- 2. Invested in enhancing skills in exploiting mature technologies that improve productivity of current innovation operations?
- 3. Enhanced competencies in searching for solutions to customer problems that are near to existing solutions rather than completely new solutions?
- 4. Upgraded skills in product development processes in which the firm already possesses significant experience?
- 5. Strengthened our knowledge and skills for projects that improve efficiency of existing innovation activities?

## **APPENDIX F: Bierly and Daly (2007) OA Instrument**

### **Bierly and Daly (2007) – 5-Point Likert Scale**

#### **Exploration (Cronbach's alpha = 0.75)**

1. We frequently experiment with radical new ideas (or ways of doing things).
2. At our company, employees frequently come up with creative ideas that challenge conventional ideas.
3. Compared to our principal competitors, a high percentage of our company sales come from new products launched within the past 3 years.
4. We are usually one of the first companies in our industry to use new, breakthrough technologies.

#### **Exploitation (Cronbach's alpha = 0.73)**

1. At our company, a strong emphasis is placed on improving efficiency.
2. Our company excels at refining existing technologies.
3. We frequently adjust our procedures, rules, and policies to make things work better.

#### **Performance (Cronbach's alpha = 0.91)**

1. Over the past 3 years, our financial performance has been outstanding.
2. Over the past 3 years, our financial performance has exceeded our competitors.
3. Over the past 3 years, our revenue growth has been outstanding.
4. Over the past 3 years, our revenue growth has exceeded our competitors.
5. Over the past 3 years, we have been more profitable than our competitors.

#### **Dynamism**

1. Our industry is more unstable than most, changing more quickly and unpredictably.

#### **Technology**

1. Our industry would be characterized as a high-technology industry.

#### **Munificence**

1. How favorably do you perceive the business outlook to be during the next 12 months?



## APPENDIX G: Cao et al. (2007) OA Instrument

### Cao et al., 2009      Used He & Wong's (2004) Instrument – 7-Point Likert Scale

<b>Exploration</b>	<u>Cronbach's Alpha</u>
1. Introduction of new generations of products.	0.82 (composite)
2. Extension of product ranges.	
3. Opening up new markets.	
4. Entering new technological fields	
<b>Exploitation</b>	
1. Improvement of existing products.	0.79 (composite)
2. Improvement of product flexibility.	
3. Reduction of production cost.	
4. Enhancement of existing markets.	

## APPENDIX H: Gibson and Birkinshaw (2004) OA Instrument

### Gibson & Birkinshaw (2004) – 7-Point Likert Scale

	<b>Cronbach's Alpha</b>
<b>Adaptability (Exploration)</b>	
1. The management systems in this organization encourage people to challenge outmoded traditions/practices/sacred cows.	0.79
2. The management systems in this organization are flexible enough to allow us to respond quickly to changes in our markets.	0.92
3. The management systems in this organization evolve rapidly in response to shifts in our business priorities.	0.9
<b>Alignment (Exploitation)</b>	
1. The management systems in this organization work coherently to support the overall objectives of this organization.	0.56
2. The management systems in this organization cause us to waste resources on unproductive activities (reversed).	0.85
3. People in this organization often end up working at cross-purposes because our management systems give them conflicting objectives (reversed).	0.85

## APPENDIX I: He and Wong (2004) OA Instrument

### He & Wong (2004) – 7-Point Likert Scale

	<b>Cronbach's Alpha</b>
<b>Exploration</b>	
1. Introduce new generation of products.	0.706
2. Extend product range.	0.844
3. Open up new markets.	0.786
4. Enter new technology fields	0.707
<b>Exploitation</b>	
1. Improve existing product quality.	0.554
2. Improve production flexibility.	0.827
3. Reduce production cost.	0.868
4. Improve yield or reduce material consumption.	0.892

## APPENDIX J: Jansen et al. (2008, 2009) OA Instrument

### **Jansen et al. (2008) – 7-Point Likert Scale**

#### **Exploration - Adapted from Jansen et al., 2006. (Cronbach's alpha for all items = 0.91)**

1. Our organization accepts demands that go beyond existing products and services.
2. We invent new products and services.
3. We experiment with new products and services in our local market.
4. We commercialize products and services that are completely new to our organization.
5. We frequently utilize new opportunities in new markets.
6. Our organization regularly uses new distribution channels. [*Item deleted after EFA*]

#### **Exploitation - Adapted from Jansen et al., 2006. (Cronbach's alpha for all items = 0.88)**

1. We frequently refine the provision of existing products and services.
2. We regularly implement small adaptations to existing products and services.
3. We introduce improved, but existing products and services for our local market.
4. We improve our provision's efficiency of products and services.
5. We increase economies of scale in existing markets.
6. Our organization expands services for existing clients.
7. Lowering costs of internal processes is an important objective [*Item deleted after EFA*]

### **Jansen et al. (2009) – 7-Point Likert Scale**

#### **Exploration - Adapted from Jansen et al., 2006. (Cronbach's alpha for all items = 0.86)**

1. Our organization accepts demands that go beyond existing products and services.
2. We commercialize products and services that are completely new to our organization.
3. We frequently utilize new opportunities in new markets.
4. Our organization regularly uses new distribution channels.

#### **Exploitation - Adapted from Jansen et al., 2006. (Cronbach's alpha for all items = 0.70)**

1. We frequently make small adjustments to our existing products and services
2. We improve our provision's efficiency of products and services.
3. We increase economies of scale in existing markets.
4. Our organization expands services for existing clients.

## APPENDIX K: Lubatkin et al. (2006) OA Instrument

Lubatkin, Simsek, Ling, and Veiga (2006) p. 656

Lubatkin, M. H., Simsek, Z., Ling, Y., & Veiga, J. F. (2006). Ambidexterity and performance in small-to-medium-sized firms: The pivotal role of top management team behavioral integration. *Journal of Management*, 32(5), 646-672.

### **Exploration** (5-Point Likert Scale)

*During the past three years, my firm*

1. Looks for novel technological ideas by thinking “outside the box.”
2. Bases its success on its ability to explore new technologies.
3. Creates products or services that are innovative to the firm.
4. Looks for creative ways to satisfy its customers’ needs.
5. Aggressively ventures into new market segments.
6. Actively targets new customer groups.

### **Exploitation** (5-Point Likert Scale)

*During the past three years, my firm*

1. Commits to improve quality and lower cost.
2. Continuously improves the reliability of its products and services.
3. Increases the levels of automation in its operations.
4. Constantly surveys existing customers’ satisfaction.
5. Fine-tunes what it offers to keep its current customers satisfied.
6. Penetrates more deeply into its existing customer base.

## APPENDIX L: Hospital Survey

**Survey Instructions**  
Please circle the correct demographic information:

**Female**    25-35    36-45    46-55    56-65    66-75    76-85    **HR**  
**Male**      36-45    46-55    56-65    66-75    76-85    **Strategy**    **Quality**  
**Age:**      25-35    36-45    46-55    56-65    66-75    76-85    **76-85**

Please think about your current job and the environment you work in and fill out this survey. Read each question and respond by circling the number on the 5-point scale. Please mail your completed survey in the Self-Addressed Stamped Envelope provided. Thank you!!

**Legend:**  
SA = Strongly Agree    A = Agree    N = Neutral    DA = Disagree    SDA = Strongly disagree

Item	SA	A	N	DA	SDA
1. My hospital generates new clinical services in order to increase patient access.	1	2	3	4	5
2. My hospital keeps the public well-informed of new clinical services.	1	2	3	4	5
3. My hospital seeks to increase market share via new ventures.	1	2	3	4	5
4. My hospital has strategic initiatives involving new technological fields (social media, electronic medical record, robotics, gamma knife, etc.).	1	2	3	4	5
5. My hospital encourages searching for novel ideas and thinking outside the box.	1	2	3	4	5
6. My hospital looks for creative ways to satisfy its patients' needs.	1	2	3	4	5
7. My hospital is flexible enough to allow us to respond quickly to changes in our strategic initiatives and goals.	1	2	3	4	5
8. My hospital evolves rapidly in response to shifts in our strategic initiatives and goals.	1	2	3	4	5
9. My hospital frequently adjusts existing clinical services to improve patient safety.	1	2	3	4	5
10. My hospital reduces the cost of providing clinical services.	1	2	3	4	5
11. My hospital continuously improves the reliability of clinical services and work flow processes.	1	2	3	4	5
12. My hospital improves labor productivity in providing clinical services.	1	2	3	4	5
13. My hospital expands clinical services for existing patients.	1	2	3	4	5
14. My hospital's departments work cohesively to support overall hospital objectives.	1	2	3	4	5
15. My hospital frequently adjusts procedures, rules, and policies to improve patient safety.	1	2	3	4	5
16. My hospital's publically reported quality indicators have continuously improved.	1	2	3	4	5
17. I am regularly provided with information regarding my hospital's financial performance.	1	2	3	4	5
18. I receive and review my hospital's income statement every month.	1	2	3	4	5
19. I have the tools I need to find and understand my hospital's financial performance.	1	2	3	4	5
20. Over the past 3 years, my hospital's financial performance has been outstanding.	1	2	3	4	5
21. Over the past 3 years, my hospital's financial performance has exceeded our competitors.	1	2	3	4	5
22. Over the past 3 years, my hospital's revenue growth has been outstanding.	1	2	3	4	5
23. Over the past 3 years, my hospital's revenue growth has exceeded our competitors.	1	2	3	4	5
24. Over the past 3 years, my hospital has been more profitable than our competitors.	1	2	3	4	5
Comments:					

## APPENDIX M: Hospital Survey Coded for Research Analyses

**Survey Instructions**  
Please circle the correct demographic information:

Female      Male      Age: 25-35      36-45      46-55      56-65      66-75      76-85  
 Your Work Area:      Strategy      Quality      HR

Please think about your current job and the environment you work in and fill out this survey. Read each question and respond by circling the number on the 5-point scale. Please mail your completed survey in the Self-Addressed Stamped Envelope provided. Thank you!!

Legend: SA = Strongly Agree    A = Agree    N = Neutral    DA = Disagree    SDA = Strongly Disagree

Legend: \* = Adapted from Jansen et al. (2009), \*\* = Adapted from He & Wong (2004)  
 Legend: \*\*\* = Adapted from Bigoski & Daly (2007); # = Adapted from Jorgensen et al. (2006)  
 Legend: ## = Adapted from Gibson & Bjorkstrand (2004); N = New item

Item	SA	A	N	DA	SDA
1. My hospital generates new clinical services in order to increase patient access. * RQ 1, RQ 2, H1	1	2	3	4	5
2. My hospital keeps the public well-informed of new clinical services. * RQ 1, RQ 2, H1	1	2	3	4	5
3. My hospital seeks to increase market share via new ventures. * RQ 1, RQ 2, H1	1	2	3	4	5
4. My hospital has strategic initiatives involving new technological fields (social media, electronic medical record, robotics, gamma knife, etc.) ** RQ 1, 2; H1	1	2	3	4	5
5. My hospital encourages searching for novel ideas and thinking 'outside the box'. # RQ 1, RQ 2, H1	1	2	3	4	5
6. My hospital looks for creative ways to satisfy its patients' needs. # RQ 1, RQ 2, H1	1	2	3	4	5
7. My hospital is flexible enough to allow us to respond quickly to changes in our strategic objectives and goals. ## RQ 1, RQ 2, H1	1	2	3	4	5
8. My hospital evolves rapidly in response to shifts in our strategic initiatives and goals. ## RQ 1, RQ 2, H1	1	2	3	4	5
9. My hospital frequently adjusts existing clinical services to improve patient safety. * RQ 1, RQ 2, H1	1	2	3	4	5
10. My hospital reduces the cost of providing clinical services. RQ 1, RQ 2, H1	1	2	3	4	5
11. My hospital continuously improves the reliability of clinical services and workflow processes. # RQ 1, RQ 2, H1	1	2	3	4	5
12. My hospital improves labor productivity in providing clinical services. ** RQ 1, RQ 2, H1	1	2	3	4	5
13. My hospital expands clinical services for existing patients. * RQ 1, RQ 2, H1	1	2	3	4	5
14. My hospital's departments work cohesively to support overall hospital objectives. ## RQ 1, RQ 2, H1	1	2	3	4	5
15. My hospital frequently adjusts procedures, rules, and policies to improve patient safety. *** RQ 1, RQ 2, H1	1	2	3	4	5
16. My hospital publicly reported quality indicators have continuously improved. N RQ 1, RQ 2, RQ 4; H1, H4	1	2	3	4	5
17. I am regularly provided with information regarding my hospital's financial performance. N RQ 4, H5	1	2	3	4	5
18. I receive and review my hospital's income statements every month. N RQ 4, H5	1	2	3	4	5
19. I have the tools I need to find and understand my hospital's financial performance. N RQ 4, H5	1	2	3	4	5
20. Over the past 3 years, my hospital's financial performance has been outstanding. *** RQ 4, H5	1	2	3	4	5
21. Over the past 3 years, my hospital's financial performance has exceeded our competitors. *** RQ 4, H5	1	2	3	4	5
22. Over the past 3 years, my hospital's revenue/growth has been outstanding. *** RQ 4, H5	1	2	3	4	5
23. Over the past 3 years, my hospital's revenue/growth has exceeded our competitors. *** RQ 4, H5	1	2	3	4	5
24. Over the past 3 years, my hospital has been more profitable than our competitors. *** RQ 4, H5	1	2	3	4	5

Comments: Questions 1-8 = Explorations; Questions 9 - 16 = Exploitation; Questions 17-22 = Financial Performance; Org size & complexity are coded on survey Size-Ownership-Trauma is coded on each survey  
 Exploration = 1-8    Exploitation = 9-16    Financial = 17-24

APPENDIX N: IRB 008-10H



Research Integrity & Compliance Review Office  
Office of Vice President for Research  
Fort Collins, CO 80523-2011  
(970) 491-1553  
FAX (970) 491-2293

**DATE:** February 16, 2010

**TO:** Thomas Chermack, Education  
Wendy Bodwell, Education

A handwritten signature in cursive script that reads "Janell Barker".

