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Research Article

STRUCTURAL EQUATION MODELING(SEM) IN MANAGEMENT OF DIGITAL VIDEO LIBRARIES OF ISLAMIC REPUBLIC OF IRAN BROADCASTING (IRIB):AN OPEN ARCHIVAL INFORMATION SYSTEM (OAIS)APPROACH

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ABSTRACT
The Islamic Republic of Iran Broadcasting (IRIB) has initiated digitization of its video libraries to organize its archival material, prevent damages, and facilitate access. Organizing the archives and converting this huge collection in line with the most recent technological advances is a major concern for the managers of IRIB. The purpose of the present research was to identify the most important factors in this process based on the Open Archival Information System (OAIS) reference model.This study was an analytical survey. The population consisted of experts in 53 archive centers in IRIB. Using Cochran's formula and convenience sampling, 106 experts were selected as the sample. A questionnaire was developed with 6 subscales and 111 items which were rated on a 5-point Likert scale (Cronbach's alpha of 0.976). The data were analyzed in SPSS and LISREL using descriptive statistics and structural equations modeling.Ingest factors included transferring descriptive information on digital videos to the Data Management entity, extraction of metadata from archival information packages, and transfer of the archival information package to the Archival Storage entity. Archival Storage factors included backup, assigning a unique number to archived digital videos, and providing copies of archived information packages for the Access entity. Data Management factors included creating digital video metadata, updating metadata, and protecting digital video metadata. Administration factors included determining formats for transition from analog to digital, setting goals for this transition, and responding to information requests. Preservation factors included determining software defects for storage and retrieval of new formats, determining hardware defects for storage and retrieval of new formats, and technology preservation. Access factors included comparison of requested information to contents found in the archive and finding inventories through search sessions and finding aids in archival information packages. The OAIS Reference Model is suitable for managing the digital video libraries of IRIB.

Keywords: *Digital Video Management, IRIB, OAIS Reference Model*

INTRODUTION
The archives of the Islamic Republic of Iran Broadcasting (IRIB) contain the richest and largest audiovisual

Table 1: A comparison of OAIS, DAITSS, CORDRA

INDICATOR	OAIS	DAITSS	CORDRA
Initial Intention	Preservation of digital space data	Preservation of digital library information	Preservation of and access to different educational material
Developer	International Organization for Standardization (ISO)	Florida Center for Library Automation (FCLA)	Carnegie-Mellon University
Development	Fully developed and detailed	Its core is based on OAIS	Developed based on a distance education design
Scope	Comprehensive, encompassing all database functions	Capable of incorporating database functions	Not comprehensive
Flexibility	High flexibility for adapting to different functions	Medium flexibility through adding different interfaces for specific functions	Low flexibility
Usage			
Accepted by the international digital preservation community as a standard model			
Used in libraries across Florida			
Used in distance education			

Source: Center for Technology Studies, Sharif University of Technology (2010).

materials of the country and are a part of its cultural heritage. Managing this huge collection and preparing the archives to respond to technological advances is the main mission of this organization. Using standard models in information archive is essential to integrating the chain from the producer to consumers of archival material. Each model has been developed for a specific purpose and has a different structure.

However, the Open Archive Information System (OAIS), Dark Archive in the Sunshine State (DAITSS), and Content Object Repository Discovery and Registration (CORDRA) are comparable in some aspects (Table 1). Based on the overview in Table 1, OAIS is selected as a suitable model for the archival structure of IRIB. Figure 1 displays an outline of the archive based on the OAIS model.

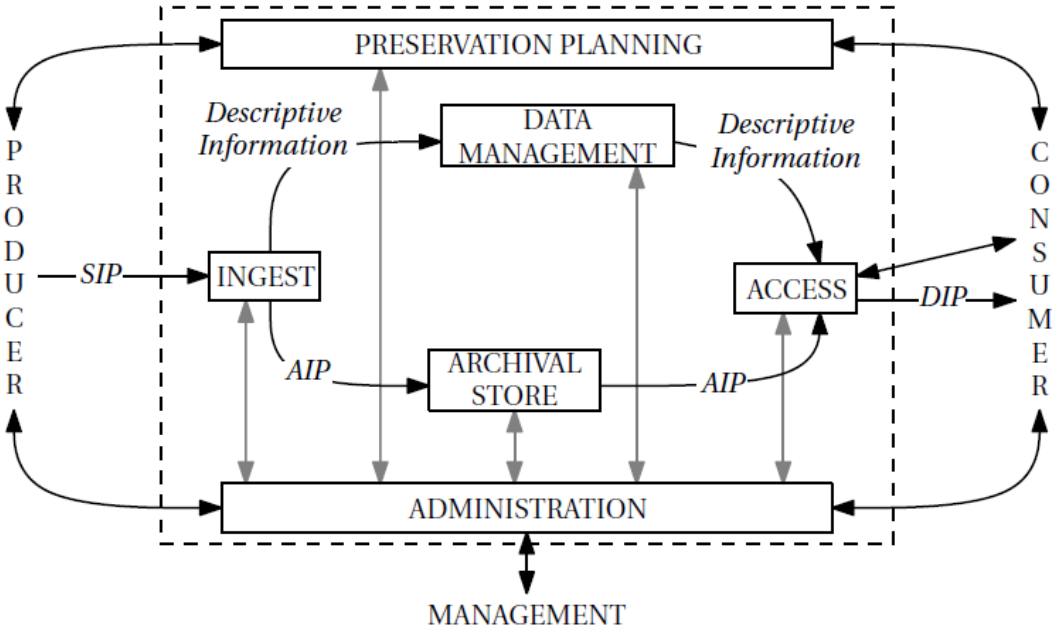

Figure 1. An outline of the OAIS model (Source: Center for Technology Studies, 2010)

The OAIS Reference Model encompasses all the parts of the digital lifecycle, which includes ingest, archival storage, data management, administration, preservation, and access. OAIS can be used to digitize a variety of resources in different information centers (Rassouli, 2011).

