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Decision Support Capabilities of Enterprise Content Management Systems: An Empirical Investigation

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Abstract

Enterprise content management (ECM) systems help organizations cope with the increasing complexity and volume of data and information. Despite the growing popularity of ECM, published literature indicates that organizations primarily use ECM for operational benefits, while the strategic decision making capabilities are rarely considered. Thus, the most significant rewards of ECM implementation may be largely forgone. This study investigates the potential of ECM technology for decision support. A research model is proposed and validated via an empirical investigation. The results show that ECM positively influences problem identification and definition, decision making speed and analysis, decision quality, and decision makers' satisfaction.

Keywords: Enterprise content management, ECM, decision support

1. Introduction

An unprecedented and clandestine predicament has emerged from the congruence of new technology and increasing volume of data. The natural consequence of cheap storage and high-speed connectivity has created the strategic tendency for organizations to amass data for the sake of extracting collective knowledge. Yet, as the information content becomes increasingly complex and dispersed, the ability to utilize this information for quick and effective decision making declines. One strategic approach to realize business value from the cumulative content assets is to employ appropriate decision support (DS) technology. DS technology offers a means to structure, filter, and analyze information in order to reduce uncertainty and increase efficiency in the decision making process [5, 6]. Traditionally, DS technology encompassed tools such as decision support systems (DSS) [74], expert systems (ES) [48], executive information systems (EIS) [72, 83], and group decision support systems (GDSS) [19]. More recently, newer technologies have emerged that are designed more specifically around the problem context of organizational data and include systems that support knowledge management and generation [3, 58, 84]. Enterprise content management (ECM) systems belong to this category.

ECM systems are implemented to manage the increasing volume of organizational data and to generate meaningful information from diverse content assets. ECM solutions have proliferated the marketplace in the recent years. According to Gartner [20] , the ECM market grew 7.2% in 2012 to a worldwide market size of $4.7 billion. The use of ECM helps organizations to be compliant with government regulations and standards, and enhances organizational reputation and competitiveness in the marketplace [54, 73].

The popularity of ECM makes it an important subject matter for information systems (IS) research [11, 41, 42, 67, 78, 81]. Most published ECM literature, to date, focuses on the operational and tactical benefits of ECM, and only a few studies address the strategic role of ECM in an organizational context [59]. For example, Smith and McKeen [73] assessed the relationship between cost reduction and work process simplification from ECM adoption, and vom Brocke et al. [80] analyzed the impact of ECM on organizational performance based on efficiency and content availability. The paucity of research on the strategic benefits of ECM (for example, decision making support and competitive intelligence) is well documented [1]. Though largely surmised in practice and in academic research, the potential to support and enhance organizational decision support is perhaps the most important strategic benefit that ECM can provide. Therefore, the objective of this study is to gain a better understanding of the decision

support capabilities of ECM systems. Specifically we look at the strategic role of ECM in the lifecycle of decision support activities. This research attempts to answer the following questions:

- How does the use of ECM impact decision support?
- What specific decision support activities are supported by the use of ECM?

To this effect, we introduce a conceptual model that combines the sequential decision making framework of Mintzberg et al. [52] with the content stewardship activities of ECM. To assess the strategic value of ECM in decision support, we propose several hypotheses and conduct an empirical analysis to test the hypotheses.

The rest of the paper is organized as follows. In the next section we provide a conceptualization of ECM as it applies to this research, and background on related work. In the subsequent section, we describe the conceptual model and formulate our hypotheses. The empirical study and results are presented next, followed by a discussion of the major findings, practical implications, and theoretical contributions. The paper concludes by summarizing the limitations of the study and suggesting directions for future research.

2. Background

2.1 Conceptualization of ECM

Content management (CM) is the identification of content requirements, creation of a structured content for reuse, and the assembling of content to meet the customers' need [64]. The origin of CM can be traced to the development of processes and tools to manage high quality websites with rapidly changing content and functionalities. The increasing need to maintain currency and consistency between content publication and organizational information led to the emergence of integrated solutions that combine CM with traditional document management solutions. In document management systems (DMS), the content components (or units) are the digital files (or documents), whereas CM goes further and involves the management of different types of content components. It allows the creation of new content by combining components from varying sources [12]. CM at the enterprise level is ECM.

ECM is the management of all types of content assets used in an organization [27, 53]. Smith and McKeen [73] define ECM as "the strategies, tools, processes and skills an organization needs to manage all its information assets (regardless of type) over their lifecycle." The Association of Information and Image Management (AIIM) defines ECM as "the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes." ECM can be viewed as an evolutionary phase of information management that involves the management of well-structured data (for example, transaction data) and less-structured data (for example, e-mails and blogs) through the complete content lifecycle [12, 53]. Rockley [64] states that one of the main goals of ECM implementation is to have transparent content sharing by making different and disparate applications (for example, web content management, and records management) interoperable. ECM systems enhance organizational processes by providing several functions such as capturing, creating, indexing, searching and accessing, organizing, and maintaining all organizational content regardless of the data format [63, 73]. It facilitates cross-departmental collaboration from the transparent sharing of knowledge and content [35]. Examples of widely used ECM solutions are Microsoft SharePoint, Drupal, Oracle Universal Content, OpenText ECM Suite, and Perceptivesoft ImageNow.

ECM offers various operational, tactical and strategic benefits. The operational benefits include saving cost and reducing workload by streamlining tasks [59], version control, traceability, reducing duplication [54], and improving search and retrieval [68]. Identified tactical benefits include improving internal and external collaboration [59], enhancing content quality and

maintaining consistency [65], standardizing workflows [54], producing organizational metadata attached to content objects [53], and provisioning for regulatory requirements [54]. Described strategic value of ECM include increasing decision making capabilities [40, 73], facilitating creativity [79] and enhancing the professional representation of the enterprise in the eyes of its stakeholders [59].