**FROM:** Janell Barker, IRB Administrator  
Research Integrity & Compliance Review Office

**TITLE:** Organizational Ambidexterity: What Roles do Human Resource Development Professionals Play?

**IRB ID:** 008-10H

**Review Date:** February 16, 2010

The Institutional Review Board (IRB) Administrator has reviewed this project and has declared the study exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b)(2): Research involving the use of ... survey procedures... in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. The IRB determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as proposed in the Exempt application,** including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- **Any modification of this research should be submitted to the IRB through an email to the IRB Administrator, prior to implementing any changes,** to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.
- **Please notify the IRB if any problems or complaints of the research occur.**



Please note that you must submit all research involving human participants for review by the IRB. **Only the IRB may make the determination of exemption**, even if you conduct a similar study in the future.

APPENDIX O: IRB 016-10H



Research Integrity & Compliance Review Office  
Office of Vice President for Research  
Fort Collins, CO 80523-2011  
(970) 491-1553  
FAX (970) 491-2293

**DATE:** March 22, 2010

**TO:** Thomas Chermack, Education  
Wendy Bodwell, Education

A handwritten signature in cursive script that reads "Janell Barker".

**FROM:** Janell Barker, IRB Administrator  
Research Integrity & Compliance Review Office

**TITLE:** Pilot Test of an Instrument Designed to Measure Organizational  
Ambidexterity in Hospitals

**IRB ID:** 016-10H                      **Review Date:** March 22, 2010

The Institutional Review Board (IRB) Administrator has reviewed this project and has declared the study exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b)(2): Research involving the use of educational tests, survey procedures, interview procedures or observation of public behavior, unless: a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects. The IRB determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as proposed in the Exempt application,** including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- **Any modification of this research should be submitted to the IRB through an email to the IRB Administrator, prior to implementing any changes,** to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.
- **Please notify the IRB if any problems or complaints of the research occur.**

Please note that you must submit all research involving human participants for review by the IRB. **Only the IRB may make the determination of exemption**, even if you conduct a similar study in the future.

**APPENDIX P: Factor Solutions for Pilot Data**

PCA Unrotated Three-Factor Solution with Eigenvalues and Communalities

<b>Principal Item</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Eigenvalue</b>	<b>Communality</b>
1	0.617	0.096	-0.344	<b>7.876</b>	<b>0.509</b>
2	0.554	0.167	0.107	<b>3.336</b>	0.346
3	0.435	0.178	0.494	<b>2.126</b>	0.465
4	0.656	0.031	0.268	<b>1.509</b>	<b>0.503</b>
5	<b>0.705</b>	-0.161	0.096	<b>1.223</b>	<b>0.532</b>
6	<b>0.753</b>	0.218	0.155	<b>1.018</b>	<b>0.639</b>
7	<b>0.705</b>	0.210	0.043	0.888	<b>0.544</b>
8	<b>0.760</b>	0.037	0.107	0.835	<b>0.591</b>
9	0.609	-0.199	0.005	0.760	0.411
10	0.459	0.036	0.603	0.610	<b>0.576</b>
11	0.632	0.292	0.240	0.564	<b>0.542</b>
12	0.644	0.186	0.455	0.476	<b>0.657</b>
13	0.613	0.080	0.184	0.440	0.416
14	0.576	0.183	0.287	0.367	0.448
15	<b>0.798</b>	0.265	0.053	0.346	<b>0.710</b>
16	0.514	-0.101	0.436	0.333	0.465
17	0.655	0.120	0.124	0.311	0.459
18	0.283	0.013	0.657	0.228	<b>0.513</b>
19	0.444	0.211	0.373	0.182	0.381
20	0.388	0.663	0.052	0.180	<b>0.594</b>
21	0.274	<b>0.854</b>	0.154	0.134	<b>0.828</b>
22	0.473	0.457	0.260	0.105	<b>0.501</b>
23	0.326	<b>0.866</b>	0.009	0.084	<b>0.857</b>
24	0.386	<b>0.821</b>	0.109	0.057	<b>0.836</b>

PCA Three-Factor Orthogonal Varimax Rotation

Principal Item	Factor 1	Factor 2	Factor 3
1	0.656	0.045	0.277
2	0.322	0.359	0.336
3	0.670	0.118	0.045
4	0.671	0.155	0.169
5	0.638	0.348	0.066
6	0.539	0.589	0.034
7	0.567	0.470	0.023
8	0.530	0.517	0.206
9	0.520	0.375	0.002
10	0.012	<b>0.733</b>	0.195
11	0.413	0.604	0.071
12	0.271	<b>0.763</b>	0.037
13	0.562	0.175	0.264
14	0.657	0.126	0.000
15	<b>0.709</b>	0.455	-0.001
16	0.678	0.044	0.054
17	0.606	0.289	0.088
18	-0.168	0.690	0.093
19	0.170	0.591	0.051
20	0.171	0.036	<b>0.750</b>
21	0.084	0.099	<b>0.900</b>
22	0.409	0.041	0.576
23	0.050	0.005	<b>0.924</b>
24	0.036	0.132	<b>0.903</b>

PCA Four-Factor Unrotated Solution with Eigenvalues and Communalities

Principal Item	Factor 1	Factor 2	Factor 3	Factor 4	Eigenvalue	Communality
1	0.617	0.096	0.344	0.391	<b>7.876</b>	<b>0.662</b>
2	0.554	0.167	0.107	0.488	<b>3.336</b>	<b>0.585</b>
3	0.435	0.178	0.494	0.375	<b>2.126</b>	<b>0.606</b>
4	0.656	0.031	0.268	0.112	<b>1.509</b>	<b>0.516</b>
5	0.705	0.161	0.096	0.087	<b>1.223</b>	<b>0.540</b>
6	<b>0.753</b>	0.218	0.155	0.016	<b>1.018</b>	<b>0.640</b>
7	<b>0.705</b>	0.210	0.043	0.136	0.888	<b>0.562</b>
8	<b>0.760</b>	0.037	0.107	0.022	0.835	<b>0.592</b>
9	0.609	0.199	0.005	0.343	0.760	<b>0.529</b>
10	0.459	0.036	0.603	0.161	0.610	<b>0.602</b>
11	0.632	0.292	0.240	0.182	0.564	<b>0.575</b>
12	0.644	0.186	0.455	0.240	0.476	<b>0.715</b>
13	0.613	0.080	0.184	0.286	0.440	0.499
14	0.576	0.183	0.287	0.014	0.367	0.449
15	<b>0.798</b>	0.265	0.053	0.249	0.346	<b>0.772</b>
16	0.514	-0.100	0.436	0.451	0.333	<b>0.669</b>
17	0.655	0.120	0.124	0.379	0.311	<b>0.603</b>
18	0.283	0.013	0.657	0.176	0.228	<b>0.544</b>
19	0.444	0.211	0.373	0.230	0.182	0.435
20	0.388	0.663	0.052	0.135	0.180	<b>0.612</b>
21	0.274	<b>0.854</b>	0.154	0.043	0.134	<b>0.830</b>
22	0.473	0.457	0.260	0.299	0.105	<b>0.591</b>
23	0.326	<b>0.866</b>	0.009	0.125	0.084	<b>0.873</b>
24	0.386	<b>0.821</b>	0.109	0.008	0.057	<b>0.836</b>

PCA Four-Factor Orthogonal Varimax Rotation

Principal Item	Factor 1	Factor 2	Factor 3	Factor 4
1	0.247	0.226	0.000	<b>0.742</b>
2	-0.036	0.287	0.350	0.615
3	0.256	-0.093	-0.168	<b>0.709</b>
4	0.595	0.153	0.083	0.362
5	0.576	0.048	0.278	0.357
6	0.483	0.013	0.531	0.352
7	0.393	-0.008	0.417	0.483
8	0.439	0.183	0.463	0.387
9	0.215	-0.041	0.337	0.606
10	0.160	0.210	<b>0.724</b>	-0.095
11	0.497	-0.076	0.550	0.138
12	0.440	0.041	<b>0.720</b>	0.015
13	0.256	0.223	0.133	0.604
14	0.522	-0.021	0.059	0.414
15	<b>0.747</b>	-0.010	0.370	0.277
16	<b>0.799</b>	0.064	-0.132	0.094
17	<b>0.733</b>	0.093	0.209	0.115
18	-0.169	0.081	<b>0.711</b>	0.063
19	0.046	-0.077	0.581	0.298
20	0.031	<b>0.732</b>	0.030	0.271
21	-0.043	<b>0.903</b>	0.111	-0.015
22	0.487	0.583	-0.091	0.076
23	0.099	<b>0.929</b>	-0.010	0.006
24	0.029	<b>0.899</b>	0.133	0.089

PCA Unrotated Five-Factor Solution with Eigenvalues and Communalities

Principal Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Eigenvalue	Communality
1	0.617	0.096	-0.344	0.391	-0.005	<b>7.876</b>	<b>0.662</b>
2	0.554	0.167	0.107	0.488	-0.115	<b>3.336</b>	<b>0.598</b>
3	0.435	-0.178	-0.494	0.375	0.146	<b>2.126</b>	<b>0.627</b>
4	0.656	-0.031	-0.268	-0.112	0.156	<b>1.509</b>	<b>0.540</b>
5	<b>0.705</b>	-0.161	-0.096	-0.087	0.094	<b>1.223</b>	<b>0.549</b>
6	<b>0.753</b>	-0.218	0.155	-0.016	-0.233	<b>1.018</b>	<b>0.694</b>
7	<b>0.705</b>	-0.210	0.043	0.136	-0.473	0.888	<b>0.787</b>
8	<b>0.760</b>	-0.037	0.107	0.022	-0.463	0.835	<b>0.806</b>
9	0.609	-0.199	-0.005	0.343	0.016	0.760	<b>0.529</b>
10	0.459	0.036	0.603	-0.161	-0.290	0.610	<b>0.687</b>
11	0.632	-0.292	0.240	-0.182	0.157	0.564	<b>0.600</b>
12	0.644	-0.186	0.455	-0.240	0.009	0.476	<b>0.715</b>
13	0.613	0.080	-0.184	0.286	0.206	0.440	<b>0.541</b>
14	0.576	-0.183	-0.287	-0.014	-0.038	0.367	0.450
15	<b>0.798</b>	-0.265	-0.053	-0.249	0.139	0.346	<b>0.791</b>
16	0.514	-0.101	-0.436	-0.451	-0.036	0.333	<b>0.671</b>
17	0.655	-0.120	-0.124	-0.379	0.165	0.311	<b>0.631</b>
18	0.283	-0.013	0.657	0.176	0.408	0.228	<b>0.711</b>
19	0.444	-0.211	0.373	0.230	0.484	0.182	<b>0.669</b>
20	0.388	0.663	-0.052	0.135	-0.122	0.180	<b>0.627</b>
21	0.274	<b>0.854</b>	0.154	-0.043	0.046	0.134	<b>0.832</b>
22	0.473	0.457	-0.260	-0.299	0.198	0.105	<b>0.631</b>
23	0.326	<b>0.866</b>	-0.009	-0.125	0.042	0.084	<b>0.875</b>
24	0.386	<b>0.821</b>	0.109	-0.008	0.014	0.057	<b>0.836</b>



PCA Five-Factor Orthogonal Varimax Rotation

Principal Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	0.219	0.224	0.151	<b>0.735</b>	-0.020
2	-0.082	0.290	0.386	0.560	0.211
3	0.267	-0.092	-0.074	<b>0.743</b>	-0.043
4	0.605	0.150	0.110	0.364	0.077
5	0.569	0.046	0.275	0.333	0.190
6	0.391	0.005	0.655	0.275	0.187
7	0.241	-0.022	<b>0.753</b>	0.399	-0.031
8	0.292	0.168	<b>0.776</b>	0.300	-0.007
9	0.190	-0.038	0.326	0.565	0.255
10	0.084	0.198	<b>0.705</b>	-0.197	0.322
11	0.510	-0.073	0.361	0.090	0.442
12	0.420	0.041	0.553	-0.062	0.476
13	0.285	0.228	0.069	0.600	0.208
14	0.483	-0.029	0.224	0.404	-0.046
15	<b>0.745</b>	-0.013	0.326	0.248	0.259
16	<b>0.762</b>	0.048	0.114	0.110	-0.248
17	<b>0.746</b>	0.088	0.181	0.107	0.148
18	-0.067	0.104	0.141	0.001	<b>0.822</b>
19	0.153	-0.056	0.073	0.266	<b>0.752</b>
20	-0.001	<b>0.729</b>	0.161	0.253	-0.071
21	-0.022	<b>0.905</b>	0.043	-0.029	0.093
22	0.525	0.579	-0.085	0.101	-0.033
23	0.115	<b>0.928</b>	-0.000	0.007	-0.023
24	0.036	<b>0.900</b>	0.108	0.071	0.082

CFA Goodness-of-Fit Statistics

Five-Factor	Value	Comment
Chi Square	401.39	Significant, should be non-significant
NFI	0.60	Not high enough
CFI	0.78	Not high enough
RMSEA	0.11	Not low enough
Seven-Factor	Value	Comment
Chi Square	285.06	Significant, should be non-significant
NFI	0.72	Not high enough
CFI	0.89	Not high enough
RMSEA	0.08	Not low enough