OAIS is widely considered as the standard model of storage of digital resources by the digital preservation community. ISO defines OAIS as "an archive, consisting of an organization of people and systems, with the responsibility to preserve information and make it available for a designated community".

The present research applies the OAIS Reference Model to the audiovisual archives of IRIB to provide an appropriate framework for management and preservation of information.

Sami (2010) examined the protection of digital resources in the National Library of Iran using the OAIS Reference Model and recommended its implementation as the only standard for digital preservation.

Rassouli (2011) used an OAIS approach to propose a model for management of digital photos in the National Archive of Iran. Several key elements were identified, including creation of descriptive metadata, creation of archival information package, backup, physical access control, determining storage formats, transfer strategies, and accessibility of resources.

In an analysis of packaging formats for complex digital objects, Bekaert (2003) argued that recent massive increase in the number of organizations making digital information available has encouraged the development of standards for packaging and encoding digital representations of complex objects.

He defined an integrated reference model, based on both the OAIS framework and some additional significant properties that affect the quality, usability, encoding and behavior of the digital objects.

MATERIALS AND METHODS

This study was an analytical survey conducted in 2014 in archive centers of the Islamic Republic of Iran Broadcasting (IRIB). The population consisted of all the employees in 53 archive centers. 106 employees were selected as the sample using Cochran's sample size formula and convenience sampling.

A questionnaire was developed with 6 subscales and 111 items rated on a 5-point Likert scale (11 items for Ingest, 14 items for Archival Storage, 13 items for Data Management, 34 items for Administration, 24 items for Preservation, and 11 items for Access). Face and content validity of the scale was confirmed by academics and experts in the field. Also a Cronbach's alpha of 0.976 was obtained, indicating the high reliability of the instrument. Data were analyzed in SPSS 22 and LISREL 8.4 using descriptive statistics and structural equations modeling at the 0.05 significance level. Items with mean scores higher than 3 were considered desirable.

RESULTS AND DISCUSSION

Results

The demographic variables of 106 participants are as follows: 50% archivists and 50% employees; 50% male and 50% female; 2.8% high school diploma, 9.4% associate degree, 59.5% bachelor's degree, 27.4% master's degree, and 0.9% PhD; 14.2% less than 5 years of experience, 27.4% between 5 and 10 years, 34% between 11 and 15 years, 17.9% between 16 and 20 years, 5.7% between 21 and 25 years, and 0.8% between 26 and 30 years.

Table 2: Fitness indices for factor analysis of the dimensions of OAIS

Dimensions	χ^2	df	$\frac{\chi^2}{df}$	p-value	RMSEA	CFI	AGFI	GFI	NFI
Ingest	53.88	16	3.36	0.000	0.084	0.93	0.86	0.89	0.89
Archival Storage	30.39	16	3.36	0.000	0.084	0.86	0.89	0.96	0.93
Data Management	19.37	6	3.22	0.003	0.082	0.95	0.83	0.99	0.92
Administration	357.99	90	3.97	0.000	0.087	0.92	0.99	0.94	0.94
Preservation	116.61	35	3.33	0.000	0.077	0.96	0.93	0.99	0.90
Access	37.20	10	3.72	0.000	0.090	0.98	0.96	0.99	0.97

As shown in Table 2, the value of χ^2/df is between 1 and 5 for all the dimensions of OAIS, indicating that the conceptual model fits the observed data. RMSEA is less than 0.090 for all the dimensions of OAIS which is an appropriate level. The value of GFI, AGFI, NFI, and CFI are also close to 0.9, suggesting the adequate fit of the model.

According to the participants, the main Ingest factors were as follows:

- *Transferring the descriptive information on digital videos to Data Management (4.23)*
- *Extracting the descriptive information on digital videos from information packages (4.16)*
- *Transferring the archival information package to Archival Storage (4.12)*
- *Information package submission method (CD, DVD, XDCAM, etc.) (4.12)*
- *Updating metadata during data update (4.08)*
- *Ensuring the quality of presented information package (4.06)*
- *Creation of archival information package (AIP) (4.03)*
- *Reassignment (if there is not enough information to create the AIP) (3.93)*
- *Confirmation to information owners for the contents submitted to the archive (3.92)*
- *Determining the uniqueness of the digital video (3.80)*

- *Negotiation with digital video owners about contracts and procedures (3.65)*
- *Digital signature on the presented information package (3.65)*
- *Setting limitations for digital video owners' access to contracts (3.58)*
- *Frequency of information ingestion (3.21).*

The main Archival Storage factors identified by the participants were as follows:

- *Backup (4.30)*
- *Assigning a unique number to the archived digital video (4.12)*
- *Providing copies of archival information packages for the Access entity (4.01)*
- *Final examination of each digital video (3.96)*
- *Selection of alternative media (3.95)*
- *Selection of media for storing the archival information package (3.92)*
- *Providing statistics for usable storage capacity (3.92)*
- *Ensuring the quality of alternative media (3.92)*
- *Transfer methods (refreshment, replication, repackaging) (3.92)*
- *Considering the costs of owning different types of alternative media (3.82)*
- *Confidence interval (prediction error) of alternative media (3.77)*
- *Providing applied statistics of accessible media repository (3.75)*
- *Recording archival storage packages (3.65)*
- *Determining the maximum permissible bit error (3.54).*

The participants identified the main Data Management factors:

- *Creating descriptive metadata for digital videos (4.12)*
- *Updating metadata and creating preservation metadata for digital videos (4.09)*
- *Creating comprehensive metadata for digital videos (3.98)*
- *Creating structural metadata for digital videos (3.95)*
- *Responding to requests from Access or Administration entities (3.93)*
- *Updating database based on changes in Access or Administration entities (3.92)*
- *Receiving and examining requests by Access or Administration entities (3.91)*
- *Preparing an explanatory table for data management (3.90)*
- *Providing information to different entities about changes in data management (3.87)*
- *Creating legal metadata for digital videos (3.84)*
- *Creating technical metadata for digital videos (3.84)*
- *Creating a list of the archived digital videos for consumers (3.76) and applicants (3.68).*

According to the participants, the main Administration factors were:

- *Determining formats for the transition from analog to digital (4.02)*
- *Setting goals for the transition from analog to digital (3.99)*
- *Responding to information requests (3.94)*
- *Determining formats for new archived digital videos (3.94)*
- *Devising mechanisms for updating archival contents (3.92)*
- *Developing policies for improvement of retrieval (3.92)*
- *Determining standards for storage formats (3.91)*
- *Developing policies for physical access control (3.90)*
- *Updating user information and access (3.90)*
- *Examining the efficiency and functioning of the system (3.92)*
- *Responding to users' feedback about access services and products (3.82)*
- *Receiving requests for change (3.79)*
- *Procedures (3.78)*
- *Data management tools (3.78)*

- *Determining data transfer formats (3.76)*
- *Assessing facilities (training facilities, personnel, storage capacity, hardware, software, etc.) required for data management and responding to requests (3.74)*
- *Monitoring system operations to ensure archive's performance (3.74)*
- *Monitoring system application to ensure archive's performance (3.74)*
- *Developing policies for error control (3.70)*
- *Determining standards for dissemination formats (based on user preferences) (3.66)*
- *Periodic examination of information accessibility (3.64)*
- *Monitoring system implementation to ensure archive's performance (3.62)*
- *Updating by sending dissemination request to the Access entity (3.59)*
- *Developing policies for intellectual property (3.59)*
- *Updating DIP and resending it to the Ingest entity (3.59)*
- *Developing strategies for renovating outdated systems (3.56)*
- *Summarizing users' opinions and making them accessible (3.55)*
- *Sending content transfer messages from IT personnel to Ingest personnel (3.50)*
- *Examining technologies that are becoming obsolete (3.49)*
- *Developing budget policies (3.41)*
- *Developing pricing policies (3.35)*
- *Sending temporary ISP to Submission Monitoring (3.25)*
- *Recording the requests submitted to the archive (2.92)*
- *Maintaining a calendar of submission sessions (2.89).*

According to the participants, the main Preservation factors were as follows:

- *Identifying software defects for storage and retrieval of new formats (4.16)*
- *Identifying hardware defects for storage and retrieval of new formats (4.15)*
- *Technology preservation*
- *Physical control of access (through surveillance cameras, physical security, doors, and locks) (4.06)*
- *Conversion (4.01)*
- *Identifying emerging technologies (3.95)*
- *Testing and extensive usage of prototypes in the transition from analog to digital (3.93)*
- *Using preservation standards and providing SIP and AIP (3.83)*
- *Developing new AIP models in response to the goals of transition from analog to digital (3.82)*
- *Technology Alerts (3.81)*
- *Adopting new standards for handling new submission conditions (3.74)*
- *Establishing a committee to monitor technology (keeping it up-do-date) (3.71)*
- *Applying manufactured technologies (3.67)*
- *Developing new standards for handling new submission conditions (3.67)*
- *Using survey forms (3.63)*
- *Creating discussion groups or workshops to identify customer needs (3.60)*
- *Making changes in user agreement (due to changes in users' information needs) (3.52)*
- *Predicting changes in user agreement (3.41)*
- *Recommendations for applicability of packaging designs and migration plans (3.31)*
- *Necessity of users' contact with the archive (3.31)*
- *Determining dissemination format from the user's perspective (3.22)*
- *Monitoring changes in user agreement (3.20)*
- *Determining the type of dissemination media from the user's perspective (2.72).*

Finally, the most important Access factors were as follows:

- *Comparison of requested information with contents found in the archive (4.02)*

- *Finding inventory through search sessions (3.88)*
- *Finding aids on archival information packages (3.83)*
- *Performing queries and delivering responses through computer networks (3.80)*
- *Username (3.63)*
- *Web interaction, user address, e-mail address (3.52)*
- *Request date (3.19)*
- *User activity (3.17)*
- *Full descriptive metadata accompanying the content delivered to the consumer (3.15)*
- *User's aim of information request (3.14).*

An important step in path analysis is to perform confirmatory factor analysis. Its main objective is to test whether the data fit a hypothesized measurement model.