2.2 Related work

In the current study we focus on the strategic role of ECM for decision support in an organizational context. In general, enterprise systems such as enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM) and ECM offer substantial decision support benefits through the use of decision aids that enable the examination of significant volumes of enterprise data [26, 59]. Although ECM is closely related to other types of enterprise systems such as SCM and CRM, a majority of the scholarly publications specifically on ECM are conceptual or technical in nature. There is limited research on whether the use of ECM improves decision making or advances decision support.

Alalwan and Weistroffer [1] conducted a review of ECM literature, classifying each reviewed article along four dimensions, namely tools, process, people, and strategy. Their comprehensive review indicates that scholarly publications on ECM primarily focus on the tools and process dimensions of ECM. For example, Aziz et al. [7] address the technological issues of multimedia data management for the publishing industry, Chiu et al. [16] discuss privacy and access control for a financial ECM solution, and Befa et al. [9] extend ECM system deployment for semantic interoperability utilizing ontologies.

Implementation challenges, user perceptions, and customization issues are other topics discussed in the ECM literature. Nordheim and Päivärinta [54] highlight the challenges that emerge during the process of implementing an ECM system. Based on an elaborate case study from the oil industry, they characterize four motors of development and change: teleological, evolutionary, life cycle, and dialectical motors. vom Brocke and Simons [80], and vom Brocke et al. [81] propose a five-phase framework for ECM adoption. The framework systematizes business process analysis, content analysis, ECM analysis, ECM-blueprint adaptation, and business process redesign. Bianco and Michelino [11] use the organizational and technological context to evaluate the impact of CM systems on publishing firms. Their results suggest that socio-technical context favors the adoption of content management technology.

Only a few published studies address the strategic dimension of ECM. Smith and McKeen [73] investigate how knowledge engineers within the organization use ECM to manage information. They maintain that an effective ECM strategy should address four content stewardship activities: *capture, organize, process,* and *maintain*. Their findings suggest short-term benefits (such as cost reduction and work flow simplification) as the main drivers for ECM adoption. Päivärinta and Munkvold [59] compare the concept of ECM to information resource management (IRM), electronic document management (EDM), and knowledge management (KM). They argue that ECM represents an integrative perspective on information management that combines IRM, EDM, and the repository model of KM. By focusing on the explicit, codified dimension of organizational knowledge, Munkvold et al. [53] highlight the tactical role of ECM in an organizational context. They propose investment in ECM as a strategic and holistic approach to manage voluminous and heterogeneous content sources.

While some previous studies have discussed the strategic capabilities of ECM, to the best of our knowledge no published research has assessed the impact of ECM on decision support in an organizational context. Specifically, we know of no research that has been conducted to determine the extend to which ECM use enables decision makers to recognize problems, explore

possible solutions, and improve decision making speed. To address this research gap we develop a conceptual model that combines the sequential decision making framework of Mintzberg et al. [52] with the content stewardship activities of ECM identified by Smith and McKeen [73]. We use this conceptual model as the basis to formulate our hypotheses, and our research model to analyze the effect of ECM use on problem definition, speed of problem identification and decision making, decision quality, and decision makers' satisfaction. We then report on the results of an empirical investigation to test our hypotheses.

3. Conceptual model and hypotheses

Past research suggests that content stewardship practices using the appropriate information technology can significantly affect an organization's performance with respect to productivity, quality, profitability, and customer satisfaction [73]. Though we recognize that the ECM lifecycle may include additional activities, such as creating and removing content, in the current research we concentrate on the four *content stewardship* activities of ECM identified by Smith and McKeen [73], viz. *capture*, *organize*, *process*, and *maintain*. According to Marchand et al. [49], in the first activity of content stewardship, the *capture* stage, organizations should capture not just the content that facilitates operational activities, but also what may be used for business intelligence (e.g., predicting market shifts, identifying competitive innovation, adjusting to economic changes, recognizing potential problems). The next activity in the content stewardship approach is organizing the content to make it easily navigable (*organize*). The third stewardship activity is analyzing the content to help in decision making (*process*). However, as mentioned before, the extent to which organizations actually use ECM for decision making is not yet well understood. The fourth content stewardship activity is keeping the content up-to-date (*maintain*). The content must be regularly assessed in order to preserve consistency across the organization [4, 51]. The *maintain* activity, which includes establishing standards for retention and disposal, is important to ensure that the content remains current and, when necessary, initiate a new cycle of content stewardship activities.