## APPENDIX Q: Revised Survey Instrument Post Pilot Study

Item	SA	A	N	DA	SDA
1. My hospital generates new clinical services in order to increase patient access.	1	2	3	4	5
2. My hospital keeps the public well-informed of new clinical services.	1	2	3	4	5
3. My hospital seeks to increase market share via new ventures.	1	2	3	4	5
4. My hospital has strategic initiatives involving new technological fields (social media, electronic medical record, robotics, gamma knife, etc.).	1	2	3	4	5
5. My hospital encourages searching for novel ideas and thinking 'outside the box.'	1	2	3	4	5
6. My hospital looks for creative ways to satisfy its patients' needs.	1	2	3	4	5
7. My hospital is flexible enough to allow us to respond quickly to changes in our strategic objectives and goals.	1	2	3	4	5
8. My hospital evolves rapidly in response to shifts in our strategic initiatives and goals.	1	2	3	4	5
9. My hospital frequently adjusts existing clinical services to improve patient safety.	1	2	3	4	5
10. My hospital reduces the cost of providing clinical services.	1	2	3	4	5
11. My hospital continuously improves the reliability of clinical services and workflow processes.	1	2	3	4	5
12. My hospital improves labor productivity in providing clinical services.	1	2	3	4	5
13. My hospital expands clinical services for existing patients.	1	2	3	4	5
14. My hospital's departments work cohesively to support overall hospital objectives.	1	2	3	4	5
15. My hospital frequently adjusts procedures, rules, and policies to improve patient safety.	1	2	3	4	5
16. My hospital's publicly reported quality indicators have continuously improved.	1	2	3	4	5
17. I have received training on how to read my hospital's financial reports.	1	2	3	4	5
18. I review my hospital's income statement every month.	1	2	3	4	5
19. I have the tools I need to find and understand my hospital's financial performance.	1	2	3	4	5
20. Over the past 3 years, my hospital's financial performance has been outstanding.	1	2	3	4	5
21. Over the past 3 years, my hospital's financial performance has exceeded our competitors.	1	2	3	4	5
22. Over the past 3 years, my hospital's revenue growth has been outstanding.	1	2	3	4	5
23. Over the past 3 years, my hospital's revenue growth has exceeded our competitors.	1	2	3	4	5
24. Over the past 3 years, my hospital has been more profitable than our competitors.	1	2	3	4	5
Comments:					

**Survey Instructions**  
Please circle the correct demographic information:  
Female      Male      Age: 25-35      36-45      46-55      56-65      66-75      76-85  
Your Work Area:      Strategy      Quality      HR

Please think about your current job and the environment you work in and fill out this survey. Read each question and respond by circling the number on the 5-point scale. Please mail your completed survey in the Self Addressed Stamped Envelope provided. Thank you!!  
Legend: SA = Strongly Agree    A = Agree    N = Neutral    DA = Disagree    SDA = Strongly disagree

**APPENDIX R: Example of Randomized Hospital List**

<b>AHA ID</b>	<b>City</b>	<b>State</b>	<b>Ownership Type</b>	<b>Critical Access *</b>	<b>Total Beds</b>
6110050	Bangor	ME	Not-for-profit, other	No	349
6110070	Bangor	ME	Not-for-profit, church-operated	No	84
6110090	Bar Harbor	ME	Not-for-profit, other	Yes	25
6110160	Boothbay Harbor	ME	Not-for-profit, other	Yes	73
6110173	Brunswick	ME	Not-for-profit, church-operated	No	55
6110200	Caribou	ME	City	No	49
6110220	Damariscotta	ME	Not-for-profit, other	No	35
6110330	Houlton	ME	Not-for-profit, other	Yes	53
6110386	Machias	ME	Not-for-profit, other	Yes	25
6110387	Millinocket	ME	Not-for-profit, other	Yes	25
6110410	Pittsfield	ME	Not-for-profit, other	Yes	25
6110430	Portland	ME	Not-for-profit, other	No	557
6110520	Sanford	ME	Not-for-profit, other	No	157
6110523	Skowhegan	ME	Not-for-profit, other	Yes	25
6110540	Togus	ME	Veterans Affairs	No	167
6110610	York	ME	Not-for-profit, other	No	79
6120010	Berlin	NH	Not-for-profit, other	Yes	25
6120020	Claremont	NH	Not-for-profit, other	Yes	25
6120080	Dover	NH	Not-for-profit, other	No	134
6120130	Franklin	NH	Not-for-profit, other	Yes	25
6120190	Laconia	NH	Not-for-profit, other	No	113
6120210	Lancaster	NH	Not-for-profit, other	Yes	25

## APPENDIX S: AHA Random Sample Document



One North Franklin  
Suite 2800  
Chicago, IL 60606-3421  
(312) 422-3000  
www.aha.org

**RANDOM SAMPLE OF U.S. GENERAL MEDICAL/SURGICAL HOSPITALS**  
Completed for Wendy Bodwell, Colorado State University  
Completed by Sara Beazley, AHA Resource Center  
February 19, 2010

### REQUEST

Provide a random sample of 2,000 general medical/surgical hospitals from the AHA Annual Survey Database, FY2008.

### METHODOLOGY

Display all hospitals in the AHA Annual Survey Database, FY2008, with selected fields, including service type (general medical/surgical, rehabilitation, psychiatric, etc.) in Excel.

Eliminate all hospitals that are located in Puerto Rico, Guam, American Samoa, the Marshall Islands, the North Mariana Islands, and the U.S. Virgin Islands.

Eliminate all hospitals with a service type other than general medical/surgical (service code 10).

Insert new column A labeled "Sort" in Excel spreadsheet and number all remaining hospitals from 1 to 4,822.

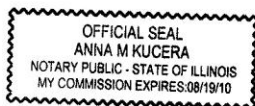
Insert an additional new column A labeled "Random" and input the following formula into the first cell:  $=\text{int}(\text{rand}()*4822)$ . Populate all the cells in the Random column that correspond to a numbered cell in the Sort column; this will be done by clicking on the auto-fill button in the lower-right hand corner of the first populated cell.

Copy the entire array of numbers in the Random column and paste only the values back into the same space. This step prevents the random numbers from resetting themselves when the next step is executed.

Sort the entire spreadsheet in ascending order by the numbers in the Random column. This will automatically sort all the corresponding data in a random array.

Eliminate all but the first 2,000 hospitals. The remaining hospitals represent a random sample of 2,000 hospitals from the universe of all general medical/surgical hospitals.

Contact Information: Sara Beazley, AHA Resource Center, (312) 422-2017, [sbeazley@aha.org](mailto:sbeazley@aha.org)



## APPENDIX T: Survey Mailer: Memo to Executive Assistant

**Colorado State  
University**

### **To: Executive Assistant**

Dear Executive Assistant,

I am a doctoral student asking your help to distribute the attached surveys to the senior executives in your hospital in the positions of Strategy, Human Resources, and Quality.

If you are a small facility you may have one person doing several functions. If that is the case, give it to the senior-most executive doing the functions.

If you are a large facility or multi-hospital system you may have these functions done at or by your Corporate Office. Please do NOT send these questionnaires to Corporate as I am seeking the opinions of people who are the senior facility-based people doing these functions (Strategy, HR, and Quality).

This survey you are about to help me with is my dissertation project, so I thank you in advance for your participation in this project.

Due to financial constraints I will not be able to send you any reminders. To this end, you have my undying appreciation for distributing these surveys to the right people at your hospital and helping them complete it. I also appreciate any reminders you could give them to send the survey back to me as soon as possible in the self-addressed stamped envelopes I've provided.

You will find information about this research study in the Informed Consent document. The actual survey has been found to take no longer than 10 minutes to complete.

Your participation is very important to help further this topic of research. Results of this study will help us understand innovation processes in hospitals and how they relate to financial performance and quality.

I am extremely thankful for your help. If you have any questions or concerns, don't hesitate to email or phone me. All conversations, as well as your completed surveys will be kept confidential.

Thank you!! Wendy

Wendy Bodwell ABD, FACHE  
Doctoral Candidate  
Colorado State University  
[wendy\\_bodwell@msn.com](mailto:wendy_bodwell@msn.com)  
720-427-5710

## APPENDIX U: Survey Cover Letter

The logo for Colorado State University, featuring the text "Colorado State University" in white, stacked vertically, on a black rectangular background.

# Cover Letter

Dear Survey Participant,

I am a doctoral student seeking your opinions on the attached survey. The survey you are about to take is my dissertation project, so I thank you in advance for your participation in this project.

Due to financial constraints I will not be able to send you any reminders. To this end, you have my undying appreciation for completing this survey and returning it to me as soon as you can!

You will find information about this research study in the Informed Consent document. The actual survey has been found to take no longer than 10 minutes to complete.

After you complete your survey, please insert into the self-addressed stamped envelope which I have provided for you. Your participation is very important to help further this topic of research. Results of this study will help us understand innovation processes in hospitals and how they relate to financial performance and quality.

**You do NOT need to return the Informed Consent, just your completed survey.**

I am extremely thankful for your help. If you have any questions or concerns, don't hesitate to email or phone me. All conversations, as well as your completed surveys will be kept confidential.

Thank you!! Wendy

Wendy Bodwell ABD, FACHE  
Doctoral Candidate  
Colorado State University  
[wendy\\_bodwell@msn.com](mailto:wendy_bodwell@msn.com)  
720-427-5710

## **APPENDIX V: Survey Mailer: Content of Self-Addressed Stamped Envelope**

### **Consent to Participate in a Research Study Colorado State University**

**TITLE OF STUDY:** Multilevel Model Analysis of Organizational Ambidexterity in Hospitals.

**PRINCIPAL INVESTIGATOR:** Thomas J. Chermack, PhD, Assistant Professor, 612.387.1951;  
[chermack@colostate.edu](mailto:chermack@colostate.edu).

**CO-PRINCIPAL INVESTIGATOR:** Wendy Bodwell, CSU Doctoral Student, 720.427.5710;  
[wendy\\_bodwell@msn.com](mailto:wendy_bodwell@msn.com).

**WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH?** You are being invited to participate in this research because you are the senior strategy, quality, and/or human resources leader in your acute care hospital. The survey you are being asked to complete provides information and your opinions of how your hospital satisfies its current patients and how your hospital prepares for the future. This information will help us to understand how the concept of organizational ambidexterity (OA) works in hospitals. We are also interested in determining whether levels of OA are related to financial performance and quality.

**WHO IS DOING THE STUDY?** This study is being conducted by Thomas J. Chermack, PhD, Assistant Professor, Colorado State University, and Wendy Bodwell, Doctoral Candidate, Colorado State University. This study is not funded.

**WHAT IS THE PURPOSE OF THIS STUDY?** The purpose of this study is to analyze OA in hospitals and determine if a hospital's level of OA is related to its quality and financial performance.

### **WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT**

**LAST?** The survey will take place at randomly selected hospitals in the United States. The survey will be mailed to the hospital CEO's Executive Assistant who will distribute this Consent Form and a survey to the senior strategy, quality, and human resources leader in the hospital. The survey will be completed manually and mailed directly back to Wendy Bodwell, Co-Principal Investigator upon completion. The survey takes approximately 5-7 minutes to complete.

**WHAT WILL I BE ASKED TO DO?** You will be asked to complete a survey regarding how your hospital satisfies current patients and prepares for future patients. You will be asked to mail the completed survey back to the Co-Principal Investigator via the self-addressed-stamped envelope provided. If you want to participate, please complete the survey and keep this letter in case you have any questions about the research.

### **ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY?**

There are no reasons not to participate in this study.

### **WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?**

Ø There are no known risks associated with this study.

Ø It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

**ARE THERE ANY BENEFITS FROM TAKING PART IN THIS STUDY?** There are no direct benefits from taking part in this study. However, by participating you will add to the knowledge of how OA works in hospitals and how hospitals satisfy their current patients while preparing for future patients. As such, you will extend our understanding of how to provide quality clinical services now and in the future. This improved understanding will ultimately benefit hospitals and patients.

Additionally, each hospital with 100% participation (three completed surveys returned to Co-Principal Investigator by the senior strategy, quality, and human resources leaders in a particular hospital) will be entered into a drawing for a \$20 gift card. Five hospitals will be drawn from a hat. Winning hospitals will have a \$20 gift card sent to your hospital CEO's Executive Assistant.

**DO I HAVE TO TAKE PART IN THE STUDY?** Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

**WHO WILL SEE THE INFORMATION THAT I GIVE?** Your name is not required. The name of your hospital is known only by a code. The information you provide will be combined with information from other people taking part in the study in hospitals throughout the United States. When we write about the study to share it with other researchers or publish the results, we will write about the combined information we have gathered. You and your hospital will not be identified in these written materials.

Only the two members of the research team (listed above) will have access to the specific survey information you provide.

**WHAT IF I HAVE QUESTIONS?** Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions about the study, you can contact the principal investigator, Dr. Thomas J. Chermack at 612.387.1951; Chermack @colostate.edu, or the Co-Principal Investigator, Wendy Bodwell at 720.427.5710 or wendy\_bodwell@msn.com. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator at 970-491-1655. We will give you a copy of this consent form to take with you.

Thank you for your participation in this study.