First-order CFA for Ingest

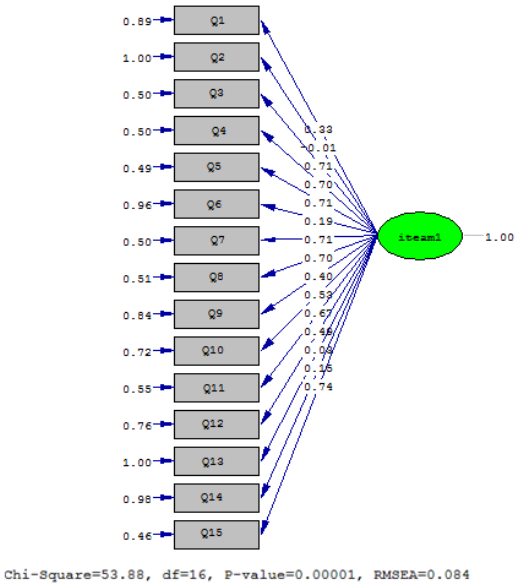

Figure 2: Standardized coefficients for Ingest

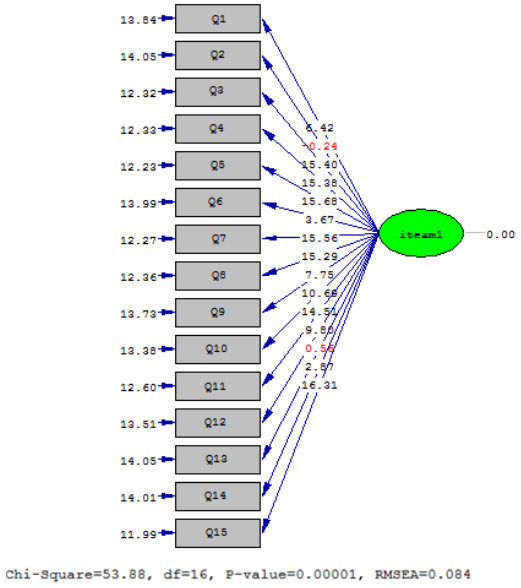

Figure 3:Test statistics for Ingest

Table 3: Goodness of fit indices for Ingest

Goodness of Fit Indices								
χ^2	df	χ^2/df	P-Value	RMSEA	CFI	AGFI	GFI	NFI
53.88	16	3.36	0.000	0.084	0.93	0.86	0.89	0.89

As shown in Table 3, χ^2/df is between 1 and 5, indicating that the conceptual model fits the observed data. The value of RMSEA is 0.084 which is appropriate. Also GFI, AGFI, NFI, and CFI are 0.89, 0.86, 0.89, and 0.93 respectively, indicating the adequate fit of the model.

First-order CFA for Archival Storage

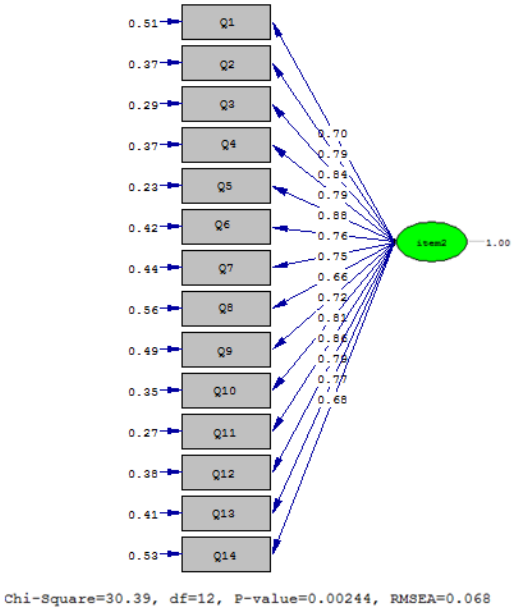

Figure 4: Standardized coefficients for Archival Storage

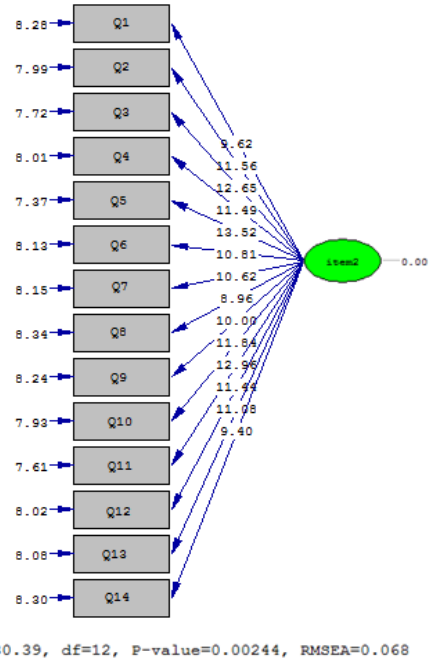

Figure 5: Test statistics for Archival Storage

Table 4: Goodness of fit indices for Archival Storage

Goodness of Fit Indices								
χ^2	df	χ^2/df	P-Value	RMSEA	CFI	AGFI	GFI	NFI
30.39	12	2.53	0.002	0.068	0.96	0.97	0.96	0.93

The value of χ^2/df is between 1 and 5, indicating that the conceptual model fits the observed data. The value of RMSEA is 0.068 which is appropriate. Also GFI, AGFI, NFI, and CFI are 0.96, 0.97, 0.93, and 0.96 respectively, indicating the adequate fit of the model.

