ADDRESSING THE SHADO IT CHALLENGE: APPLICATIONS TO HIGHER EDUCATION

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ABSTRACT

Universities, small and large, continue to battle Shadow IT (SIT). Some of the challenges associated with SIT include cybersecurity concerns, noncompliance with regulatory requirements, duplication of existing applications, lack of IT help desk support, and user-built applications not coded to institutional standards. In today's digital economy, end users have a growing number of IT options and recent data suggest that these end users are increasingly using SIT in support of their work and school assignments. The purpose of this article is to apply the end user-driven IT (EUDIT) model to the higher education universe with the goal of establishing the most appropriate level of Shadow IT that optimizes overall institutional performance.

Keywords: Shadow IT, Higher Education, End user-driven IT model
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INTRODUCTION

For years, corporate IT organizations have battled Shadow IT (SIT), defined as IT devices, software and services outside the ownership or control of central IT [12]. The reasons for central IT to engage in this conflict are logical and reasonable: unvetted IT brought into the university can cause a host of issues, including cybersecurity threats, regulatory requirements noncompliance, duplication of existing applications, lack of IT help desk support, massive data caused by standalone apps, user-built applications not coded to university standards, non-integrated applications, and inefficient use of the IT budget [20], [17]. However, in today's digital economy, end users have more IT options than ever before, and the data suggest that these users are increasingly using IT not provided or sanctioned by the universities' central IT department [6], [11].

> *The nature of shadow IT implies that organizations must cope with the associated challenges. Business managers, IT professionals, risk managers, and auditors can use our methodological steps to identify and manage shadow IT. Organizations benefit from unapproved end-user computing; thus, decision makers can address the question of business autonomy for IT* [21].

The higher education universe is now struggling to contain the SIT epidemic [4]**,** [5]. Oversight of university information assets has traditionally fallen under the auspices of the information systems organization (UISO). Historically, the UISO's vertically-integrated stratagem provided a one-stop-shop for applications, infrastructure, cybersecurity, database, architecture, and support. As IT becomes ever more essential for the realization of university objectives in the digital age, and demand for IT-enabled capabilities increases, the timely fulfillment of IT needs is often beyond the UISO's capacity. Operating units within the university (e.g., schools of business) unmet IT

needs are driving end users to seek their own solutions and thus diminishing the UISOs control over the IT environment. Some specific factors driving this transition include: 1) UISO does not deliver solutions quickly, 2) UISO does not offer the appropriate resources, 3) UISO is viewed as a barrier, 4) consumer technology has surpassed business technology, 5) UISO is handcuffed by outdated policies and processes, and 6) end users don't understand UISO usage policy. As universities become ever-more digital, UISOs must weigh the impression of being an institutional enabler and embracing user-sourced IT versus the perception of being an institutional obstacle, recognized by end users as frustrating, slow, and outmoded. If the UISO cannot meet the IT needs of their constituents, end users have the incentive to source IT on their own, circumventing the UISO in the process. In response, UISOs have reacted to this phenomenon in various ways, from clamping down on SIT to assuming a more accepting posture. As IT affordances become increasingly available to administration, students, and staff the notion that the UISO is responsible for all things IT is in question [1], [15].

In addition to the diminished control over the use of IT, UISOs no longer have sole budgetary control over the purchasing of IT solutions. Today, IT budgets are being allocated to individual schools as well as to the UISO, e.g., the development, delivery, and support of online programs. This trend, of course, possess many problems for the institution since the performance of the various vendors can vary considerably. Faced with this proliferation of seemingly unstoppable end user IT autonomy, UISOs need to develop strategies for stewarding IT solutions that meet local needs while protecting the university from negative consequences. To deliver on this aspiration, UISOs should first understand the scope of autonomous IT as well as the end users' motivations for its use. This paper is organized as follows: 1) a review of current trends and slants in SIT throughout higher education, 2) an introduction to the EUDIT model, and 3) an overview on EUDIT implementation strategies. This paper's primary contribution is to identify how the EUDIT model can be used to enhance IT operational efficiencies throughout higher education.