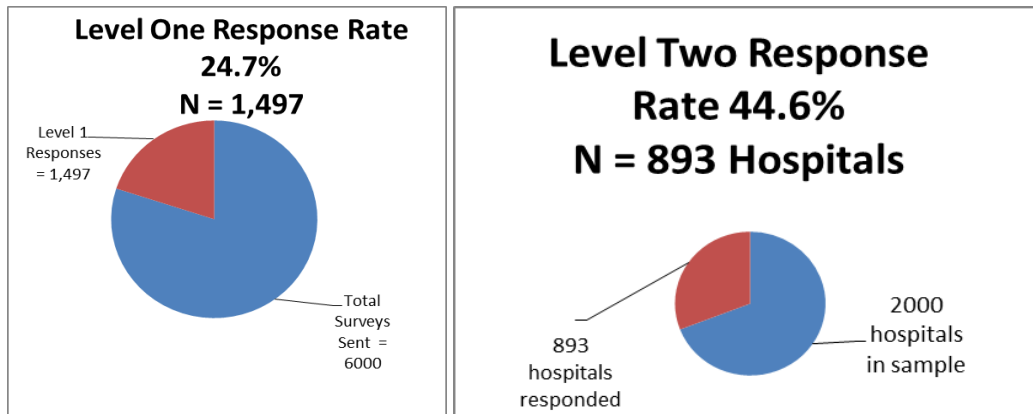
Sincerely,

Wendy Bodwell  
Doctoral Candidate  
Colorado State University

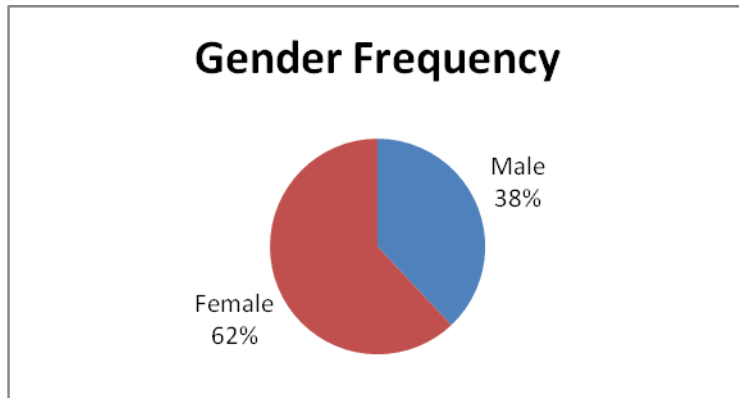
Thomas J. Chermack, PhD  
Assistant Professor  
Colorado State University



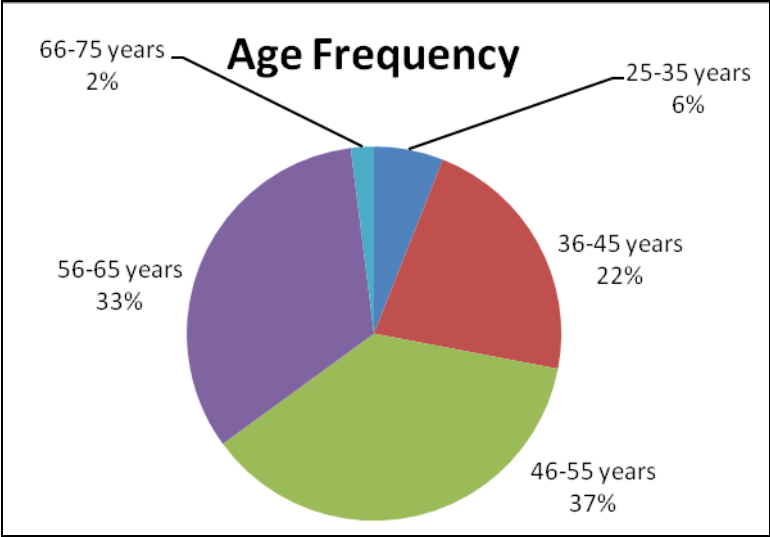
## APPENDIX W: Response Distributions



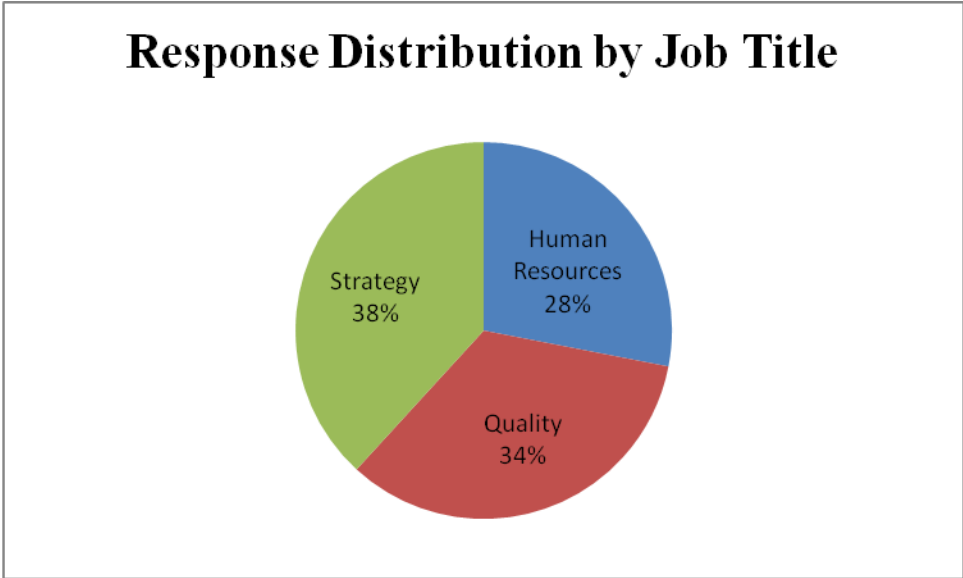
Level One and Level Two Total Response Distribution.



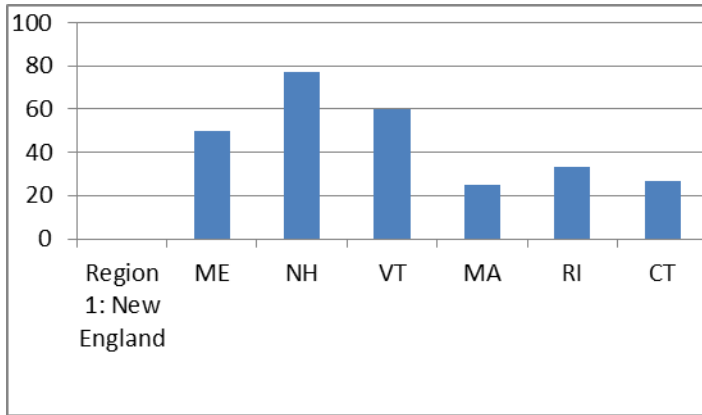
Response Distribution by gender. N = 1,070.



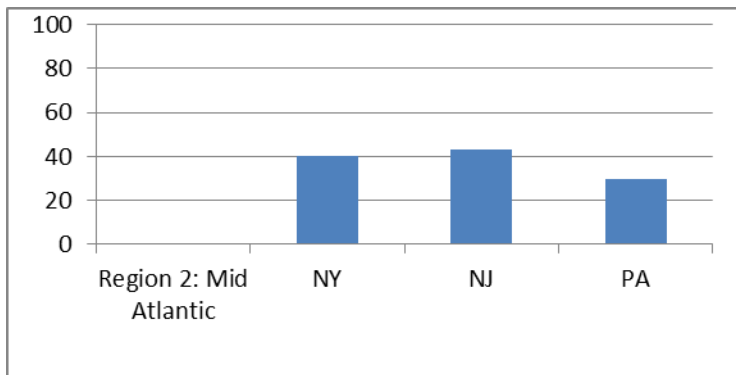
Response Distribution by age. N = 1,254.



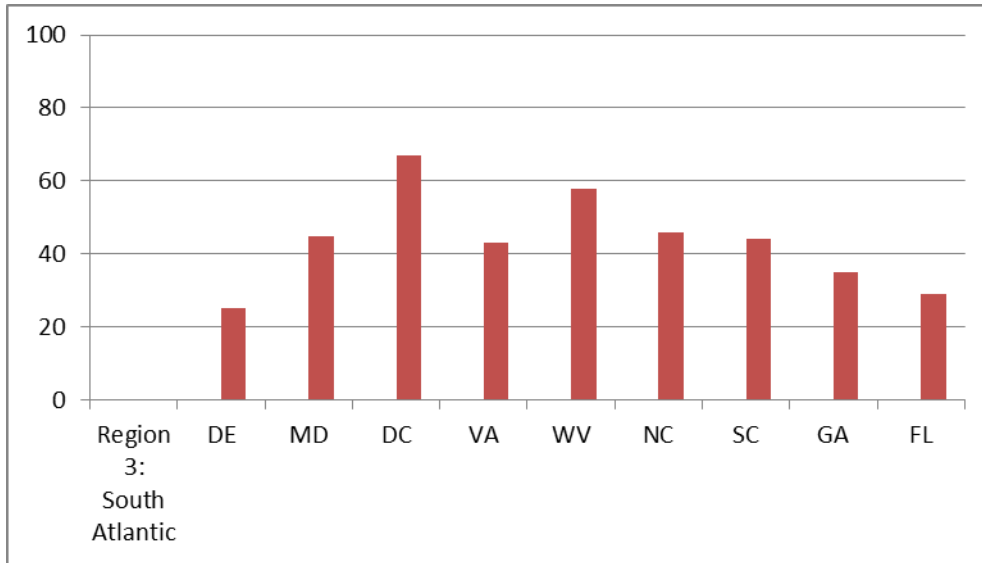
Response Distribution by Job Title. N=1,497.



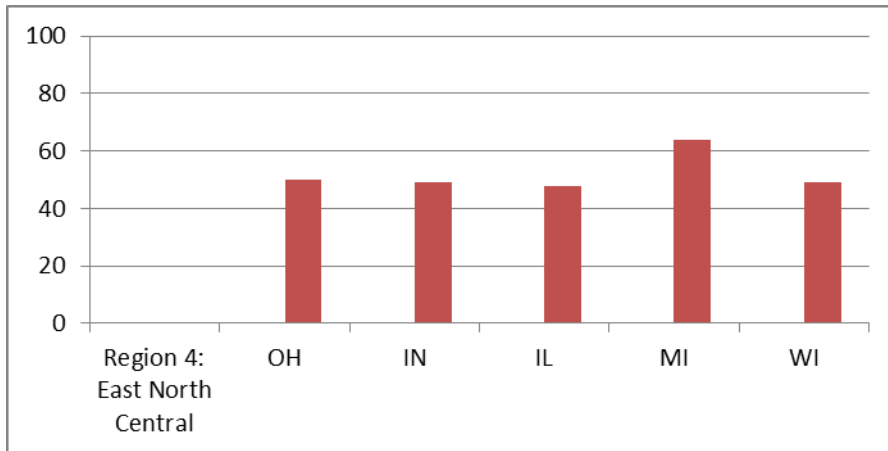
Percentage Response Distribution by Region – New England



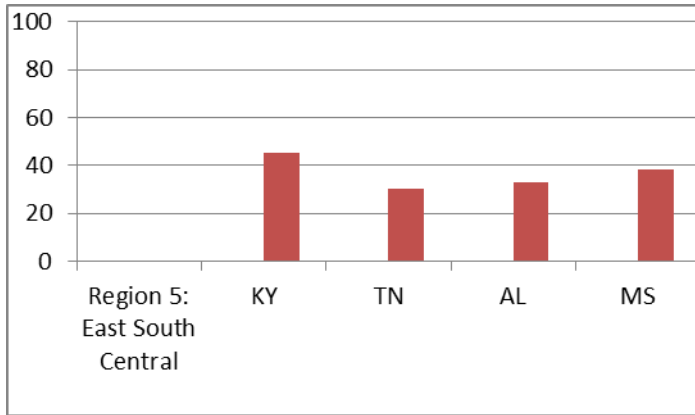
Percentage Response Distribution by Region – Mid Atlantic



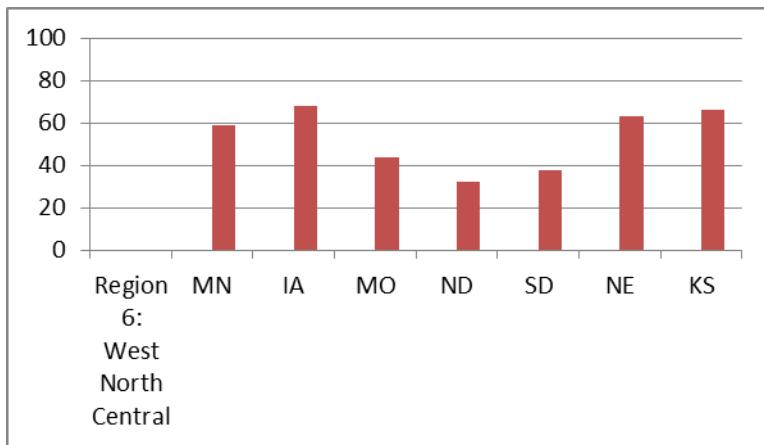
Percentage Response Distribution by Region – South Atlantic



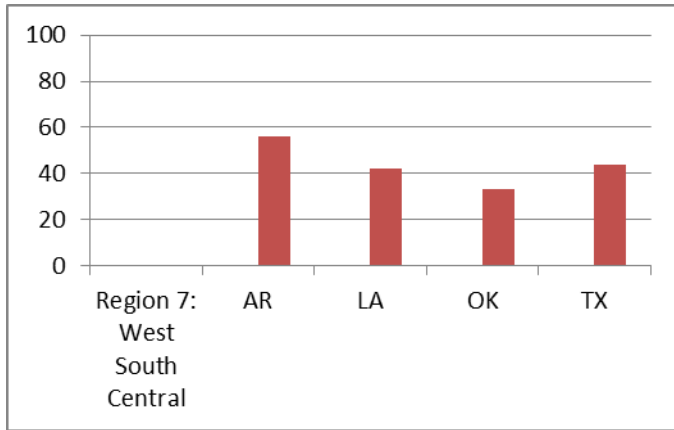
Percentage Response Distribution by Region – East North Central



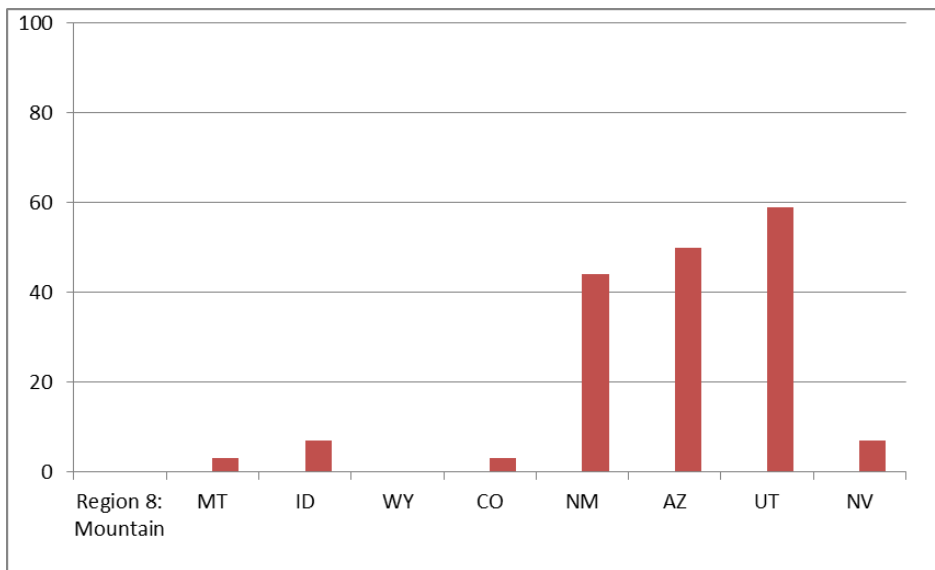
Percentage Response Distribution by Region – East South Central