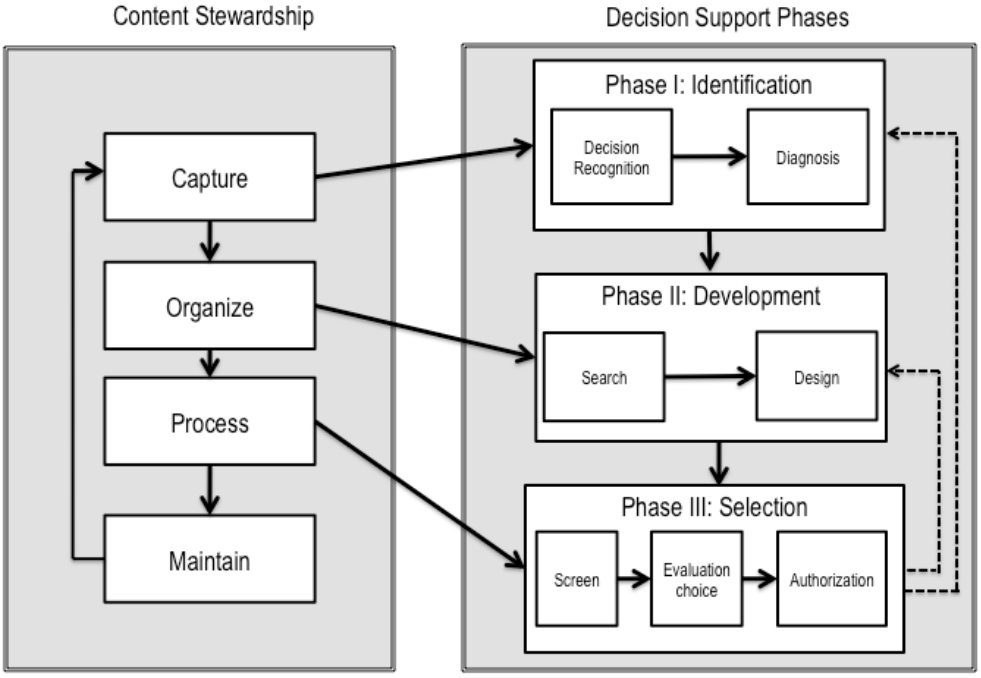


Figure 1: Conceptual model with content stewardship and DS activities (based on ECM literature and Mintzberg et al. [52])

Content stewardship activities are critical for providing effective decision support. For example, information has to be accurately captured and well organized to enable decision makers to make sound decisions based on the right information. The left side of Figure 1 shows the content stewardship activities [35, 39, 49, 73].

DS activities are widely discussed in the literature. Inherently, DS activities involve identifying and synthesizing useful information for making decisions. Walker et al. [82] investigated DS activities from the 'uncertainty' point of view and specified policy analysis, integrated assessment, and risk assessment as the main DS activities. Howard [33] defines three essential decision activities (choice, information, and value) and calls them the decision base. Langley et al. [43] contend that the decision making literature can be positioned between two poles, with sequential theories at one end and anarchical processes at the other. For our research a sequential framework seems most appropriate, as we try to relate the activities of the content lifecycle to specific decision making phases. We adopt the sequential framework of Mintzberg et al. [52], as it is widely accepted, has gained much empirical support [50, 70], and is consistent with the steps in Simon's rational decision making [71]. The model of Mintzberg et al. consists of the three phases *identification*, *development*, and *selection*. Although other sequential decision models proposed in the literature (such as one suggested by Power [62]) include additional steps, the model proposed by Mintzberg et al. identifies the DS phases and activities for which ECM would seem appropriate. The right side of Figure 1 shows these three phases. Each phase is described in terms of several 'routines' (shown as the inner boxes and explained in the next section). The dotted arrows on the far right indicate that the decision maker may return to a previous phase as needed.

The conceptual model shown in Figure 1 links the content stewardship activities identified by Smith and McKeen [73] with the theoretical perspectives of Mintzberg et al. [52]. The model is explained further in the following section, as we develop our hypotheses.

3.1 Identification phase and the 'capture' activity

Mintzberg et al. [52] specify two routines in the identification phase. The 'decision recognition' routine initiates the DS process by recognizing problems, opportunities, and crises. The second routine, 'diagnosis,' refers to collecting the needed data or information to define and clarify the previously recognized problem, opportunity, or crisis. This corresponds to the 'capture' phase of content stewardship. The ECM repository captures and stores information vital to the organization. The data may come from a variety of internal and external sources. The 'captured' content is essential for defining problems, opportunities, and crises. Capturing content is crucial to identifying economic, political, and social issues, recognizing changes in customer demands and market trends, and necessary for establishing effective business partnerships [49]. Thus we hypothesize:

> *H1a*: The use of ECM positively influences problem definition in the decision support process.
> *H1b*: The use of ECM positively influences the speed of problem identification in the decision support process.

3.2 Development phase and the 'organize' activity

Mintzberg et al. [52] identify two routines in the development phase. The 'search' routine is where the decision maker engages in various activities to explore possible solutions to the recognized problem. The 'design' routine is where solutions identified in the search routine are adapted to fit a specific problem situation, or where a new alternative solution is suggested. ECM can help decision makers find the right information to solve a recognized problem since

information search and retrieval are essential features of ECM systems [73]. The 'organize' activity of content stewardship thus corresponds to the development phase of DS. Sykes et al. [75] argue that content management systems are useful to organize and create better information access. The 'organize' activity allows users to find relevant data rapidly [39]. Dynamic content arrangement and classification are key functions in ECM solutions [17, 44, 53]. The content indexing and linking capabilities of ECM [49] facilitate the search and design routines of DS. Therefore we hypothesize:

> *H2*: The use of ECM positively influences decision making analysis in the decision support process.

3.3 Selection phase and the 'process' activity

The selection phase starts with the 'screening' routine to eliminate impractical alternatives [52]. The best alternative is selected through the process of analysis in the 'evaluation-choice' routine. Finally, the selection phase goes through the 'authorization' routine where the individual with authority performs a specific course of action in the decision making process. In the content stewardship activities of ECM, the 'process' activity is analyzing the content to select the best alternative in the shortest possible time. For example, Kettinger and Paddack [40] report on the success of a company in using ECM to screen alternatives that are optimal in converting human capital (i.e. skills and experience) into structural capital (i.e. customer relationships). Processes such as defining, standardizing, storing, and delivering content are effectively managed using ECM systems [29]. Kemp [39] indicates that the primary benefit of ECM is reducing the time spent looking for the appropriate content. Empirical evidence shows that the content management systems at Volvo Group enhanced the efficiency of their key business processes [38]. The shared-service content management system in the Commonwealth of Virginia helped in reducing the time and cost of solving 'records retention issues' [36]. Thus we hypothesize:

> *H3a*: The use of ECM positively influences decision quality in the decision support process.
> *H3b*: The use of ECM positively influences the speed of decision making in the decision support process.