END USER-DRIVEN IT MODEL

Identifying the various manifestations of autonomous IT is the first step to understanding how best to address these challenges. Adding to the confusion are implicit references to unsanctioned IT use such as accessing SaaS "Cloud" apps without the approval of the UISO, unsanctioned implementation of Platform-as-a-Service (PaaS) infrastructure by individual schools, unsupervised Web 2.0 and social media usage such as blogs, social networking, mashups, and video sharing, and end user developed digital capabilities (i.e. new applications or modifications of existing applications). Subsuming these applications under the overarching EUDIT designation helps the UISO consider the various sectors of IT use within the institution [2], [13]. Within the context of the university, EUDIT can be defined as institutional decisions that drive technological initiatives. Table 1 provides a taxonomy overview of the EUDIT paradigm.

Table 1 - End User-Driven IT (EUDIT) Taxonomy Overview

Category	Examples
Bring your own device (BYOD)	Mobile phones, tablets, notebook computers
End-User Development	Spreadsheets, personal databases, user-developed applications (UDA)
File Sharing and Storage	Commercial file sharing apps
Group Collaboration	Cloud-based document applications, team collaboration apps
Personal Productivity	Calendaring, note taking/organizing apps

Public Cloud PaaS	Cloud platforms that provide infrastructure needed to deploy UDAs
Public Cloud SaaS Apps	Cloud platforms that allow users to rapidly deploy applications
Web 2.0/Social Media	Blogs, microblogging services, wikis

Envisioning EUDIT as a System Through Causal Loop Diagrams

Acknowledgement by the UISO regarding the positive value of EUDIT can facilitate open and honest discussions with higher education users that can ultimately deliver better outcomes for the institution. For example, by supporting the safe use of EUDIT through dialogue with end users, the UISO can also raise awareness of its potential negative consequences such as exposing proprietary information via "free" SaaS apps. It is often difficult to categorically define an instance of EUDIT as either beneficial or harmful. In this regard, having end users consider the UISO a trusted consultant rather than an obstacle to be avoided can help to avert disaster as more scrutiny is directed to digital safety. EUDIT used in the service of innovation efforts can be considered beneficial, while EUDIT that subjects the institution to cybersecurity threats or unwanted exposure of proprietary data on the Cloud can be considered harmful [9].

Causal loop diagrams are useful models that depict how systems work in a simplified manner. They feature two types of loops: *positive*, or *reinforcing* loops; and *negative*, or *balancing* loops. Reinforcing loops are depicted as moving in a clockwise direction, while balancing loops move counter-clockwise. These loops can be conceived of as a dialogue between two competing interests. The reinforcing loop seeks to extend previous limits while the balancing loop pushes back when the reinforcing loop has "gone too far". Reinforcing feedback is goal-seeking and balancing feedback is stability-seeking behavior. This momentum is fostered by five principles: 1) a *culture* that emphasized innovation; 2) a perception that the UISO could be an *obstacle* to project success and could often eliminate end user solutions categorically; 3) the *tech-savviness* of the users obviated the need for UISO participation, which allows them to be self-sufficient; 4) the fact that end users are often *unaware* of existing IT options and how individual choices might impact other information systems; and 5) the *inappropriateness* of an UISO-provided solution, which motivates the end user to self-source. Figure 1 illustrates the reinforcing and balancing loops.
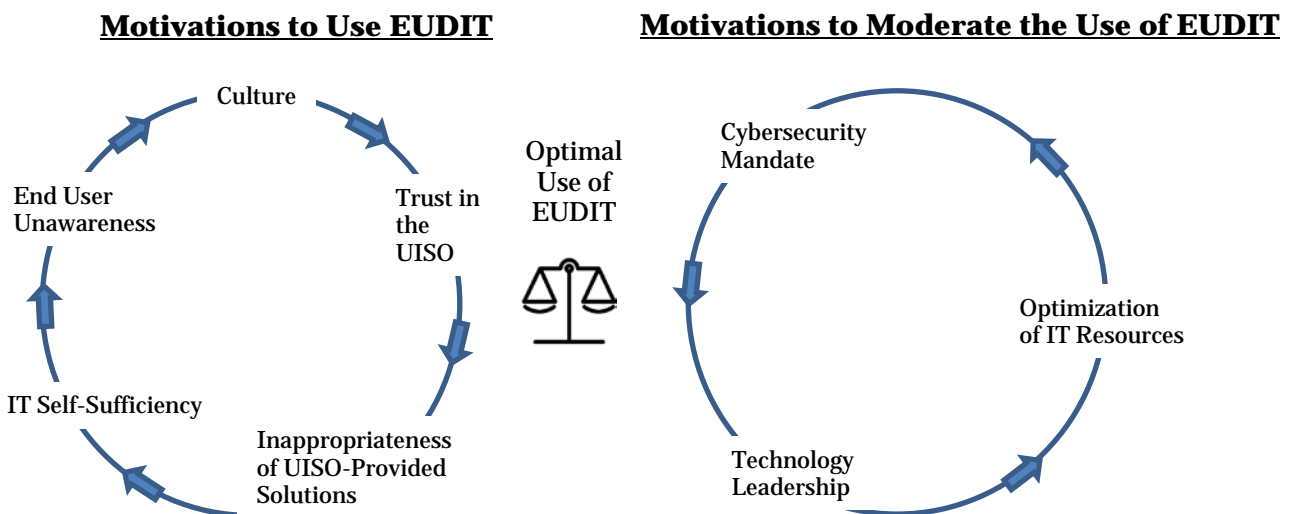
Motivations to Use EUDIT   Motivations to Moderate the Use of EUDIT