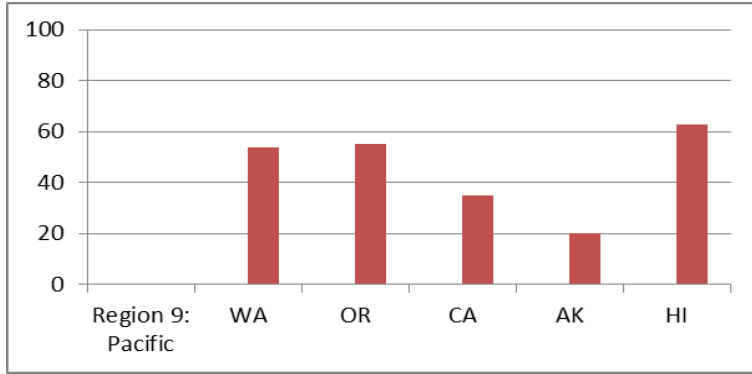
Percent Response Distribution by Region – West North Central



Percentage Response Distribution by Region – West South Central



Percentage Response Distribution by Region – Mountain



Percentage Response Distribution by Region – Pacific

## APPENDIX X: Comments Received

### Selection of Comments about Survey and/or Survey items

- #20-24 – N/A due to VA hospital.
- #12 – unions; Increased MA rate which hinders profitability; decreased reimbursement for MA.
- #15 – when necessary; #20-24 – true last 2 years.
- #20 – facing closure or acquisition; #22 – dismal due to lack of vision and strategy; We are facing closure or acquisition due to poor financial and strategic vision over last 20 years; current leadership has good strategy, but too little too late?
- #13 – odd question.
- #16 – in some areas; I do not know how we compare to competitors; we do a good job at keeping costs low.
- #20-24 – N/A, 2 years old; New hospital only 2 years old difficult to answer questions #20-24; s/b N/A.
- #17 – don't need training – N/A.
- #11 – but does not sustain changes; #15 – but does not hold staff accountable (clinical only, not pt. satisfaction); #19 – I'm an MBA, not sure our managers do); "Making adjustments" and achieving results are not the same thing. We celebrate "activity" rather than achieve results.
- #11– beginning Six Sigma training.
- #20 – operating income vs. net income; investment portfolio took a hit.
- I really didn't know how we performed as compared to our competitors in #21, 23, 24.
- #20-24 – Hurricane Katrina devastation of our community affected these answers significantly. Even positive trends resulted in negative margins due to this factor, for 3-5 years at least.



- #20 – recession.
- Difficult to answer #21, 23, 24 – don't follow competitor information.
- #21, #23, #24 – Don't have competitors' information.
- #9 – As required for safety; #15 – As required; Comparing revenue growth/performance to other Army medical centers. Currently experiencing unprecedented growth which complicates increase in hospital productivity.
- Many questions do not apply to a VA facility in the same way that the question would apply to a private sector facility.
- Could have done this with Survey Monkey.
- Because of the nature of our business model (integrated delivery system), questions 21-24 are not particularly relevant to us.
- I would like to find a hospital whose net revenue has increased 3 years in a row; questions 20-24 need to be reworded; profit vs. revenue, revenue increases, expenses increase at a higher rate.

### **General Survey Comments**

- Payer mix and state budget woes have a greater impact on profitability despite the factors above.
- Healthcare culture is extremely diverse in this country; our motto for business 'ambidexterity' is to be: fast/flexible/fat free.
- Financial performance is linked to payer mix and high % of government payers whose annual increases have not kept pace with medical and labor inflation. Hospital is part of a system which can sometimes limit agility but often helps in other areas.
- I am not sure if this impacts but my hospital is a critical access hospital with case-based reimbursement. We also are part of a health system without full control of strategic planning.
- Our hospital has been through a turnaround. New leadership over the past two years. If the financial question were 2 years vs. past 3 years, answers would have been strongly agree. The use of frequently ??? patient safety is why I said agree. If the question was do we frequently look at ways to improve patient safety, it would have been SA. Once a problem is found and we look proactively all the time we move immediately to correct. This is part of our new culture.

- We are ahead of the curve with EMR – thanks to Medical Home project.
- Don't need training.
- We serve many uninsured and their numbers are growing. Medicaid cuts are frequent.
- My system has been selected as Fortune 100 best places to work for 2 years and AARP Best Places to work over 50 for 3 years.
- Last two years were good financial – FY 2010 bad, lost \$2.8 million.
- Lost \$2.8m, FY2010; had good profit FY08 & FY09.
- We are a military hospital (USAF). As such the time to program and schedule change through the government process takes longer than civilian hospitals.
- Recent restructuring resulted in creation of a VP, Quality position (myself). We have recently began several initiatives, “Patient-centered excellence” and benchmarking; that will increase our ability to adjust better to the ever changing healthcare world.
- Growth, revenue, and changes are slow due to our small facility. Cultural change is constant.
- Just built a new hospital and moved 2 years ago.
- Quality first, revenue will follow.
- We are not allowed access to the financial info of our hospital. It is kept at the home office and we only know what comes to us, not other information.
- Small rural critical access hospital; amazing turnaround last 5 years after “left for dead” by a for-profit company.
- My small hospital is unique. My hospital is a joint 50/50 venture between a multi-specialty medical clinic in a small town and a large hospital. The large hospital is located 60 miles away, and is part of a very large hospital system. My hospital contracts HR services from the clinic, and I am an employee of the clinic. All finances, budgets, revenue and production issues are handled by corporate.
- We're a new hospital. Though we just opened in 2007, we have exceeded our predicted performance, financial and patient safety /satisfaction expectations.
- The past 3 years have been financially tough but many strategic initiatives were begun in 2009 that have resulted in marked financial performance improvement.

- Our hospital has been squeezed by health systems that has linkage to insurance (managed care) and we have excellent quality, but receive reimbursement below Medicare. We are forced to merge.
- We are a critical access hospital; our “competitors” are larger tertiary facilities. While I can’t say whether our financial performance or revenue growth has exceeded them, I can tell you we have been the top performer for our management group throughout the US for past 2-3 years.
- We are a small hospital and a lot of our competitors are larger hospitals.
- We are a CAH affiliating with a health system towards merger.
- Clinical services, as well as procedures, rules and policies are adjusted for patient safety but not “frequently.”
- Small rural hospital with large Medicare/Medicaid population – limited resources.
- Not sure as far as competitors performance financially.
- The past 3 years have not been good and the economy status and loss of joint health care reform is not our friend.
- Compared to other critical access hospitals, my hospital is financially sound.
- We are a thriving community hospital – doing better than others, but not great.
- Despite visions, goals, and efforts, my hospital continues to struggle due to economy, payer mix, and contractuals – this confines resources needed to grow and improve.
- We use the Hoshin Kanri Philosophy of Strategic Planning which allows us to be more nimble and improve more rapidly than tradition planning. That, coupled with lean implementation has really changed our organization and made us successful across the board.
- Hospital is affiliated with larger hospital recently have new CEO/CFO – so undergoing many changes.
- CEOs need to know and believe – quality done right – affect the bottom line in a positive manner.
- Federal organization. Some of the questions are not applicable.
- Just received Top 100 Hospital Award from Thompson Renters.

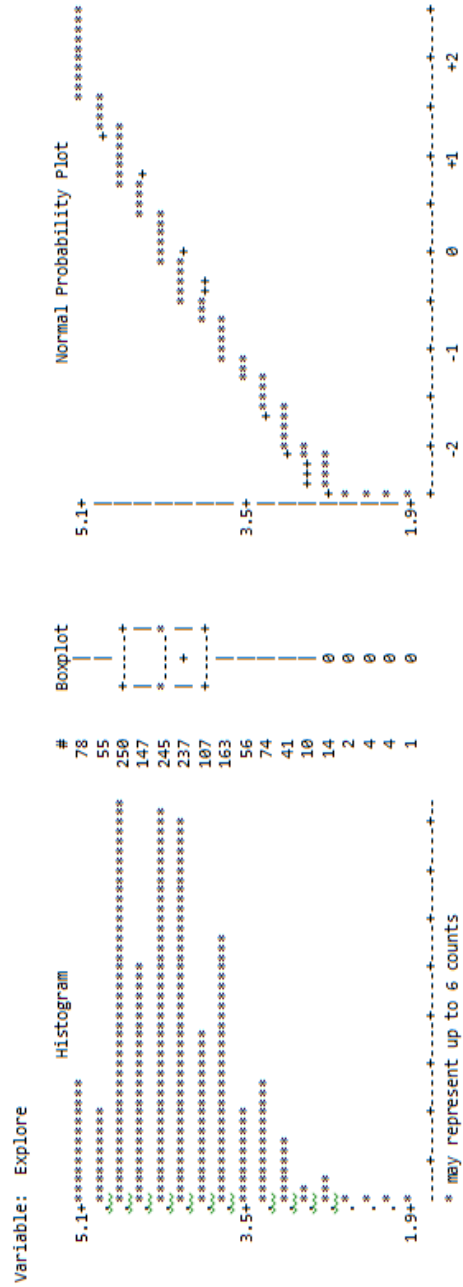
- As a truly integrated health care system, we do not think of ourselves as hospitals and clinics but as a seamless system. Physician leaders are paired with administrative partners from top on down and we work on improving patient care, not improving or analyzing “hospital” care or “hospital” finances. We look at our system quality and financial metrics. Thus, this survey was difficult to complete but I tried. I wish you well.
- Competitors include critical access hospitals. They are reimbursed differently than non-critical access.
- We are small enough to be severely limited on our options – mostly due to availability of specialty physician staffing.
- Financials off site at corp office.
- Hospital financial statement is not available to department heads – only leadership.
- Hospital spent all time and efforts to stay alive.
- Ambidexterity is an interesting term to apply to organizational function. After contemplating this, it is evident to me that this trait is essential to our success, being a small rural hospital with limited resources. Without OA, we would certainly fail.
- I think we are doing the best we can in an economy that does not support growth.
- Our facility is currently going through a lot of changes including a new CEO so we are addressing many of these issues and look forward to great things in the future.
- Quality improvements are ahead of the publicly reported numbers (time lag).
- Financial performance issues do not apply to my job nor do I have information to compare competitors; upper management or administration has this info.
- We are a critical access (CAH) hospital non-profit.
- Our revenue growth over past 3 years has been exceptional. However, our facility has seriously declining community support, which inadvertently affects our county appropriations. Therefore, our overall financial performance has not been good.
- Many hospitals in surrounding areas are having financial difficulties. We are very sound financially due to 5 great docs and CEO & CFO that know what they’re doing.
- With upcoming cuts in healthcare reimbursement, it will be impossible for small critical access hospitals to stay open.
- Our mission is to care for the indigent population.

- We are in a market undergoing major transition due to physician ownership of boutique hospitals and our new hospital under construction.
- We are a public hospital – puts us in a different competitive frame (market & financial).
- Small rural facility – hard to beat large competitors.
- Our organization is in a turnaround situation and is gradually improving.
- Performance standards are heavier on quality, patient safety, customer service than financial performance.
- My hospital was “leased” in 01/2007 due to \$ problems. We are coming back into the black, but are not there yet. Over \$20M in capital improvements have been used over this time to improve.
- Struggling hospital – opened July 2005.
- This last year to 1 ½ years has been extremely difficult for rural hospitals; volumes have been greatly reduced mainly due to the economic downturn.
- The term “hospital” is unclear to me. My role is over a multihosp system ? health plan and large medical group is too constraining.
- We are very diligent and aware of our metrics, but somewhat slow to change processes.
- Profitable in operating margin – yes; in dollars – no.
- ~ 15 years ago, our Board of Directors (BOD) elevated quality and safety to the same level of significance and BOD oversight as financial matters. Eight years ago, we established an internal consulting practice with experienced personnel from nationally recognized consulting firms to enhance our processes and workflows.
- Our hospital market is a lot different because of our location – 4 critical access hosp. within 25 miles; next full-service acute care hosp. is 2 hours away.
- Financial stressors are very pronounced currently.
- In 2008 and 2009, our stand-alone community not for profit hospital had 2 of the best years in our history. As the fall of 2009 and these months of 2010 have passed, our census and revenue sources are drying up. This facility is currently undergoing a reduction in force and reorganization of services to meet our reduced census. In 2008, we delivered 8000 babies; in 2009 this number dropped by 800 births. Our NICU that was constantly over-bedded at 60+ babies is now averaging 48. ED continues to see a rise in unfunded patients waiting until

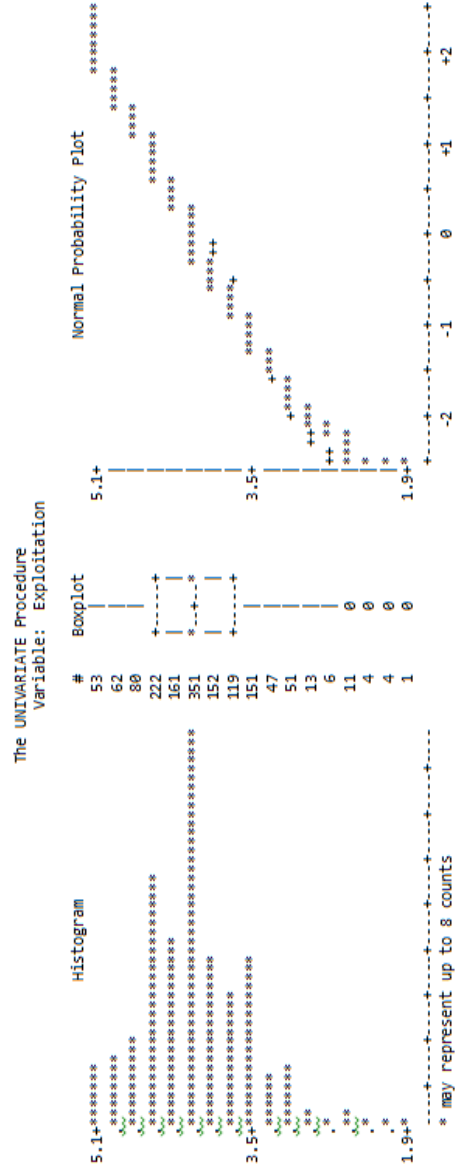
they are really ill to be seen. Certain payers = Blue Cross and state owe large sums of \$ in past payments. Federal RACs are reviewing 1-2 year old cases and denying payment based on audits related to documentation issues. All in all, no one could have predicted how the downturn in our economy would ultimately affect all the service industries. Hoping for an improved future.