First-order CFA for Data Management

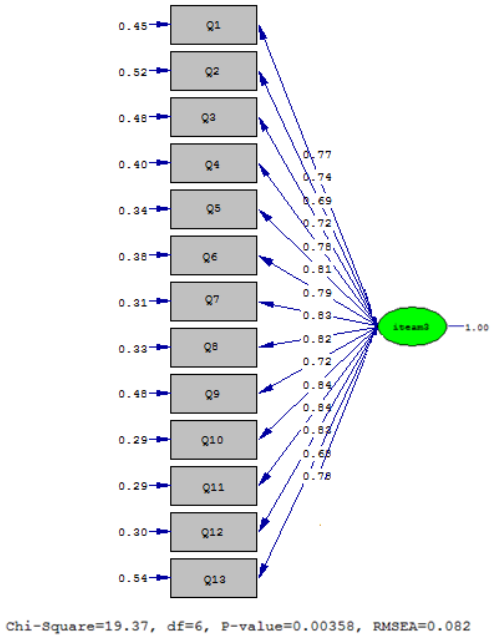

Figure 6. Standardized coefficients for Data Management

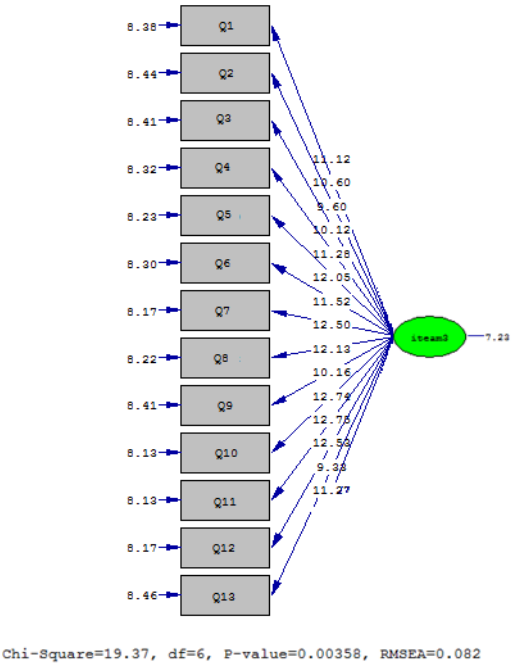

Figure 7: Test statistics for Data Management

Table 5: Goodness of fit indices for Data Management

Goodness of Fit Indices								
χ^2	df	χ^2/df	P-Value	RMSEA	CFI	AGFI	GFI	NFI
19.37	6	3.22	0.003	0.082	0.95	0.83	0.99	0.92

The value of χ^2/df is between 1 and 5, indicating that the conceptual model fits the observed data. The value of RMSEA is 0.082 which is appropriate. GFI, AGFI, NFI, and CFI are 0.99, 0.83, 0.92, and 0.95 respectively, indicating the adequate fit of the model.

