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Risk Management for New Student Admission Information Systems at Higher Education using the Octave Allegro Approach

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Abstract

In the current digital era, especially in the world of education, the use of information and communication technology (ICT) is growing rapidly to meet needs. Universities rely on information systems, especially in managing new student admissions. The new student admission selection information system contains sensitive and dangerous prospective student data, as well as the risks that arise in the information system, limited to data processing during the new student admission process and the administration process, thus causing problems. The New Student Registration Information System is one of the services provided by the university as part of the new student registration process. Therefore, risk management is needed to minimize the impact of risks on maintaining data integrity, confidentiality, and availability. The aim of the research is to identify, analyze, and evaluate risks when using information systems for new student admission procedures. The approach used in risk management is Octave Allegro, and Octave Allegro is used to help evaluate information assets. The method used is data collection by conducting interviews with related sources. Based on the findings on the New Student Admissions site, there are 5 risk areas; 9 IT risks were identified as a result of potential risk analysis; and 4 IT risks were mitigated based on recommendations.

Keywords: *Risk Management, Octave Allegro, Information Systems, Selection for New Student Admissions*

1. Introduction

In the current digital era, the use of Information and Communication Technology (ICT) in various aspects of human life is growing very rapidly, including in the world of education [1]. The role of ICT in the world of education is very important for the continuity of decision-making in higher education companies [2].

Currently, many universities have utilized ICT as a means of serving students, especially in the process of admitting new students [3], [4]. Research looks at student services, especially prospective new

students in new student admissions activities, which is the initial stage of the academic life cycle of higher education and has an impact on the quality, productivity, and reputation of educational institutions [5].

The research carried out took the form of direct observation of the process of admitting new students through the site [6], [7]. Using the information system site for new student admissions is the most important thing without any interference, because there are various kinds of information for prospective new students, such as purchasing PINs and registration tokens and inputting data for prospective new students [8]. The new student admissions information system site is visited by many prospective new students, so it could pose a risk to the site [9][10].

Based on direct interviews with stakeholders, the information system site for new student admissions has never had a risk assessment, and server downs often occur, so that several features cannot run normally [11]. So, risk evaluation and assessment are needed to find out how big the threat is. The research focuses on the process of risk identification, risk analysis, and risk assessment in the New Student Admissions Information System using the Octave Allegro approach [12], [13]. The Octave Allegro approach is an approach in the form of a risk assessment framework for higher education information assets [14]. The results of the risk assessment are presented in the form of documentation of risks that have the potential to threaten the sustainability of the information system and preventive solutions in the form of control recommendations as a means of monitoring risk reduction [15], [16].

2. Research Method

2. 1. Data Collection

The method used uses a qualitative approach, and a qualitative approach uses the Octave-Allegro approach. The data used in the research covers the period 2020–2022. Depending on the case study, data collection is carried out in the form of direct observation, interviews with stakeholders, and documentation of several informants [17].

2. 2. OCTAVE Allegro Approach

OCTAVE is an abbreviation for Operationally Critical Threat, Asset, and Vulnerability Evaluation and was first developed by the Software Engineering Institute of Carnegie Mellon University in 1999 [18], [19]. The OCTAVE approach enables organizations to develop information protection, especially for their most critical IT resources, based on risky decisions. The use of OCTAVE is designed to help organizations, namely [20] :

1. Develop qualitative risk metrics that describe your organization's tolerance for operational risk.
2. Identify all assets critical to achieving your organization's mission.
3. Identify vulnerabilities and threats to assets.
4. Identify and assess the possible impact on the organization if a threat occurs.

The OCTAVE Allegro approach is a framework developed for information security risk management that can produce effective, reliable, and impersonal risk assessments in the form of comprehensive risk assessment knowledge [21], [22]. Allegro's OCTAVE approach not only performs a contextual risk assessment that focuses on the information assets used, stored, distributed, and processed, but also provides information about risk threats, vulnerabilities, and potential risk disruptions [23]. In Figure 1, there are the stages of OCTAVE Allegro.

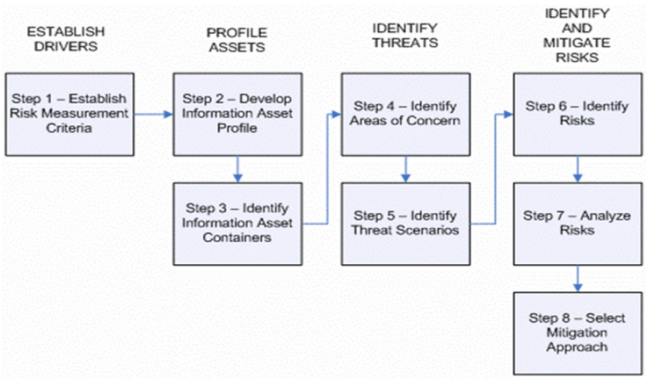

Figure 1. OCTAVE Allegro Stages

The following is a description of the OCTAVE allegro levels:

1. Step 1: Define risk metrics.
   Develop qualitative measurement definitions as described in the Risk Standards Framework. Risk metrics are used to assess the impact of each area and assign priority values.
2. Step 2: Create an information asset profile.
   An asset profile is a representation of asset information that details unique assets. The result of these activities is information about the business organization's important asset profile.
3. Step 3: Identify Information Resource Containers.
   Containers are where information resources are stored, transmitted, and processed.
4. Step 4: Identify problem areas.
   Use interviews or collaborative modeling to identify risky situations that may threaten the organization's information assets.
5. Step 5: Identify Threat Scenarios.
   Threat scenarios provide complete information and results from developing threat scenarios in the subject area. The output of this activity is a list of information sources.
6. Step 6: Identify Risks.
   You can document the impact on your organization if a threat occurs to get a complete picture of your risks.
7. Step 7: Risk Analysis.
   A simple quantitative measure of how much impact a threat will have on an organization is calculated.
8. Step 8: Select a Risk Mitigation Approach.
   The output of the risk mitigation approach is a matrix of relative proportions, a level of information vulnerability, a mitigation list of all discovered risks, and a mitigation strategy for each mitigated risk [24].

3. Results and Analysis

1. Step 1: Establish risk metrics.
   Step 1 requires two different activities. Assess your business vision, mission, and goals, and identify key areas of impact [25]. In Activity 1, you will identify qualitative measures and document them on the Risk Metrics Worksheet [26]. Meanwhile, in Activity 2, you will use the Impact Area Classification Worksheet to determine the priority value of your impact area. Table 1 shows the areas impacted by reputation and customer loss [27]. Meanwhile, Table 2 shows the priority order of areas affected by disasters [28].

Table 1. Impacted Areas: Customer Reputation and Loss

Affected Areas	Low Risk	Medium Risk	High Risk
The reputation of information sites accepting new students is declining.	If the admissions office is compromised or damaged, its reputation will be somewhat affected, so efforts should be made to repair the system.	If the Admissions Office is vandalized, its reputation will be somewhat affected, and repairs will be time-consuming and costly.	If the Admissions Office is breached or damaged, the site's reputation will be affected, and remediation efforts will be time-consuming and expensive.
Loss of potential new students	Less than 2% of new students experience setbacks due to a lack of confidence.	Loss of self-confidence results in a reduction in new students of around 2% to 10%.	New students experience a decline of more than 10% due to a loss of self-confidence.

Table 2. Priority of Affected Areas

Priority	Affected areas
1	Fines and Penalties
2	Finance
3	Safety and Health
4	Reputation and Customer Trust
5	Productivity

2. Step 2: Develop an information resource profile.
   Developing an information resource profile includes eight activities [29]. The first activity is the identification of information assets, and the second activity is a structured risk assessment of assets classified as critical [30]. The third and fourth activities involve gathering information that you believe is important and documenting the reasons for selecting those important assets [31]. The fifth and sixth activities are to create a description of important information sources and determine ownership of these important information resources [32]. The seventh and eighth activities are aimed at addressing information security aspects, especially security needs related to confidentiality, integrity, and availability [33].

Table 3. Asset Profile Information

Allegro Worksheet 8	**Critical Information Asset Profile**	
(1) Critical Asset What is the name of a critical information asset?	**(2) Rationale for Selection** Why are sources of information important?	**(3) Description** What is an information asset description?
New student data	Prospective student data includes data or information relating to prospective students' personal information in order to support university registration activities.	Personal information of new students (KTP number, telephone number, address, photo, parent's name, parent's telephone number, etc.)
(4) Owners Who owns information assets?		
IT Department, Admissions Department, and Marketing Department		
(5) Security Requirement What are the aspects of information resource security requirements?		
Confidentiality	Ensure that only authorized individuals can access and control information sources.	Only IT staff, admissions staff, marketing staff, and new students can access the data.
Integrity	Ensure that only authorized persons can modify information assets.	Only IT staff, admissions staff, marketing staff, and new students can change data.
Availability	Ensure all your data is accessible 24 hours a day, 7 days a week.	Data is always available to interested parties.
(6) Most Important Security Requirement What security requirements apply to information assets?		
Confidentiality.	Integrity	Availability

3. Step 3: Identify information asset containers.
   Step 3 describes the information asset bucket by identifying the types of technology assets: hardware, software, and personnel. People refers to an individual who has access to confidential information. Table 4 provides a technical description of the information asset container.

Table 4 Technical Information Asset Container

Allegro Worksheet 9a	**Information Asset Risk Environment Map (Technical)**
Internal	
Container	**Owner**
Database	IT Department

Website	IT Department, Admissions Department, and Marketing Department
Hardware : Komputer	Admissions Department, and Marketing Department
External	
Server	Cloud AWS

4. Step 4: Identify problem areas.
   In step 4, review each container to identify potential problem areas and continue to document each identified problem area.