- Our hospital is part of a major corporation – they have many additional resources.
- Military hospital. Don't technically compete or ??? a market share.

## APPENDIX Y: Exploratory Statistics for Variable 'Explore': Frequency Histogram, Boxplot, and Normal Probability Plot

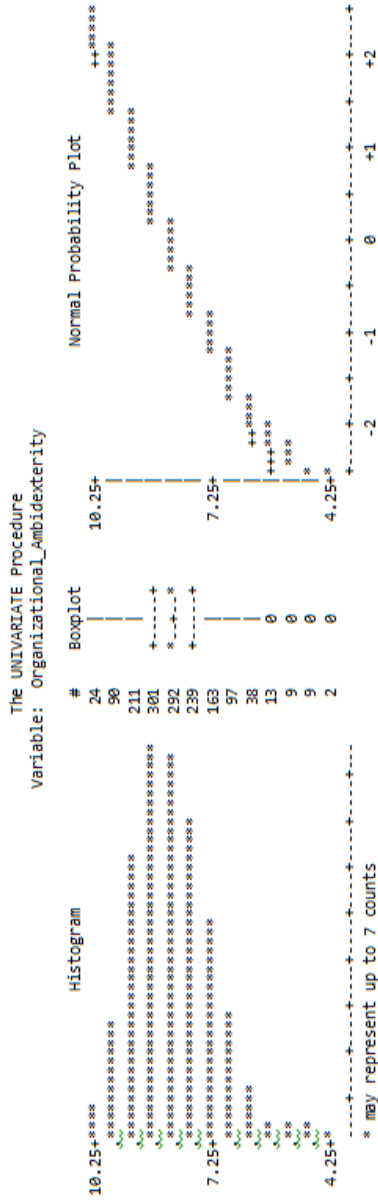


**APPENDIX Z: Exploratory Statistics for Variable 'Exploitation': Frequency Histogram, Box Plot, Normal Probability Plot**

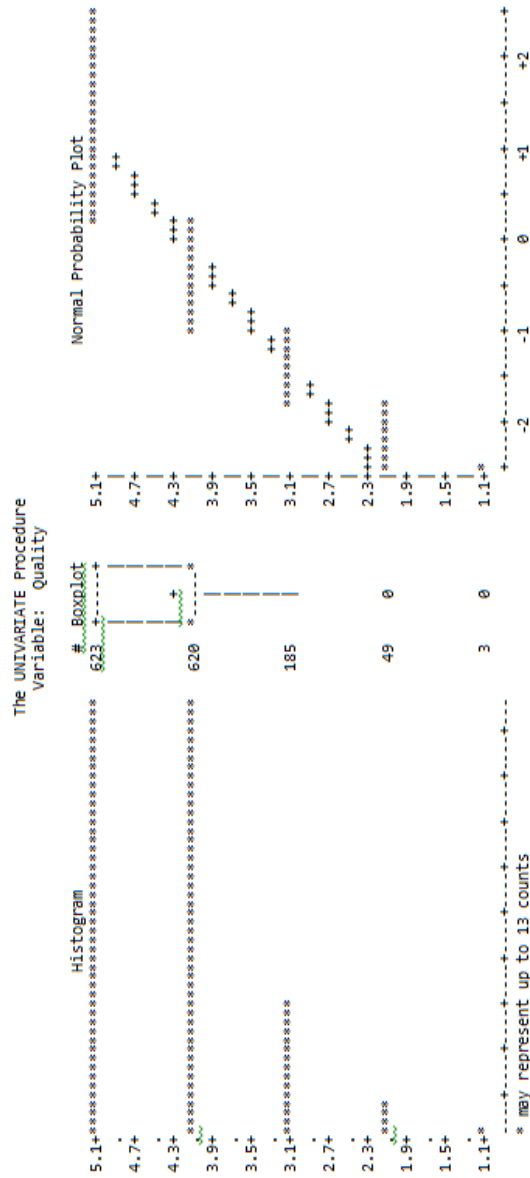




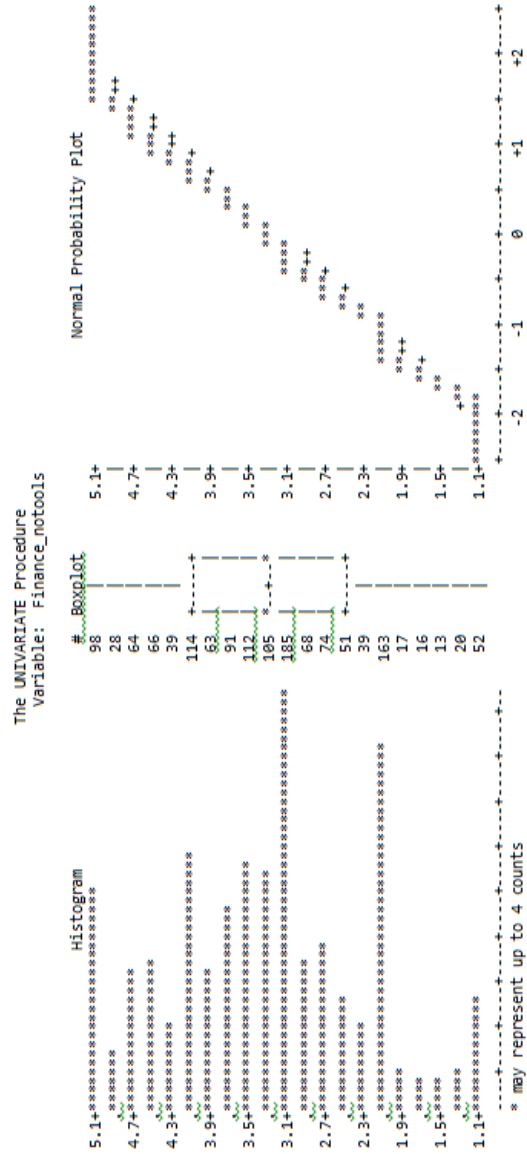
## APPENDIX A1: Exploratory Statistics for Variable 'OA': Frequency Histogram, Box Plot, and Normal Probability Plot



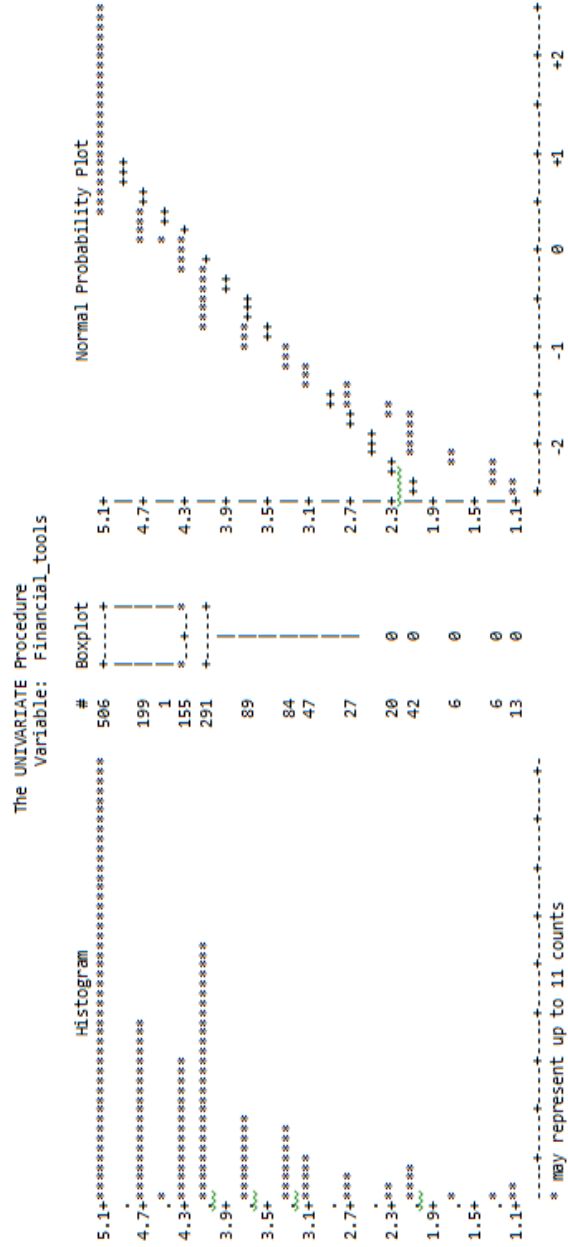
## APPENDIX A2: Exploratory Statistics for Variable 'Quality': Frequency Histogram, Box Plot, Normal Probability Plot



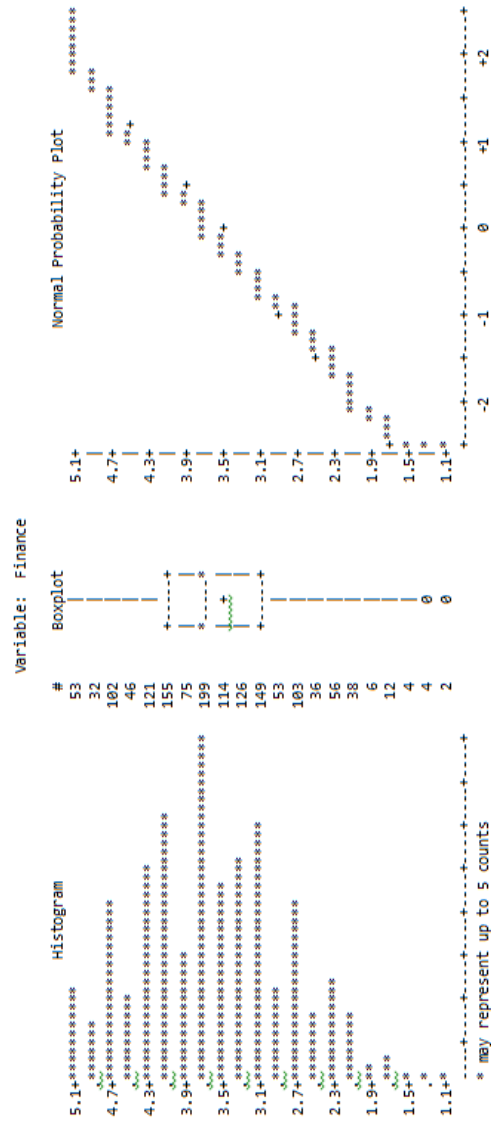
**APPENDIX A3: Exploratory Statistics for Variable 'Finance No Tools':  
Frequency Histogram, Box Plot, Normal Probability Plot**



**APPENDIX A4: Exploratory Statistics for Variable 'Financial Tools':  
Frequency Histogram, Box Plot, Normal Probability Plot**



## APPENDIX A5: Exploratory Statistics for Variable 'Finance': Frequency Histogram, Box Plot, Normal Probability Plot



## APPENDIX A6: Correlation Tables & Goodness-of-Fit Indices

Correlation Matrix (Level One, individual survey responses)

<b>Factor</b>	<b>OA</b>	<b>Explore</b>	<b>Exploitation</b>	<b>Quality</b>	<b>Finance</b>	<b>Financial Tools</b>	<b>Financial No Tools</b>
<b>OA</b>	1.000	0.923 < 0.0001 1488	0.917 < 0.0001 1488	0.485 < 0.0001 1480	0.502 < 0.0001 1486	0.402 < 0.0001 1486	0.412 < 0.005 1478
<b>Explore</b>		1.000	0.694 < 0.0001 1488	0.418 < 0.0001 1480	0.479 < 0.0001 1486	0.360 < 0.0001 1486	0.405 < 0.0001 1478
<b>Exploitation</b>			1.000	0.475 < 0.0001 1480	0.443 < 0.0001 1486	0.381 < 0.0001 1486	0.353 < 0.0001 1478
<b>Quality</b>				1.000	0.311 < 0.0001 1478	0.263 < 0.0001 1478	0.248 < 0.0001 1471
<b>Finance</b>					1.000	0.609 < 0.0001 1486	0.917 < 0.0001 1478
<b>Financial Tools</b>						1.000	0.243 < 0.0001 1478
<b>Financial No Tools</b>							1.000

*Correlation Matrix (Level Two, hospital responses)*

<b>Factor</b>	<b>OA</b>	<b>Explore</b>	<b>Exploitation</b>	<b>Quality</b>	<b>Finance</b>	<b>Financial Tools</b>	<b>Financial No Tools</b>
<b>OA</b>	1.000	0.926 < 0.0001 834	0.917 < 0.0001 834	0.506 < 0.0001 829	0.525 < 0.0001 833	0.411 < 0.0001 833	0.442 < 0.0001 831
<b>Explore</b>		1.000	0.697 < 0.0001 834	0.431 < 0.0001 829	0.497 < 0.0001 833	0.364 < 0.0001 833	0.429 < 0.0001 831
<b>Exploitation</b>			1.000	0.503 < 0.0001 829	0.468 < 0.0001 833	0.394 < 0.0001 833	0.383 < 0.0001 831
<b>Quality</b>				1.000	0.335 < 0.0001 828	0.291 < 0.0001 828	0.272 < 0.0001 826
<b>Finance</b>					1.000	0.602 < 0.0001 833	0.928 < 0.0001 831
<b>Financial Tools</b>						1.000	0.262 < 0.0001 831
<b>Financial No Tools</b>							1.000