First-order CFA for Administration

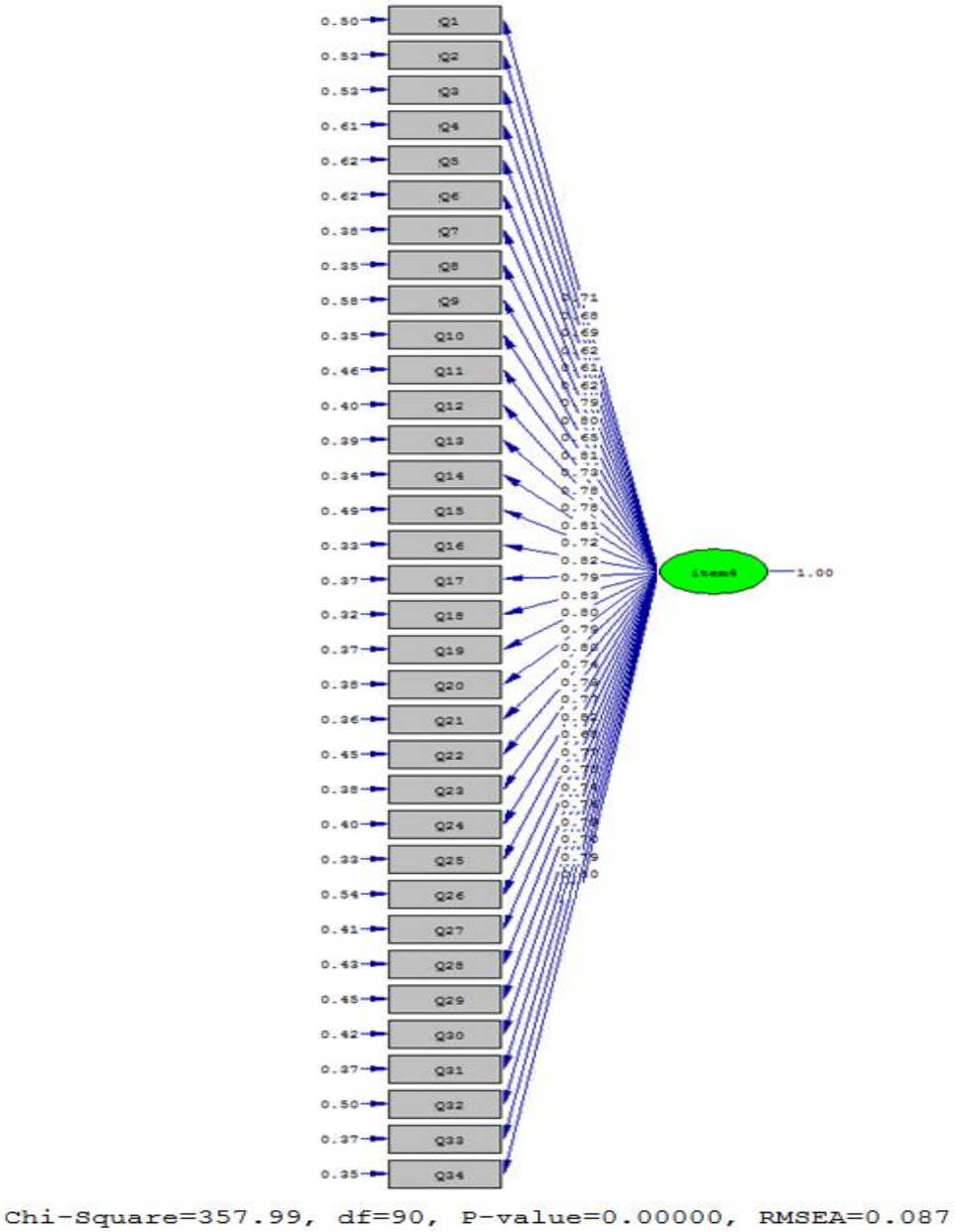

Figure 8: Standardized coefficients for Administration

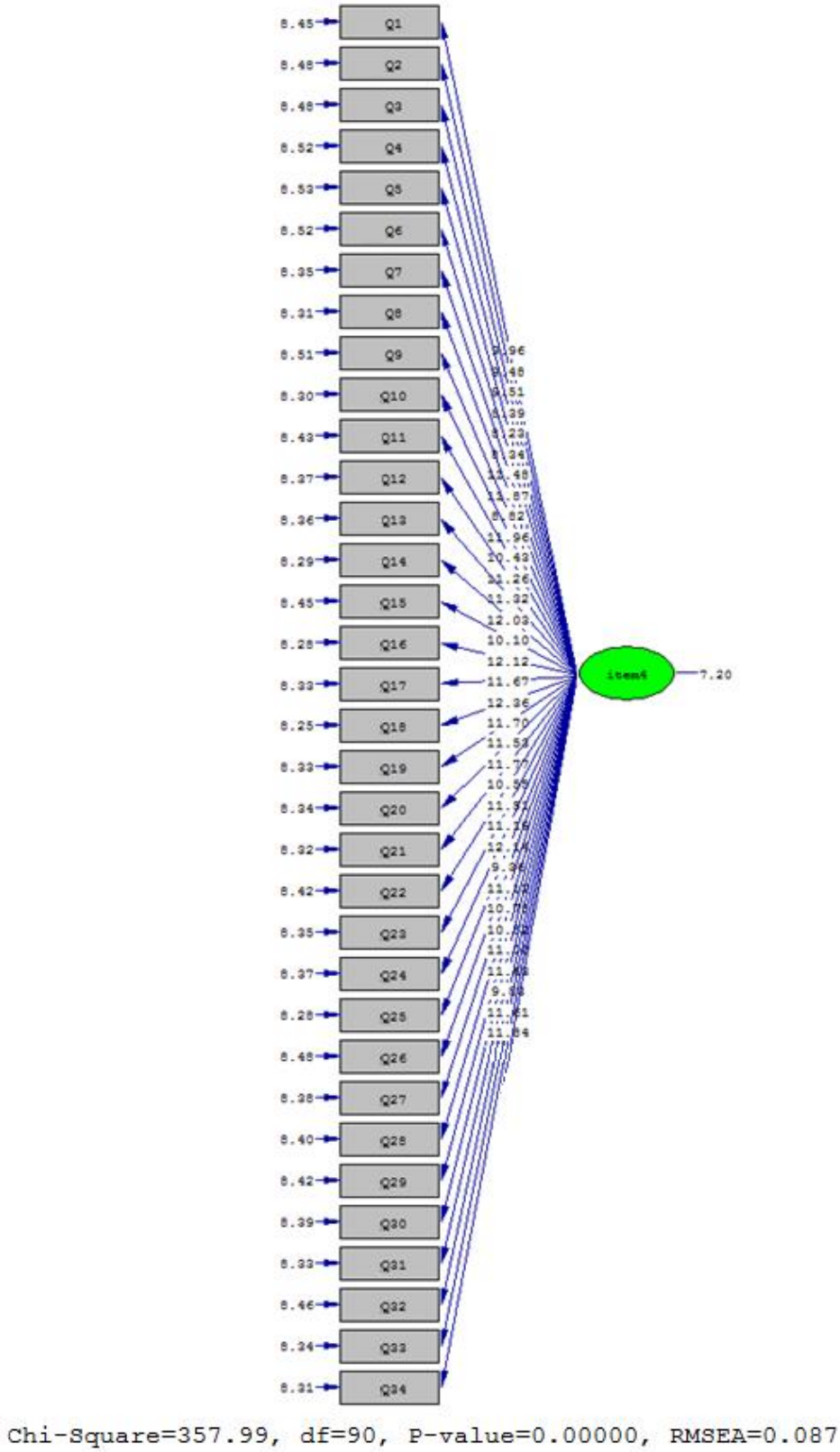

Figure 9: Test statistics for Administration

Table 6: Goodness of fit indices for Administration

Goodness of Fit Indices								
χ^2	df	χ^2/df	P-Value	RMSEA	CFI	AGFI	GFI	NFI
357.99	90	3.97	0.000	0.087	0.92	0.99	0.94	0.94

The value of χ^2/df is between 1 and 5, indicating that the conceptual model fits the observed data. The value of RMSEA is 0.087 which is appropriate. GFI, AGFI, NFI, and CFI are 0.94, 0.99, 0.94, and 0.92 respectively, indicating the adequate fit of the model.