Culture

End User Unawareness

Trust in the UISO

Optimal Use of EUDIT

IT Self-Sufficiency

Inappropriateness of UISO-Provided Solutions

Cybersecurity Mandate

Optimization of IT Resources

Technology Leadership

Figure 1: EUDIT Causal Loop Model

Reinforcing Motivations for End Users to Adopt EUDIT

Table 2 presents a summary of the reinforcing loop categories.

Table 2 - EUDIT Reinforcing Loop Categories

Category	Characteristics
Inappropriateness of UISO-provided solutions	• Institutionally provided IT does not meet the unique needs of the business • End user IT solutions are often better than UISO-provided IT • Local optimization emphasis reduces UISO ability to mandate institutionally-provided systems
Culture	• Employees feel a sense of pride that encourages innovation • Open and permissive and end users are empowered to use their judgment • Users have "always done things this way" • End users will use whatever IT they deem necessary unless there is a policy prohibiting it • End users resent the UISO providing IT leadership • Using the latest IT attracts younger workers
Perception of UISO as Obstacle vs. UISO as Enabler	• Viewed as bureaucratic • Cannot be counted on to deliver results in the timeframe needed • Does not possess the domain knowledge necessary to "own" business unit applications • Sees itself as a technology leader but it infringes on end users.
IT Self-Sufficiency	• End users' tech savviness is at a high level and they require little support • Strong end user IT identity promotes EUDIT use • IT affordances such as SaaS apps are readily available • End users believe that they understand their business better than the UISO and can develop/source IT better than the UISO can
End user Unawareness	• The IT they use contravenes policy • The ramifications of their IT choices • What IT is already available from the UISO • The true cost of IT services

Ineffectiveness of UISO-provided solutions

The evidence suggests that, in many cases, end user IT often is superior to UISO-supplied solutions [3]; [18]. One of the most challenging issues facing the adoption of standardized information systems is the fit of those systems to the processes and needs of the implementing unit. Globally-optimized IT benefits the university, while local optimization gives individual IT initiatives control, which often enhances the chances of successful outcomes. The argument regarding whether the uniqueness of the process justifies modification of the system, or conversely, that the benefit of the standardized system justifies changing the process has been a dilemma facing the USIO for years. To that end, many end users believe that they can procure IT that is less expensive and more efficient than institutionally-supplied IT. While this belief does not always account for the full cost of an IT solution, a lower cost and more customized option is a strong motivator. Lack of knowledge of IT policies or misperceptions regarding the complexity of university-level systems can motivate end users to circumvent policy and source their own IT. Often UISO policies

may not be understood by end users. Recent research has illuminated that often end users lack an understanding of the existing management systems, the true cost of IT services, and the need for system integration [14]. As faculty, staff, students, and administrators are now employing easy-to-use IT, and as tech-savviness rises, some end users may develop an unrealistic sense of how complex enterprise systems really are and may denigrate the need for UISO professional oversight. The perceived high cost of using institutionally-supplied IT is often a factor in end user sourcing decisions. End users' misunderstanding of the need for UISO processes and controls can lead to unintended exposure, among other things, of intellectual property [10].