*CFA Seven-Factor Goodness-of-Fit Statistics*

	<u>Value</u>	<u>Comment</u>
N	1,406	
Chi -Square	1005.41	Significant, should be non-significant
Chi -Square DF	208	
Chi-Square/DF	4.83	Should be < 2
NFI	0.94	Good Fit
CFI	0.95	Good Fit
RMSEA	0.05	Good Fit
RMSEA 90% Confidence Interval	0.0490 - 0.0555	Good Fit

## APPENDIX A7: Factor Solutions & Goodness-of-Fit Indices

Unrotated Two-Factor PCA with Eigenvalues and Communalities

Component	Factor 1	Factor 2	Eigenvalue	Communality
1	<b>0.536</b>	0.044	<b>8.000</b>	0.289
2	<b>0.506</b>	0.149	<b>2.796</b>	0.278
3	<b>0.506</b>	0.140	<b>1.861</b>	0.276
4	<b>0.481</b>	0.106	<b>1.334</b>	0.242
5	<b>0.633</b>	0.216	<b>1.113</b>	0.447
6	<b>0.636</b>	0.252	0.877	0.469
7	<b>0.638</b>	0.183	0.810	0.440
8	<b>0.679</b>	0.186	0.738	0.496
9	<b>0.608</b>	0.276	0.697	0.446
10	<b>0.471</b>	0.243	0.629	0.281
11	<b>0.632</b>	0.267	0.587	0.471
12	<b>0.586</b>	0.247	0.568	0.405
13	<b>0.636</b>	0.135	0.525	0.423
14	<b>0.566</b>	0.223	0.498	0.370
15	<b>0.566</b>	0.259	0.434	0.387
16	<b>0.525</b>	0.165	0.408	0.303
17	<b>0.468</b>	0.161	0.404	0.245
18	<b>0.418</b>	0.153	0.382	0.198
19	<b>0.502</b>	0.143	0.359	0.273
20	<b>0.635</b>	-0.578	0.280	<b>0.730</b>
21	<b>0.640</b>	-0.670	0.238	<b>0.859</b>
22	<b>0.619</b>	-0.612	0.220	<b>0.759</b>
23	<b>0.628</b>	-0.676	0.125	<b>0.852</b>
24	<b>0.627</b>	-0.666	0.104	<b>0.837</b>



Rotated Two-Factor PCA

<b>Component</b>	<b>Factor 1</b>	<b>Factor 2</b>
1	<b>0.477</b>	0.248
2	<b>0.508</b>	0.143
3	<b>0.503</b>	0.150
4	<b>0.463</b>	0.166
5	<b>0.651</b>	0.153
6	<b>0.673</b>	0.125
7	<b>0.638</b>	0.184
8	<b>0.674</b>	0.203
9	<b>0.662</b>	0.090
10	<b>0.528</b>	0.044
11	<b>0.677</b>	0.110
12	<b>0.628</b>	0.102
13	<b>0.610</b>	0.224
14	<b>0.598</b>	0.112
15	<b>0.617</b>	0.082
16	<b>0.532</b>	0.140
17	<b>0.482</b>	0.113
18	<b>0.435</b>	0.092
19	<b>0.501</b>	0.146
20	0.230	<b>0.827</b>
21	0.184	<b>0.908</b>
22	0.198	<b>0.848</b>
23	0.171	<b>0.907</b>
24	0.176	<b>0.897</b>

Unrotated Three-Factor PCA with Eigenvalues and Communalities

<b>Component</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Eigenvalue</b>	<b>Communality</b>
1	<b>0.536</b>	0.044	-0.021	<b>8.007</b>	0.290
2	<b>0.506</b>	0.149	-0.151	<b>2.796</b>	0.301
3	<b>0.506</b>	0.140	0.061	<b>1.861</b>	0.280
4	<b>0.481</b>	0.106	0.009	<b>1.334</b>	0.242
5	<b>0.633</b>	0.216	-0.164	<b>1.113</b>	0.474
6	<b>0.636</b>	0.252	-0.240	0.877	<b>0.526</b>
7	<b>0.638</b>	0.183	-0.212	0.810	0.486
8	<b>0.679</b>	0.186	-0.241	0.738	<b>0.554</b>
9	<b>0.608</b>	0.276	-0.140	0.697	0.466
10	<b>0.471</b>	0.243	-0.006	0.629	0.281
11	<b>0.632</b>	0.267	-0.127	0.587	0.487
12	<b>0.586</b>	0.247	-0.016	0.568	0.406
13	<b>0.636</b>	0.135	-0.044	0.525	0.425
14	<b>0.566</b>	0.223	-0.142	0.498	0.390
15	<b>0.566</b>	0.259	-0.133	0.434	0.405
16	<b>0.525</b>	0.165	-0.016	0.408	0.304
17	<b>0.468</b>	0.161	<b>0.673</b>	0.404	<b>0.699</b>
18	<b>0.418</b>	0.153	<b>0.748</b>	0.382	<b>0.758</b>
19	<b>0.502</b>	0.143	<b>0.743</b>	0.359	<b>0.826</b>
20	<b>0.635</b>	-0.578	-0.023	0.280	<b>0.738</b>
21	<b>0.640</b>	-0.670	0.009	0.238	<b>0.859</b>
22	<b>0.619</b>	-0.612	-0.048	0.220	<b>0.762</b>
23	<b>0.628</b>	-0.676	0.008	0.125	<b>0.852</b>
24	<b>0.627</b>	<b>0.666</b>	0.0191	0.104	<b>0.837</b>

Rotated Three-Factor PCA

Survey Question	Factor 1	Factor 2	Factor 3
	<b>0.458</b>	0.239	0.153
2	<b>0.531</b>	0.136	0.039
3	<b>0.452</b>	0.139	0.237
4	<b>0.433</b>	0.157	0.174
5	<b>0.669</b>	0.144	0.077
6	<b>0.716</b>	0.116	0.013
7	<b>0.674</b>	0.175	0.028
8	<b>0.719</b>	0.194	0.014
9	<b>0.671</b>	0.08	0.102
10	<b>0.499</b>	0.034	0.18
11	<b>0.680</b>	0.099	0.12
12	<b>0.596</b>	0.09	0.206
13	<b>0.591</b>	0.213	0.177
14	<b>0.611</b>	0.102	0.078
15	<b>0.626</b>	0.072	0.093
16	<b>0.507</b>	0.130	0.174
17	0.218	0.091	<b>0.802</b>
18	0.148	0.070	<b>0.855</b>
19	0.212	0.122	<b>0.875</b>
20	0.234	<b>0.823</b>	0.079
21	0.181	<b>0.904</b>	0.096
22	0.213	<b>0.845</b>	0.044
23	0.170	<b>0.903</b>	0.090
24	0.170	<b>0.893</b>	0.101

Unrotated Four-Factor PCA with Eigenvalues and Communalities

<b>Component</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>	<b>Eigenvalue</b>	<b>Communality</b>
1	<b>0.536</b>	0.044	-0.021	<b>0.553</b>	<b>8.000</b>	<b>0.597</b>
2	<b>0.505</b>	0.149	-0.151	<b>0.389</b>	<b>2.796</b>	0.453
3	<b>0.506</b>	0.140	0.061	<b>0.579</b>	<b>1.861</b>	<b>0.615</b>
4	<b>0.481</b>	0.106	0.009	<b>0.349</b>	<b>1.334</b>	0.364
5	<b>0.633</b>	0.216	-0.164	-0.024	<b>1.113</b>	0.475
6	<b>0.636</b>	0.252	-0.024	-0.093	0.877	<b>0.535</b>
7	<b>0.638</b>	0.183	-0.212	-0.217	0.810	<b>0.533</b>
8	<b>0.679</b>	0.186	-0.241	-0.158	0.738	<b>0.579</b>
9	<b>0.608</b>	0.276	-0.140	-0.132	0.697	0.484
10	<b>0.471</b>	0.243	-0.006	-0.056	0.629	0.284
11	<b>0.632</b>	0.267	-0.127	-0.165	0.587	<b>0.514</b>
12	<b>0.586</b>	0.247	-0.016	-0.021	0.568	0.406
13	<b>0.636</b>	0.135	-0.044	<b>0.311</b>	0.525	<b>0.522</b>
14	<b>0.566</b>	0.223	-0.142	-0.223	0.498	0.440
15	<b>0.566</b>	0.259	-0.133	-0.314	0.434	<b>0.503</b>
16	<b>0.525</b>	0.165	-0.016	-0.083	0.408	0.310
17	<b>0.468</b>	0.161	<b>0.673</b>	-0.108	0.404	<b>0.710</b>
18	<b>0.418</b>	0.153	<b>0.748</b>	-0.046	0.382	<b>0.760</b>
19	<b>0.505</b>	0.145	<b>0.743</b>	-0.101	0.359	<b>0.836</b>
20	<b>0.635</b>	<b>0.578</b>	-0.023	-0.060	0.280	<b>0.742</b>
21	<b>0.640</b>	<b>0.670</b>	0.009	-0.028	0.238	<b>0.860</b>
22	<b>0.619</b>	<b>0.612</b>	-0.048	-0.060	0.220	<b>0.765</b>
23	<b>0.628</b>	<b>0.676</b>	0.008	-0.045	0.125	<b>0.854</b>
24	<b>0.627</b>	<b>0.666</b>	0.019	-0.025	0.104	<b>0.838</b>

Rotated Four-Factor PCA

<b>Component</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>
1	0.162	0.179	<b>0.730</b>	0.072
2	<b>0.305</b>	0.092	<b>0.593</b>	0.021
3	0.146	0.078	<b>0.751</b>	0.153
4	0.229	0.117	<b>0.532</b>	0.120
5	<b>0.607</b>	0.135	0.289	0.064
6	<b>0.682</b>	0.114	0.238	0.009
7	<b>0.695</b>	0.184	0.116	0.039
8	<b>0.710</b>	0.198	0.189	0.017
9	<b>0.655</b>	0.081	0.191	0.103
10	<b>0.465</b>	0.031	0.189	0.174
11	<b>0.677</b>	0.104	0.169	0.125
12	<b>0.536</b>	0.083	0.271	0.194
13	<b>0.385</b>	0.174	<b>0.572</b>	0.124
14	<b>0.641</b>	0.118	0.084	0.092
15	<b>0.694</b>	0.0916	0.008	0.115
16	<b>0.482</b>	0.129	0.174	0.171
17	0.213	0.094	0.101	<b>0.803</b>
18	0.120	0.068	0.131	<b>0.850</b>
19	0.200	0.124	0.116	<b>0.875</b>
20	0.211	<b>0.821</b>	0.129	0.074
21	0.147	<b>0.900</b>	0.144	0.088
22	0.193	<b>0.844</b>	0.118	0.040
23	0.144	<b>0.900</b>	0.123	0.084
24	0.135	<b>0.889</b>	0.141	0.093

Unrotated Five-Factor PCA with Eigenvalues and Communalities

<b>Component</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>	<b>Factor 5</b>	<b>Eigenvalue</b>	<b>Communality</b>
1	<b>0.536</b>	0.044	0.021	<b>0.553</b>	-0.026	<b>8.000</b>	<b>0.597</b>
2	<b>0.506</b>	0.142	0.151	<b>0.389</b>	-0.218	<b>2.796</b>	<b>0.501</b>
3	<b>0.506</b>	0.140	0.061	<b>0.579</b>	-0.046	<b>1.861</b>	<b>0.618</b>
4	<b>0.481</b>	0.106	0.009	<b>0.349</b>	0.115	<b>1.334</b>	0.378
5	<b>0.633</b>	0.216	0.164	-0.024	-0.292	<b>1.113</b>	<b>0.560</b>
6	<b>0.636</b>	0.252	0.240	-0.093	-0.265	0.877	<b>0.605</b>
7	<b>0.638</b>	0.183	0.212	-0.217	-0.371	0.818	<b>0.671</b>
8	<b>0.679</b>	0.186	0.241	-0.158	-0.307	0.738	<b>0.674</b>
9	<b>0.608</b>	0.276	0.140	-0.132	0.092	0.697	0.492
10	<b>0.471</b>	0.243	0.006	-0.056	<b>0.498</b>	0.629	<b>0.532</b>
11	<b>0.632</b>	0.267	0.127	-0.165	0.263	0.587	<b>0.584</b>
12	<b>0.586</b>	0.247	0.016	-0.021	<b>0.500</b>	0.568	<b>0.656</b>
13	<b>0.636</b>	0.135	0.044	<b>0.311</b>	0.116	0.525	<b>0.536</b>
14	<b>0.566</b>	0.223	0.142	-0.223	0.005	0.498	0.440
15	<b>0.566</b>	0.259	0.133	-0.314	0.067	0.434	<b>0.508</b>
16	<b>0.525</b>	0.165	0.016	-0.083	0.177	0.408	0.342
17	<b>0.468</b>	0.161	<b>0.673</b>	-0.108	-0.084	0.404	<b>0.718</b>
18	<b>0.418</b>	0.153	<b>0.748</b>	-0.041	-0.106	0.382	<b>0.771</b>
19	<b>0.502</b>	0.143	<b>0.743</b>	-0.101	-0.113	0.359	<b>0.849</b>
20	<b>0.635</b>	0.578	0.023	-0.060	0.023	0.280	<b>0.742</b>
21	<b>0.640</b>	0.670	0.009	-0.028	0.040	0.238	<b>0.862</b>
22	<b>0.619</b>	0.612	0.048	-0.060	0.009	0.220	<b>0.765</b>
23	<b>0.628</b>	0.676	0.008	-0.045	0.017	0.125	<b>0.854</b>
24	<b>0.627</b>	0.666	0.019	-0.025	0.024	0.104	<b>0.838</b>