First-order CFA for Preservation

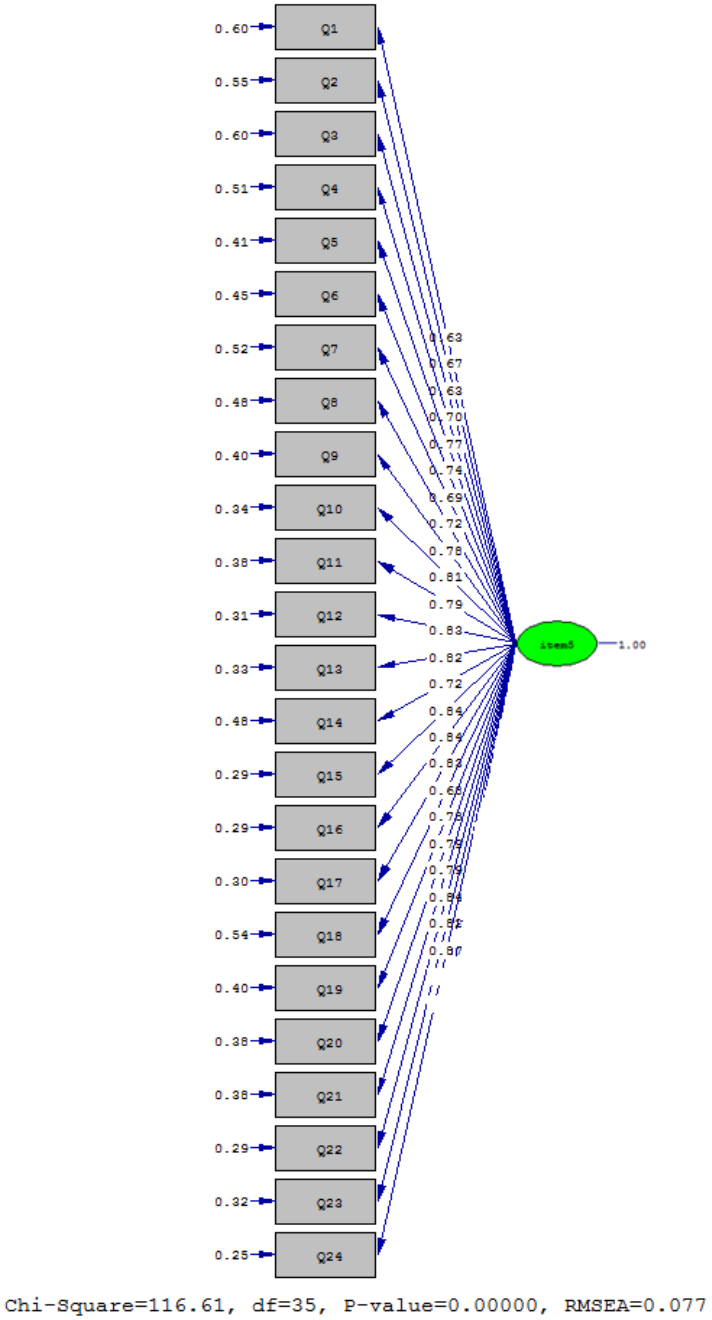

Figure 10: Standardized coefficients for Preservation

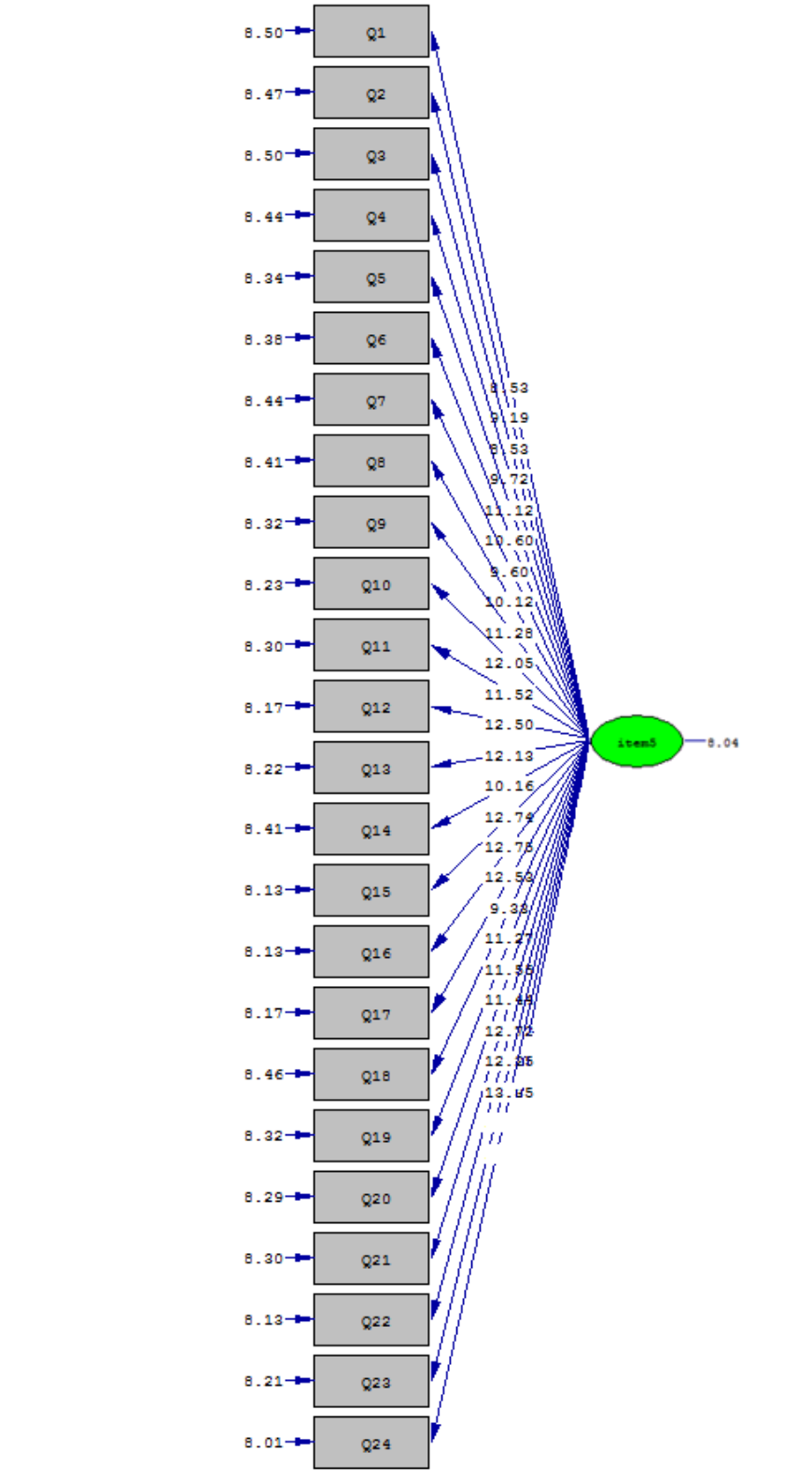

Figure 11: Test statistics for Preservation

Table 7: Goodness of fit indices for Preservation

Goodness of Fit Indices								
χ^2	df	χ^2/df	P-Value	RMSEA	CFI	AGFI	GFI	NFI
116.61	35	3.33	0.000	0.077	0.96	0.93	0.99	0.90

The value of χ^2/df is between 1 and 5, indicating that the conceptual model fits the observed data. The value of RMSEA is 0.077 which is appropriate. GFI, AGFI, NFI, and CFI are 0.99, 0.93, 0.90, and 0.96 respectively, indicating the adequate fit of the model.