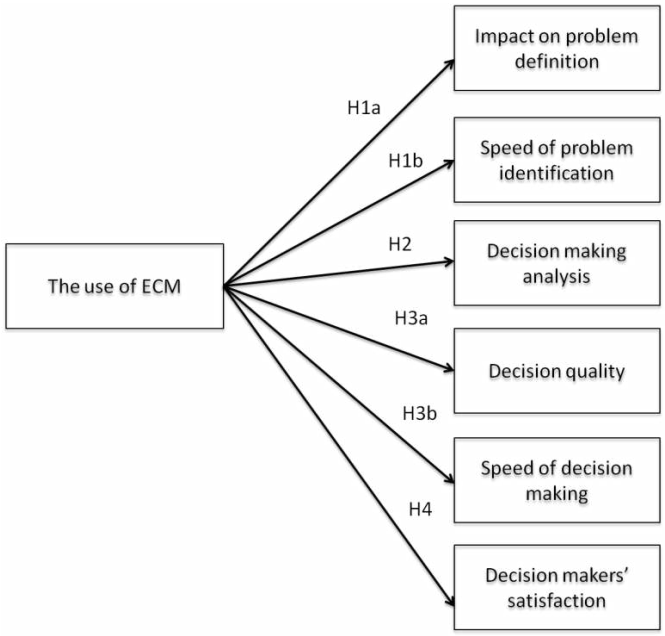


Figure 2: Research model

The decision maker plays a major role in the DS activities [19], as with the use of ECM systems [18]. ECM solutions can have an impact on improving employees' satisfaction by providing better work efficiency [69]. Though ECM may lead to reduced worker autonomy and flexibility, its adoption is becoming a recommended means to improve an organization's efficiency in managing digital content and increasing workers' satisfaction [2]. ECM technology provides utility in varying environments ranging from oil production [53] to the medical field [59]. For example, Päivärinta and Munkvold [59] found that the ECM solution implemented at Baltimore Johns Hopkins University Hospital aids in monitoring and managing patient referral, thereby increasing both physician and patient satisfaction. Therefore, we hypothesize:

H4: The use of ECM positively influences decision makers' satisfaction.

The 'maintain' activity of content stewardship is not directly associated with any phase in the DS process. The primary purpose of the 'maintain' activity is to keep the content up-to-date. It provides a feedback to initiate another cycle of stewardship activities when new content is to be captured, organized and processed. Our research model with the hypotheses is shown in Figure 2.

4. Empirical study

4.1 Measurement

To test the research model, an empirical study was carried out at a large public research university[1] on the east coast of the United States that has implemented ImageNow software, a commercial ECM system for capturing, organizing, and managing the diverse content assets. A survey instrument was developed based on published literature. The instrument included six demographic questions, seven sections to measure the model constructs, and a section for general feedback. The questionnaire was reviewed for content validity [77] by four academic IS researchers and one ECM practitioner. The measurement instrument was then pilot tested among a small sample of six ECM software users who were not included in the main survey. The objective was to examine whether the respondents had difficulty answering the questionnaire, as well as test the reliability and validity of the scales. Based on the pilot study results, minor revisions were made to the questionnaire to reduce ambiguity and simplify interpretation. The results of the pilot test provided evidence that the scales were reliable and valid [22, 55].

The survey instrument and the measurement items are summarized in Appendix A. The variable *Use of ECM System* is measured as the extent to which ECM is used to perform business tasks in the user's area of responsibility. Three items adopted from [85] are used to measure this variable – frequency of use, duration of use, and number of tasks conducted using ECM. The independent variable *Impact on Problem Definition* is measured by five items adopted from [56] and gauges the extent to which ECM helps identify problems and delineate the requirements. Two items are used to assess *Problem Identification Speed*. They measure the impact of ECM on identifying critical factors and potential problems in the user's area of responsibility. The three items for *Decision Making Analysis* measure whether ECM use facilitates the evaluation of alternatives from a comprehensive set of information sources. *Decision Making Speed* is measured by two items and determines if ECM use will shorten the decision making time. The items for *Problem Identification Speed*, *Decision Making Analysis*, and *Decision Making Speed* are adopted from [46, 47]. Based on [34], four items are used to measure *Decision Quality*. The items assess the extent to which the decision outcome from the use of ECM is accurate and dependable. *Decision Maker's Satisfaction* is measured using thirteen items adopted from [66]. They comprehensively measure the level of satisfaction of the decision maker in using ECM to identify problems,

[1] Classified as RU/VH: Research Universities (very high research activity) by the Carnegie Classification of Institutions of Higher Education.

organize information, evaluate options, and perform action in the decision making process. All items are assessed using a five point Likert scale on an interval level ranging from "strongly disagree" to "strongly agree".

4.2 Data

A survey was conducted in 2012 using an online version of the questionnaire. Invitations to participate were sent via email to 618 users of the ImageNow software. 157 completed responses were received of which 111 were usable. The sample covered 28 different departments and functional units within the organization. We used the "key informant" approach for data collection [10, 57, 60] to target respondents who are most involved in, and knowledgeable about ECM. Since it is important that the respondents have appropriate knowledge about ECM, we specified that the person who had a good overview of their functional unit's stance on ECM, and familiar with the use of the ECM application complete the survey. The respondents were qualified individuals (administrators, managers, program specialists, etc.) that use the ImageNow software to organize, manage, search and evaluate data assets. 31% of responders held a masters degree or higher, and 44% were in a managerial position (directors, coordinators, accountants, advisors, and budget managers). The descriptive characteristics of the sample are shown in Table 1. The sample indicates good quality of the data.