Rotated Five-Factor PCA

Component	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	0.181	0.133	0.121	<b>0.726</b>	0.072
2	0.083	<b>0.368</b>	0.031	<b>0.598</b>	0.013
3	0.079	0.119	0.112	<b>0.748</b>	0.155
4	0.124	0.104	0.270	<b>0.518</b>	0.098
5	0.123	<b>0.654</b>	0.134	0.292	0.115
6	0.102	<b>0.706</b>	0.189	0.238	0.057
7	0.167	<b>0.778</b>	0.105	0.123	0.105
8	0.183	<b>0.755</b>	0.162	0.191	0.072
9	0.086	<b>0.473</b>	<b>0.472</b>	0.169	0.094
10	0.055	0.080	<b>0.702</b>	0.143	0.093
11	0.116	<b>0.393</b>	<b>0.624</b>	0.136	0.085
12	0.106	0.135	<b>0.750</b>	0.225	0.113
13	0.182	0.233	<b>0.361</b>	<b>0.554</b>	0.103
14	0.114	<b>0.514</b>	<b>0.385</b>	0.068	0.095
15	0.094	<b>0.520</b>	<b>0.464</b>	0.012	0.111
16	0.138	0.278	<b>0.448</b>	0.153	0.143
17	0.094	0.141	0.160	0.098	<b>0.808</b>
18	0.068	0.072	0.099	0.131	<b>0.856</b>
19	0.127	0.140	0.140	0.116	<b>0.883</b>
20	<b>0.822</b>	0.172	0.123	0.121	0.073
21	<b>0.901</b>	0.110	0.104	0.137	0.083
22	<b>0.844</b>	0.170	0.100	0.112	0.042
23	<b>0.901</b>	0.122	0.082	0.117	0.083
24	<b>0.890</b>	0.109	0.086	0.135	0.090

Oblique Varimax Three-Factor Pattern Solution

	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>
1	<b>0.332</b>	0.215	0.161
2	<b>0.478</b>	0.116	0.049
3	<b>0.318</b>	0.099	0.263
4	<b>0.319</b>	0.126	0.192
5	<b>0.598</b>	0.113	0.096
6	<b>0.679</b>	0.089	0.031
7	<b>0.615</b>	0.153	0.039
8	<b>0.660</b>	0.173	0.023
9	<b>0.607</b>	0.041	0.130
10	<b>0.414</b>	-0.008	0.213
11	<b>0.604</b>	0.060	0.148
12	<b>0.487</b>	0.044	0.240
13	<b>0.461</b>	0.179	0.195
14	<b>0.551</b>	0.072	0.099
15	<b>0.567</b>	0.037	0.119
16	<b>0.400</b>	0.094	0.198
17	-0.132	-0.010	<b>0.879</b>
18	-0.219	-0.036	<b>0.937</b>
19	-0.177	0.013	<b>0.957</b>
20	-0.016	<b>0.861</b>	0.009
21	-0.097	<b>0.948</b>	0.018
22	-0.028	<b>0.890</b>	-0.030
23	-0.106	<b>0.948</b>	0.011
24	-0.108	<b>0.937</b>	0.024



## CFA Goodness-of-Fit Statistics

### Two-Factor

	<u>Value</u>	<u>Comment</u>
N	1,409	
Chi-Square	4599.44	Significant, should be non-significant
Chi-Square DF	229	
Chi-Square/DF	20.08	Should be < 2
NFI	0.74	Not high enough
CFI	0.75	Not high enough
RMSEA	0.12	Not low enough
RMSEA 90% Confidence Interval	0.1135-0.1194	Not low enough

### Three-Factor

	<u>Value</u>	<u>Comment</u>
N	1,439	
Chi-Square	1541.45	Significant, should be non-significant
Chi-Square DF	101	
Chi-Square/DF	15.26	Should be < 2
NFI	0.82	Not high enough
CFI	0.83	Not high enough
RMSEA	0.10	Not low enough
RMSEA 90% Confidence Interval	0.0952-0.1040	Not low enough

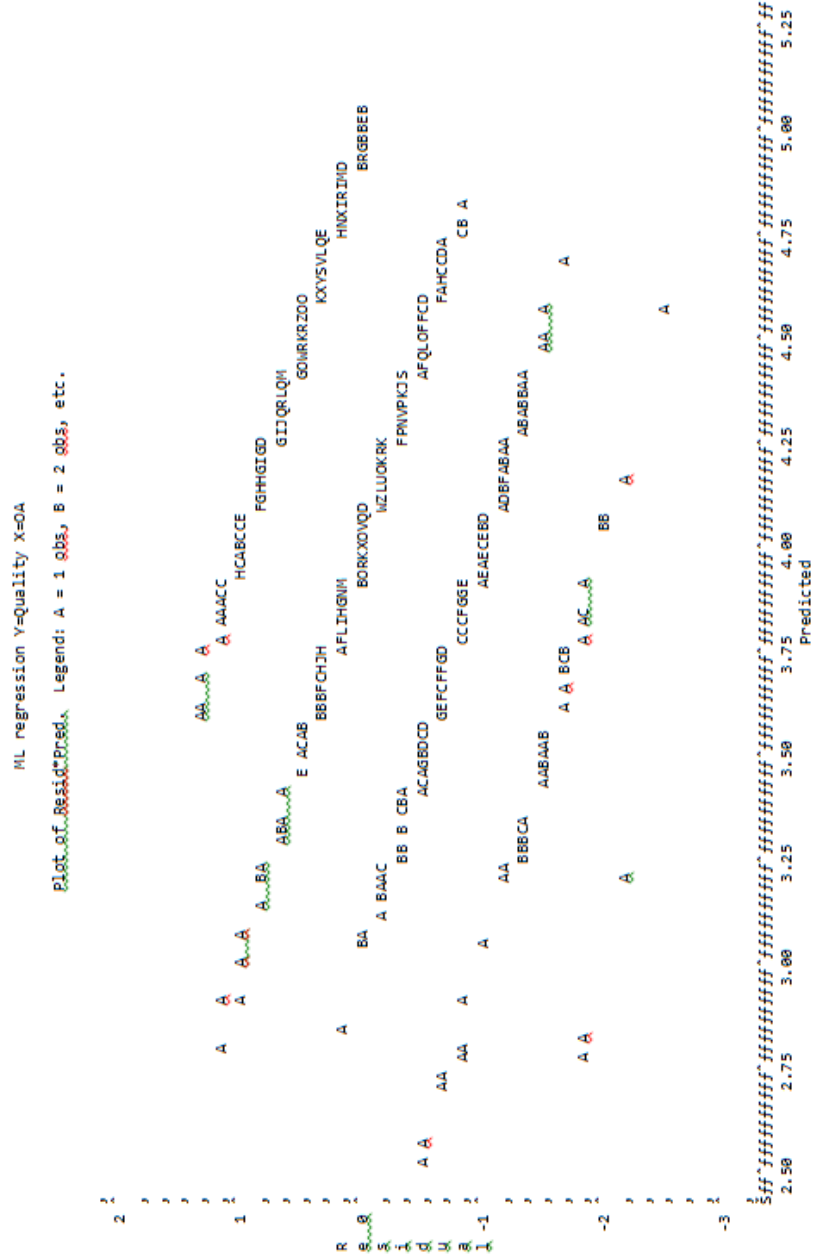
### Four-Factor

	<u>Value</u>	<u>Comment</u>
N	1,409	
Chi-Square	2262.5615	Significant, should be non-significant
Chi Square DF	224	
Chi-Square/DF	10.1007	Should be < 2
NFI	0.8727	Not high enough
CFI	0.8836	Not high enough
RMSEA	0.0804	Not low enough
RMSEA 90% Confidence Interval	0.0774-0.0834	Not low enough

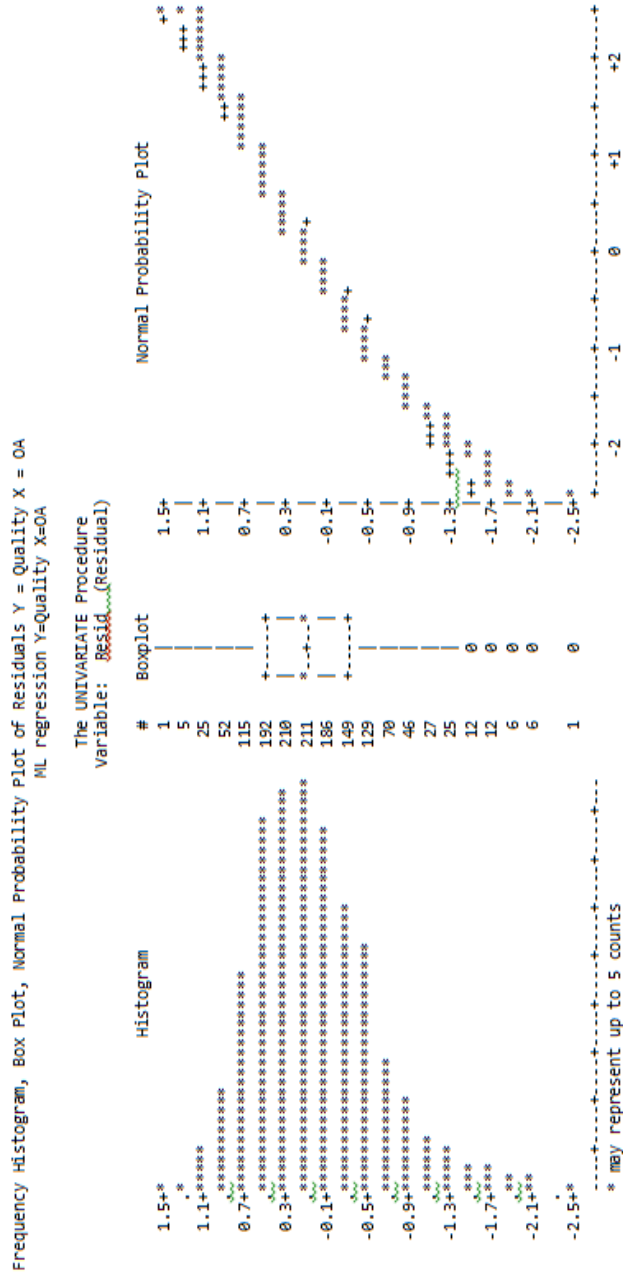
### Five-Factor

	<u>Value</u>	<u>Comment</u>
N	1,406	
Chi-Square	2297.11	Significant, should be non-significant
Chi-Square DF	242	
Chi-Square/Degrees of Freedom	9.49	Should be < 2
NFI	0.87	Not high enough
CFI	0.88	Not high enough
RMSEA	0.08	Not low enough
RMSEA 90% Confidence Interval	.0749 - .0807	Not low enough

## APPENDIX A8: Plot of Residuals, Y = Quality, X = OA

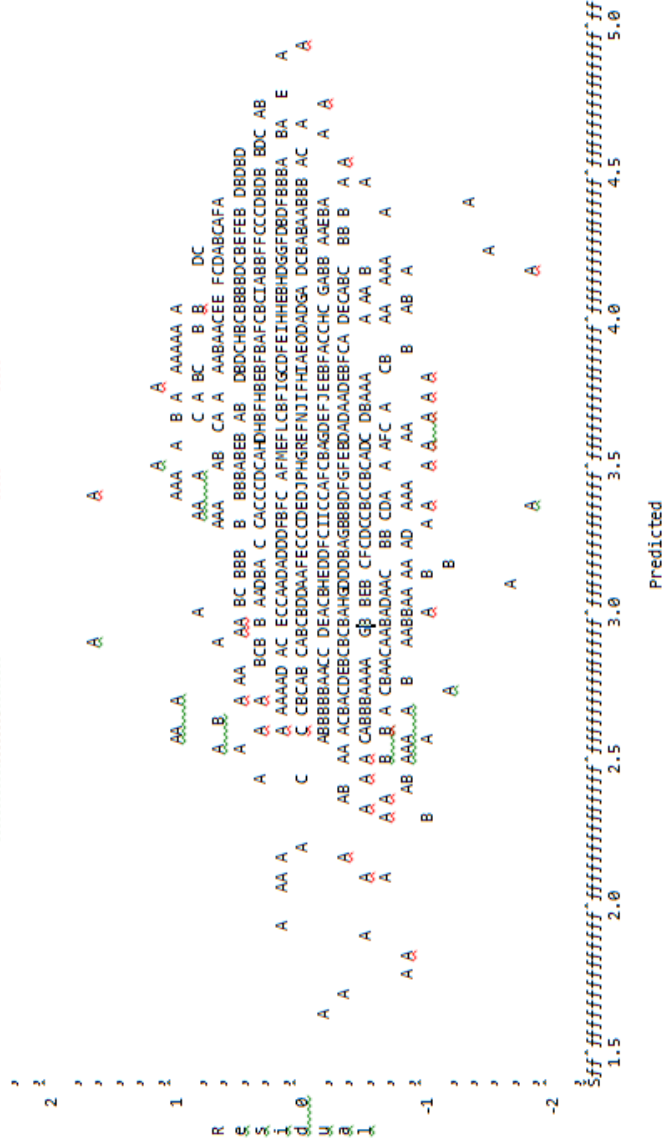


APPENDIX A9: Frequency Histogram, Box Plot, Probability Plot, Y = Quality, X = OA



# APPENDIX A10: Plot of Residuals, Y = Finance, X = OA

Scatter Plot of Residuals, Y = Finance, X = OA  
 ML regression Y=Finance X=OA, 11:43 Friday, October 29, 2010 112  
 Plot of Resid\*Pred. Legend: A = 1 obs, B = 2 obs, etc.



NOTE: 2 obs had missing values.

**APPENDIX A11: Frequency Histogram, Box Plot, Probability Plot, Y = Finance, X = OA**