First-order CFA for Access

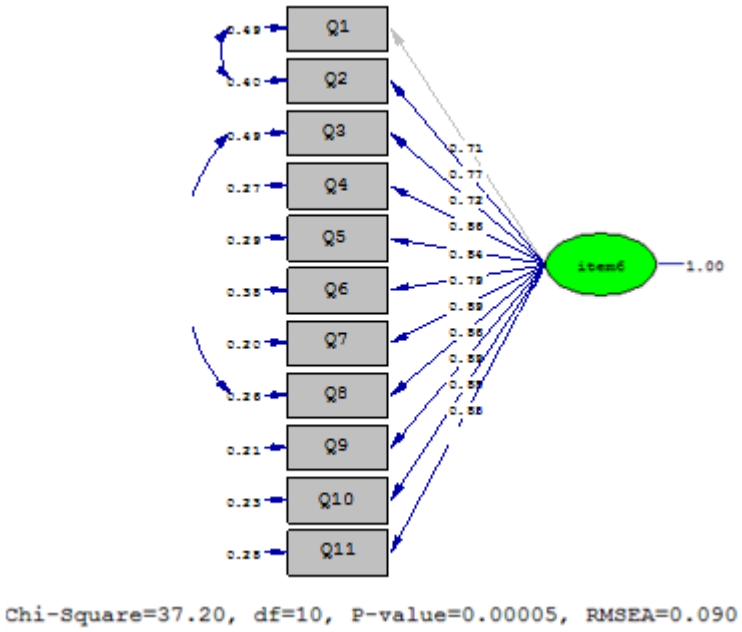

Figure 12: Standardized coefficients for Access

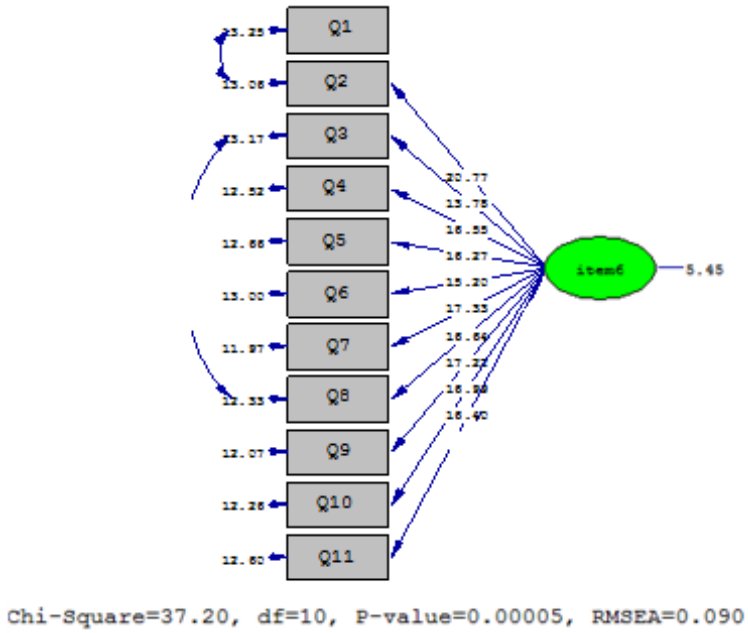

Figure 13: Test statistics for Access

Table 8: Goodness of fit indices for Access

Goodness of Fit Indices								
χ^2	df	χ^2/df	P-Value	RMSEA	CFI	AGFI	GFI	NFI
37.20	10	3.72	0.000	0.090	0.98	0.96	0.99	0.97

The value of χ^2/df is between 1 and 5, indicating that the conceptual model fits the observed data. The value of RMSEA is 0.09 which is appropriate. GFI, AGFI, NFI, and CFI are 0.99, 0.96, 0.97, and 0.98 respectively, indicating the adequate fit of the model.

Discussion

The present findings suggest that the OAIS Reference Model is suitable for managing the digital video archives of IRIB. The most important entities were Data Management (3.90), Archival Storage (3.89), Preservation (3.67), Administration (3.66), and Access (3.55) respectively. This is consistent with the results of Sami (2010), Rassouli (2011), Lee (2005), Spence (2006), Altenhöner (2006), Nordland (2007), Kim and Yoon (2009), and Laughton (2012). Sami (2010) examined the protection of digital resources in the National Library of Iran using the OAIS Reference Model and recommended its implementation as the only standard for digital preservation. Rassouli (2011) used an OAIS approach to propose a model for management of digital photos in the National Archive of Iran. Several elements were identified, including creation of descriptive metadata, creation of archival information package, backup, physical access control, storage formats, transfer strategies, and accessibility of resources.

Lee (2005) described OAIS as a fundamental component of digital archive research and development in a variety of disciplines and sectors. He recommended it as a means to develop and maintain archives and support long-term access and understanding of the information in those archives. Spence (2006) investigated the feasibility of the OAIS model for application in small organizations and provided a conceptual example of how the OAIS model can be used in a multiple transfer context. Altenhöner (2006) proposed a solution OAIS as a solution for long-term preservation in the development of systems for the long-term availability of digital objects. Nordland (2007) recommended compliance with the OAIS reference model for long-term preservation of information deposits. Kim and Yoon (2009) proposed a multi-level metadata structure for image archiving based on OAIS and recommended it as a standard for maintaining and preserving information. Finally, Laughton (2012) recommended OAIS functional model compliance for the members of the World Data Centre (WDC).

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