Table 5. Identifies area of concern

No	Area of Concern – Data on Prospective New Students
1	The server went down, causing some services to be inaccessible.
2	There was a malware attack on the cloud server.
3	Error entering prospective new student data (human error)
4	Information related to graduates is invalid with the selection of prospective new students (human error).
5	The new student information system site often has errors (downtime).
6	Data leaks from prospective new students.
7	Theft of prospective new student data.
8	A brute force attack occurred on the super admin login.
9	An attack occurred on the system while IT staff was carrying out development and maintenance (software problem).

5. Step 5: Identify Threat Scenarios
   In Step 5, threat scenarios are identified by providing characteristics of each new threat, such as actor, motivation, access, consequences, and level of security in each area of interest.

Table 6. Identifying threat scenarios

No	Areas of Concern	Threat Scenarios	
1	Server down	Actor	Not known
		Mean	Insufficient storage capacity
		Motive	Accidental
		Outcome	Interruption
		Security Requirement	Monitoring storage capacity
		Probability	Low
2	Malware attacks on cloud servers	Actor	Third-party servers
		Mean	Inserting viruses into application security
		Motive	On purpose
		Outcome	Disclosure Modification Interruption
		Security Requirement	Scan the system.
		Probability	Medium

6. Step 6: Identify Risks
   Step 6 involves assessing the impact of risks on the organization based on previously identified affected areas.

Table 7: Risk Identification

No	Risk	Consequence
1	Server down	a. The registration process for prospective students will be more difficult. b. The process of managing prospective student data will be hampered. c. The page is inaccessible. d. The reputation and trust of prospective new students will decline.

		e. The opportunity to recruit prospective new students is no longer possible. f. Increased complaints from new students.
2	Malware attacks on cloud servers	a. Cannot access the system. b. The process of managing prospective student data is hampered. c. Theft of new student data and information. d. Data on prospective new students is damaged.

7. Step 7: Risk Analysis
   In step 7, a risk analysis is performed where all the risk results recorded in the previous stage are evaluated considering the risk metrics. Next, calculate the area effect value and relative risk value for each risk.

Table 8. Impact Area Values

Affected Areas	Priority	Low (1)	Medium (2)	High (3)
Productivity	5	5	10	15
Reputation and trust of prospective new students	4	4	8	12
Security	3	3	6	9
Finance	2	2	4	6
Fines and penalties	1	1	2	3

Table 9: Risk Analysis: Server Failure

Area of Concern	Information Asset Risk Worksheet			
Server Down	Information Assets	Data on Prospective New Students		
	Consequence	a. The system cannot be accessed b. The process of managing new student data is hampered c. Theft of data and information of prospective new students d. Data on prospective new students is damaged		
	Severity	**Affected Areas**	**Mark**	**Score**
		Productivity	High	15
		Reputation and trust of prospective new students	High	12
		Security	High	3
		Finance	High	6
		Fines and penalties	Low	1
		Relative Risk Score		**37**

Table 10: Risk Analysis: Malware

Area of Concern	Information Asset Risk Worksheet			
Malware attacks on cloud servers	Information Assets	Data on Prospective New Students		
	Consequence	a. The system cannot be accessed b. The process of managing data on prospective new student admissions is hampered c. Theft of data and information of prospective new students d. Damage to prospective new student data		
	Severity	**Affected Areas**	**Mark**	**Score**
		Productivity	High	15
		Reputation and trust of prospective new students	High	12
		Security	High	9
		Finance	High	6
		Fines and penalties	Low	1
		Relative Risk Score		**43**

8. Step 8: Select a Risk Mitigation Approach
   Step 8 is the final step in Allegro's OCTAVE approach, which establishes a risk mitigation approach by classifying each identified problem area based on its relative risk value [34]. If you want a relative risk matrix, the relative risk matrix in Table 11 is used to determine risk mitigation actions based on the order of relative risk scores from highest to lowest. Table 12 shows the relative risk matrix.

Table 11. Relative Risk Matrix

Relative Risk Matrix		
Risk Value	**Pool**	**Mitigation Approach**
30-45	1	Mitigate
16-29	2	Defer
0-15	3	Accept

Table 12. Risk Analysis Results

No	Area of Concern	Action
1	The server went down, causing some services to be inaccessible.	Defer
2	There was a malware attack on the cloud server.	Mitigate
3	Error entering prospective new student data (human error)	Mitigate
4	Information related to graduates is invalid with the selection of prospective new students (human error).	Accept
5	The new student information system site often has errors (downtime).	Defer
6	Data leaks from prospective new students	Defer
7	Theft of prospective new student data	Defer
8	A brute force attack occurred on the super admin login.	Mitigate
9	An attack occurred on the system while IT staff was carrying out development and maintenance (software problem).	Mitigate

4. Conclusion

Based on the findings carried out using the OCTAVE Allegro approach, the following conclusions can be drawn: There are 5 areas affected by risk on the new student admissions site, namely the Fines and Penalties area at a low level, the Security area at a medium level, as well as the Finance area, the Reputation and Customer Trust area, and the Productivity area at a high level, resulting in a risk impact on the site admission of new students. From the results of the potential risk analysis, nine IT risks were identified at the location of the new student registration site. There are 4 recommendations for IT risks that need to be mitigated.

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