Optimizing the Balancing Act Between the UISO and EUDIT

The degree of control for a centralized UISO is contingent on the context of the organization's operating model: how regulated they are, how standardized they need to be, the level of integration required. Although the UISO senior leadership is usually committed to supporting local projects, many end users do not want to be encumbered with what they perceive to be unreasonable UISO constraints. Optimizing between the local project level and the university level is an important consideration: too much global optimization can inhibit innovation while too much local optimization can increase organizational spending and negatively impact the enterprise environment (e.g. computers taking up scarce floor space that would be better utilized by people, duplication and fragmentation of commonly used applications). An argument in favor of standardized IT provided by the UISO is that end users do not need to be concerned about researching and acquiring their own IT solutions, instead they can focus on project work. Another argument is that typically the UISO has university wide responsible for vetting the cybersecurity compliance of new applications. For example, proposed new IT that will be utilized by individual schools should be submitted for testing by the UISO cybersecurity team early in the proposal stages to avoid delay later in the development process. Table 3 presents the primary categories for the balancing loop that seeks to regulate EUDIT use.

Table 3 - Summary of Balancing Loop Concepts

Category	Characteristics
Optimization of IT Resources	• UISO oversight reduces application duplication and promotes integration/interconnectivity between applications • Operating a single help desk optimizes customer service and trouble ticket tracking as well as allows for root-problem analysis and remediation • Consolidated data centers and data storage are advantageous on multiple levels (e.g., reducing the compute footprint) • Institutionally-provided IT improves supportability, reduces TCO, fosters Project resource flexibility, and allows end users to focus on work, not IT
Cybersecurity	• The need for cybersecurity controls justifies UISO oversight • Information systems need to be vetted by UISO cybersecurity
Technology Leadership	• UISO is the broker/consultant for introducing new IT into the organization • UISO has visibility across the university to reduce IT duplication

Technology Leadership

Many UISOs view technology leadership as one of their most important roles. Researching new technologies, analyzing how they could strategically add value to the institution, and piloting demonstrations of the new technology are some of the tasks typically undertaken by the UISO.

The UISO can also sponsors advisory boards to foster communication and knowledge sharing between the UISO and the various project communities [7]. The UISO's cross-departmental view makes it best positioned to avoid duplication and fragmentation caused by the individual projects introducing the same new technology at the local level multiple times, resulting in unnecessary complexity and costs. For example, cloud computing offers a variety of benefits to the university, including: reduction of data center footprint, the availability of the latest technology provided and maintained by the cloud provider, and the ability to ramp computing power up or down based on demand [19]. Use of the latest technologies has significant benefits for the individual schools. Utilizing a cloud model will allow the individual schools to use the latest technology because they are "renting" rather than committing to purchase systems [16]. While a primary objective of the UISO is in harnessing new IT that can further the university's goals, the UISO needs to ensure that these actions do not burden the progress of the individual schools.

> *At the same time staff based in central services – notably information services and systems faced significant challenges since the devolved model over time resulted in a proliferation of school-specific processes and massive inconsistencies* [8].

CONCLUSIONS

The primary purpose of this article was to introduce the end user-driven IT (EUDIT) model to the higher education universe, with the goal of improving overall IT operational performance. As digital ubiquity transforms the higher education landscape, as the level of end users' IT savviness increases, and as the ability of the UISO to control IT use diminishes, a new approach is needed to help the UISO address the resultant challenges. Emerging strategies include:

- A dialogue between end users and the UISO regarding EUDIT is essential. Unrestricted EUDIT use can be moderated by both sides based on implementing a rational solution. Engaging in constructive dialogue can raise awareness on both sides of the EUDIT issue. This communication can often be best achieved through collaboration networks.

- Understanding the basics behind EUDIT is a necessary first step to assess the overall impact. The university's UISO needs to better understand end user motivations in making pragmatic choices on stewarding IT use throughout the institution. Using the principles outlined in this article as a starting point, the UISO can analyze these motivations and use this knowledge in shaping the roll-out of the EUDIT model.

- Delivering a consistent message from the UISO regarding EUDIT is important. Aligning the UISO community around both a consistent message and a consistent attitude toward EUDIT use that is attuned to the organization's culture should reduce end user concerns.

- Framing the EUDIT model in an easy-to-understand visual representation such as a causal loop model can facilitate the EUDIT dialogue.

- Providing end users with a set of UISO-approved options such as enterprise app stores may assist in the transition process.

To this end, perhaps awareness represents the greatest challenge in developing an effective SIT strategy. Specifically, 1) end users may not fully understand the ramifications of SIT use such as unknowingly exposing proprietary data on the public cloud and 2) end users may not perceive the benefits that the UISO can provide through optimization of IT resources, which can lead to missed opportunities such as data integration between applications and new IT developments.

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