5. Results

Structural equation modeling (SEM) technique was used to analyze the data and test the hypotheses. Specifically, partial least squares (PLS) technique, a component-based methodology that examines structural equation models [76] was used to evaluate the proposed research model. PLS was selected for the following reasons. First, PLS can be described as "distribution free" since it requires no assumptions with respect to normality and independence of observation [14]. Also, small sample size is usually not a problem with PLS [13]. PLS analysis avoids both factor indeterminacy and improper solutions that may arise when using other approaches such as covariance-based SEM [21]. Finally, PLS is considered a good causal predictive analysis approach when there is low theoretical basis [37].

SmartPLS software was used to analyze the data. We first examined the instrument (the measurement model) to assess reliability and validity before testing the structural model using the level of significance of the path coefficients and the variance explained (R^2 measures).

5.1 Measurement model

The measurement model results are presented in Tables 2, 3, and 4. We assessed construct reliability, indicator reliability, convergent validity, and discriminant validity. The construct reliability was tested using the composite reliability coefficient. The composite reliability values for all constructs (Table 2) exceed the recommended threshold of 0.70. The related Cronbach's alpha values are more than the recommended limit of 0.60 indicating a robust internal consistency reliability of the scales [55]. The average variance extracted (AVE) was used to test convergent validity. The AVE should be higher than 0.50 so that the latent variables explain more than half of the variance of its indicators [22, 31, 32]. As seen in Table 2, all constructs meet this criteria suggesting a sufficient degree of convergent validity [22].

The discriminant validity of the constructs was tested based on two criteria. The first criterion postulates that the loading of each indicator should be greater than cross loadings [15, 25, 28]. The second criterion requires that the square root of AVE should be greater than the correlations between the constructs [22]. As seen in Table 3, the square roots of AVEs (diagonal elements) are

higher than the correlation between constructs (off-diagonal elements). The results support the discriminant validity of the scale used [30].

Sample characteristics (N = 111)			
Respondent's Position		Obs.	(%)
Administrators (Directors, Deans)		19	17.12%
Managerial (Coordinators, Advisors, Counselors)		30	27.03%
Fiscal (Budget managers, Accountants)		9	8.11%
Specialists (IT analysts, Admin Assistants, Data specialists)		14	12.61%
Support (Technicians, Data processors)		4	3.60%
Others (Faculty, Student Workers)		3	2.70%
Unspecified		32	28.83%
Gender	Male	26	24%
	Female	69	62%
	Unspecified	16	14%
Age	20-29	18	16%
	30-39	18	16%
	40-49	19	17%
	>50	22	20%
	Unspecified	34	31%
Education	Bachelor degree	42	38%
	Masters degree	25	23%
	Doctorate degree	9	8%
	Unspecified	35	31%
Ethnicity	White, Euro-American	51	46%
	Black, African	27	24%
	Asian, Pacific Islander	2	2%
	Native American	2	2%
	Unspecified	29	26%

Table 1: Descriptive statistics of respondents

Finally, the factor loadings and the cross loadings are shown in Table 4. All factor loadings on their assigned latent variables are higher than the cross loadings on all other latent variables. In addition, the T-statistics of the outer model loadings range from a low value of 11 to a high value of 151, which demonstrates that each item's factor loading is highly significant. The assessment of the measurement model shows good results for the validity and reliability tests indicating that the constructs can be used to test the structural model.

Constructs	Composite reliability (Internal consistency reliability)	Average variance extracted/explained	Cronbach's Alpha
Decision making analysis	0.90	0.75	0.84
Decision making speed	0.96	0.93	0.93
Decision quality	0.93	0.78	0.91
The use of ECM	0.85	0.66	0.73
Impact on problem definition	0.90	0.66	0.87
Problem identification speed	0.91	0.83	0.80
Satisfaction	0.95	0.61	0.94

Table 2: Reliability indicators

5.2 Structural model

The structural model was assessed using the variance explained (R^2 measures) and the level of significance of the path coefficients. Figure 3 shows the model results. The results indicate that impact on problem definition ($\beta = 0.574$, $p<0.001$) and problem identification speed ($\beta = 0.427$, $p<0.001$) are statistically significant. Thus, hypotheses *H1a* and *H1b* are supported. The R^2 of dependent variables indicate that the model explains 32.9% of the variance in impact on problem definition and 34.9% of the variance in problem identification speed. The path coefficients for decision making analysis ($\beta = 0.315$, $p<0.001$), decision quality ($\beta = 0.411$, $p<0.001$), and decision making speed ($\beta = 0.427$, $p<0.001$) are statistically significant. This confirms hypotheses *H2*, *H3a*, and *H3b*. The model explains 9.9% of the variance in decision making analysis, 16.9% of the variance in decision quality, and18.2% of the variance in decision making speed. With regard to decision maker's satisfaction with the use of ECM in decision support, the path coefficient ($\beta = 0.642$, $p<0.001$) is also statistically significant. Thus, hypothesis *H4* is supported. The model explains 41.2% of the variance in satisfaction of decision makers in the use of ECM in providing decision support.

Latent variables	1	2	3	4	5	6	7
1. Decision making analysis	**0.87**						
2. Decision making speed	0.48	**0.97**					
3. Decision quality	0.59	0.63	**0.89**				
4. The use of ECM	0.31	0.43	0.41	**0.81**			
5. Impact on problem definition	0.62	0.55	0.64	0.57	**0.81**		
6. Problem identification speed	0.49	0.57	0.51	0.59	0.67	**0.92**	
7. Satisfaction	0.57	0.74	0.71	0.64	0.73	0.74	**0.78**

Table 3: Discriminant validity results

6. Discussion

The objective of our study is to unfold the decision support capabilities of ECM. A conceptual model is proposed that combines the sequential decision making framework of Mintzberg et al. [52] with the content stewardship activities of ECM. To assess the strategic value of ECM in decision support, a research model with six hypotheses is proposed. The research used results of a survey of 111 users of ImageNow software at a large public research university. The empirical analysis confirmed all six hypotheses.

The findings suggest that problem definition and the speed of problem identification are positively associated with ECM use. 42% of the survey respondents agreed that the use of ECM software helps them identify potential problems before they become serious. In addition, the study results indicate that the use of ECM positively influences decision making analysis, decision quality, and decision making speed. The survey results showed that 50% of respondents agreed that the use of ECM helps them in evaluating alternatives, 64% responded that ECM enables them to use more information sources for analysis, 60% indicated that the outcomes of the decisions are dependable, and 54% of respondents agreed that ECM shortens the time frame for making decisions. The survey results also indicated that the use of ECM systems positively affects decision makers' satisfaction. The results are significant, as satisfaction is a general indicator of achieving organizational expectations and objectives [66]. Though one may argue that the survey results could be prejudiced by the decision makers' preconceptions about ECM

inherently improving the analysis and speed of decision making, most of the survey respondents had significant managerial experience and had been in decision making roles prior to the use of ECM. The decision makers may therefore recognize the actual time and effort saving from the use of ECM to perceive its value in the decision making process.

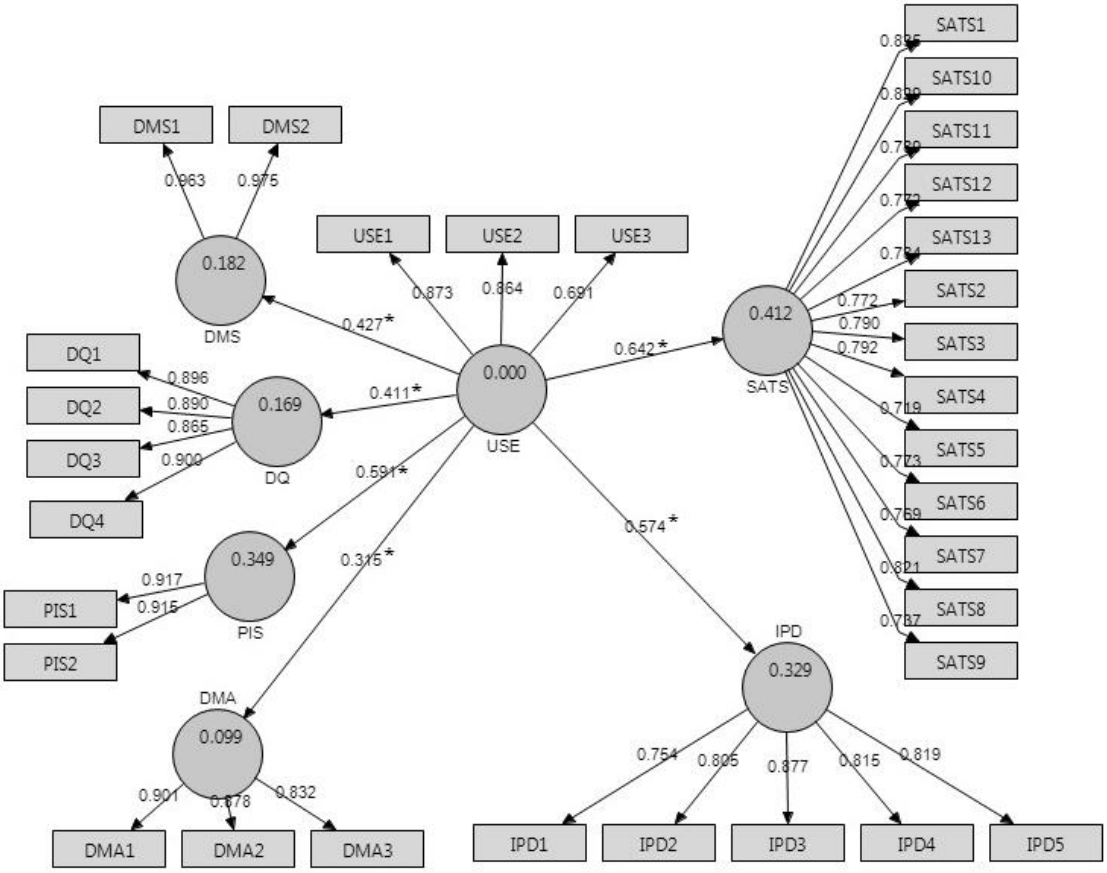
	DMA	DMS	DQ	IPD	PIS	SATS	USE
DMA1	**0.90**	0.41	0.54	0.53	0.43	0.52	0.28
DMA2	**0.88**	0.44	0.56	0.52	0.40	0.50	0.28
DMA3	**0.83**	0.41	0.44	0.57	0.45	0.45	0.26
DMS1	0.50	**0.96**	0.61	0.53	0.53	0.71	0.37
DMS2	0.44	**0.98**	0.61	0.54	0.58	0.73	0.45
DQ1	0.55	0.56	**0.90**	0.60	0.49	0.63	0.40
DQ2	0.51	0.53	**0.89**	0.51	0.42	0.60	0.32
DQ3	0.55	0.55	**0.87**	0.61	0.46	0.62	0.33
DQ4	0.47	0.59	**0.90**	0.55	0.45	0.67	0.39
IPD1	0.41	0.51	0.46	**0.75**	0.58	0.58	0.49
IPD2	0.53	0.51	0.59	**0.81**	0.56	0.63	0.47
IPD3	0.52	0.42	0.54	**0.88**	0.56	0.67	0.47
IPD4	0.51	0.41	0.51	**0.82**	0.47	0.51	0.37
IPD5	0.54	0.40	0.50	**0.82**	0.56	0.57	0.51
PIS1	0.51	0.50	0.47	0.62	**0.92**	0.74	0.54
PIS2	0.38	0.56	0.47	0.61	**0.91**	0.62	0.54
SATS1	0.35	0.57	0.56	0.53	0.63	**0.83**	0.66
SATS2	0.44	0.46	0.44	0.58	0.59	**0.77**	0.43
SATS3	0.38	0.50	0.51	0.56	0.52	**0.79**	0.55
SATS4	0.27	0.52	0.47	0.50	0.57	**0.79**	0.60
SATS5	0.38	0.49	0.47	0.46	0.48	**0.72**	0.43
SATS6	0.51	0.55	0.58	0.57	0.53	**0.77**	0.55
SATS7	0.43	0.58	0.66	0.57	0.58	**0.77**	0.45
SATS8	0.53	0.58	0.60	0.69	0.71	**0.82**	0.54
SATS9	0.52	0.54	0.59	0.62	0.55	**0.74**	0.38
SATS10	0.50	0.63	0.65	0.66	0.61	**0.83**	0.46
SATS11	0.45	0.87	0.59	0.55	0.61	**0.79**	0.42
SATS12	0.53	0.76	0.58	0.58	0.57	**0.77**	0.42
SATS13	0.58	0.63	0.60	0.68	0.63	**0.78**	0.50
USE1	0.24	0.35	0.33	0.47	0.51	0.53	**0.87**
USE2	0.25	0.32	0.29	0.48	0.46	0.49	**0.86**
USE3	0.27	0.37	0.38	0.44	0.46	0.54	**0.69**

Table 4: Results of factor loadings and cross loadings

6.1 Implications for practice

Though the scope and rationale for ECM initiatives vary across organizations, the trend towards implementing ECM as a holistic approach to manage the organizational content assets is well recognized [53]. While users generally appreciate the operational and tactical benefits of ECM systems, the strategic decision support capabilities have not been empirically established. To help managers and decision makers couple content stewardship practices in ECM to decision making, an elucidation of the decision support capabilities of ECM is essential. Our study highlights several key facets of ECM for decision support that are summarized below.

ECM aggregates organizational information content in digital form and provide real time information as needed to managerial decision makers [65]. The results of the study indicate that ECM use facilitates problem assessment and definition by enabling the exploration of organizational digital assets required in a decision situation. ECM systems delineate functional boundaries, secure access to information, and provision legal requirements [54]. They establish traceability and ownership of information processed and utilized by the decision maker [54, 59]. As indicated by the study results, use of ECM may thus help lower concerns of risk for the individual and the organization.



*** Significant at P < 0.001**

Figure 3: The structural model

The study found that the time spent using ECM and the frequency of use has an impact on the speed of problem identification. The findings suggest that using ECM for a wider range of business tasks may help reduce the time needed by decision makers to identify problems. It is therefore likely that over time the familiarity with ECM may increase managers' abilities to acquire and process information even if it entails data from multiple sources. The use of ECM may thus allow decision makers to react faster to potential trouble situations.

Availability of reliable information is a key component of an effective decision making process [46]. The results of the study suggests that ECM use enables the decision maker to increase the number of information sources used, examine more alternatives during decision analysis, and test a wider range of assumptions. ECM formalizes workflows [54], and provides the tools and techniques to enhance content quality and consistency [65]. Thus, as decision makers become

more accustomed to ECM for acquiring, processing and interpreting information, the use of ECM may improve decision making analysis.

Evidence from the study suggests that ECM enables the decision maker to shorten the decision making time frame. A plausible explanation is the inherent capabilities of ECM systems to organize the digital content [63, 64], and provision accurate and readily accessible information [27]. ECM use may therefore be beneficial in organizational environments demanding fast response and up to date information.

The study results indicate that ECM may facilitate more dependable and consistent decision outcomes with fewer or no errors. Thus ECM use may contribute to the effectiveness, quality and timeliness in the decision making process. The results indicate that the decision makers are satisfied with the decision outcomes when using ECM. This finding is consistent with previous studies that have reported the relationship between the use of enterprise systems and higher quality decisions [47].

Our study highlights the importance of developing and implementing comprehensive content stewardship strategies [18, 71] to foster content sharing, collaboration and reuse of organizational information assets. ECM may enable the decision maker to set priorities in decision making, and present arguments more convincingly through the analysis of alternatives. A strong user experience can help drive the adoption of ECM technology [24]. Making managers and users aware of the benefits of ECM therefore may not only deliver business value, but also prepare the organization to align business strategies with ECM capabilities.

6.2 Contributions to theory

As enterprises adapt to the growing volume of digital content and real-time information processing, the innovative use of ECM becomes more integral to the organizational IT strategy. Thus research to assess the strategic value of *capturing*, *organizing*, *processing* and *maintaining* digital content becomes increasingly relevant.

There is a recognized paucity in studies on the strategic dimension of ECM use for decision making [1, 54, 73]. Our study makes important contribution to the body of research on ECM in that it links the sequential decision making framework of Mintzberg et al. [52] to the content stewardship perspective of Smith and McKeen [73] into a conceptual model, which then allows the formulation of several hypothesis on the impact of EC use on decision support. The study delineates several elements of decision support that benefit from ECM use. Our research is thus different from other studies on ECM that have addressed challenges related to implementation [54] and data management [7, 53]. The instrument used in this study has been verified for reliability, validity, and discriminant tests. The conceptual model (Figure 1) together with the structural model (Figure 3) that resulted from our empirical hypothesis testing provide a basis for understanding the use of ECM for decision support in an organizational context, and thus for future research on the strategic use of ECM systems.

The study extends the current research on ECM beyond the descriptive strategic qualities of ECM to a theoretically based inquiry into the organizational decision support capabilities of ECM. By assessing the specific information needs of managers, the study empirically validates the role of ECM in problem definition and identification. By determining the extent of decision making analysis, speed, and quality, the study articulates the association between ECM use and decision makers' satisfaction. The study thus offers new insights on the use of ECM for decision support and contributes to the still scarce body of research on ECM that has been mostly limited to examining operational and tactical benefits [73]. Thus these findings lay a foundation for

advancing further research on ECM topics such as content management best practices, information quality, and governance.

7. Conclusion, limitations, and future directions

The increasing volume, complexity and diversity of digital content makes ECM technology an essential component of organizational IT. Furthermore, the necessity and importance of making quick and accurate decisions in today's dynamic environment positions ECM in a strategic role for decision support. The objective of this study was to improve our understanding of the decision support capabilities of ECM in an organization. We conducted an empirical investigation of the impact of ECM on the decision making variables using a large sample (111 users from 28 different functional units at a large public research university in the United States). We use structural equation modeling, a statistically powerful technique to analyze the data and test six hypotheses. The results of the study confirm all hypotheses, indicating that the use of ECM positively impacts decision support activities. Our study thus addresses an identified research gap by connecting the content stewardship activities of ECM [71] to the activities in the different stages of decision support [52].

Like with most empirical studies, our study is not without limitations. One limitation is that the study used data from a university setting, which may limit the broader validity of the results, as ECM system requirements may not be as demanding in this setting as they might be in a global manufacturing firm or service firm. Thus, our study suggests the need for further research to develop model estimates in faster paced organizational contexts. Such additional results would allow a comparative and thus fairer assessment regarding the strategic benefits of ECM in decision making.

The variables examined in this study were chosen based on previously published research on decision support [34, 46, 47, 56, 66, 85], and established theories [52, 73]. We acknowledge that factors such as information quality [23], learning curve [61], organizational culture as it relates to participative decision making, competitive advantage [8], and alignment of business strategy to IT-enabled business processes [45] are not explored in this study. They are important determinants considered in research that assess the benefit of enterprise systems such as ERP and CRM. Future research to include these variables could conceivably portray a more complete picture of the strategic benefit of ECM for decision support.

Another limitation of our study is that the subjects were users of ImageNow software, which is not the leader in the commercial ECM marketplace. Other competing products such as EMC Documentum and Microsoft Sharepoint have unique features and a wide client base. A comparative analysis to assess similar capabilities of other ECM solutions would be worthwhile. Also, in this study we focused only on basic decision support activities. Functionalities available from ECM solutions vary widely based on the installed components, and the software vendor. For instance, with the growing importance of real time analytics on large volumes of data, many ECM solutions now offer integrated data analytics and business intelligence capabilities. The strategic value of integrating analytics with the creation and consumption of content cannot be overlooked [26]. Future research may address the strategic benefits underlying the integration of content management and content analytics.

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Appendix A: Survey items and sources

Variables		Items	Source
Use of ECM System	USE1	Actual daily use: time spent using ECM	Zain et al. [85]
	USE2	Frequency of use of ECM system	
	USE3	Number of business tasks for which the computer systems were used (i.e. the extent to which respondents use a computer in their work)	
Satisfaction	SATS1	I have become dependent on ECM	Sanders and Courtney [66]
	SATS2	As a result of ECM, I am seen as more valuable in this organization	
	SATS3	I personally benefitted from the existence of ECM in this organization	
	SATS4	I have come to rely on ECM in performing my job	
	SATS5	All in all I think that ECM is an important system for this organization	
	SATS6	ECM is extremely useful	
	SATS7	Utilization of ECM has enabled me to make better decisions	
	SATS8	As a result of ECM, I am better able to set my priorities in decision making	
	SATS9	Use of data generated by ECM has enabled me to present my arguments more convincingly	
	SATS10	ECM has improved the quality of decisions I make in this organization	
	SATS11	As a result of ECM, the speed at which I analyze decisions has increased	
	SATS12	As a result of ECM, more relevant information has been available to me for decision making	
	SATS13	ECM has led me to greater use of analytical aids in my decision making	
Problem Identification Speed	PIS1	ECM helps me sense key factors impacting my area of responsibility	Leidner and Elam [46, 47]
	PIS2	ECM helps me notice potential problems before they become serious crises	
Decision Making Speed	DMS1	ECM helps me make decisions quicker	
	DMS2	ECM helps me shorten the time frame for making decisions	
Decision Making Analysis	DMA1	ECM helped the organization evaluate more alternatives	Leidner and Elam [46, 47]

Variables		Items	Source
	DMA2	ECM helped the organization increase the number of information sources	
	DMA3	ECM helped the organization test assumptions and spend more time before making a decision.	
Decision Quality	DQ1	Based on the information from ECM, the outcome of the decision that I make is usually correct (the outcome may have minor errors)	Jarupathirun and Zahedi [34]
	DQ2	Based on the information from ECM, the outcome of the decision that I make is usually accurate (the outcome has no errors at all)	
	DQ3	Based on the information from ECM, the outcome of the decision that I make is usually precise (the ECM will lead to the same outcome every time I face the same problem)	
	DQ4	Based on the information from ECM, the outcome of the decision that I make is usually dependable	
Impact on Problem Definition	IPD1	How much do you think ECM is helpful in addressing existing and anticipated needs in your department?	Oh [56]
	IPD2	How much do you think ECM is helpful in assessing your manager's familiarity with the problem in your department?	
	IPD3	How much do you think ECM is helpful in clearly delineating the desired change in your department?	
	IPD4	How much do you think ECM is helpful in assessing the extent in which the change (that is proposed by ECM) enhances the public image of the organization?	
	IPD5	How much do you think ECM is helpful in assessing the extent to which successful implementation of the change (that is proposed by ECM) poses risks to individuals or the organization?	