

# Reliability analysis through system dynamics modeling for intellectual capital protection with a cloudservices

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**Abstract** –This paper analyzes the reliability of cloud-based recovery solutions for protecting organizational information systems. Using a System Dynamics model, it identifies key factors affecting resilience, supporting informed selection of dependable cloud services to ensure business continuity and sustained protection of intellectual capital.

**Keywords** –Reliability, System Dynamics, Intellectual capital, cloud service, Disaster Recovery.

## I. INTRODUCTION

In today’s digitally dependent business environment, organizations rely heavily on effective Business Continuity Plans (BCPs) to protect their intellectual capital. These plans are designed to enable fast recovery after disruptions, as downtime can result in data loss, reduced customer trust, and financial problems with direct affects in their businesses.

Despite advances in recovery technologies (from local infrastructure to cloud-based solutions[1]), achieving uninterrupted operations remains challenging due to threats like cyberattacks and natural disasters. As a result, businesses focus on identifying acceptable downtime limits to mitigate risks to their intellectual property and long-term operations.

Implementing a successful and reliable disaster recovery (DR) concepts requires selecting technologies and strategies that meet defined usage and performance criteria. However, earlier research often assessed these systems using limited parameters, omitting key operational factors such as data volume and system load during recovery processes [2][3][4] without addressing reliability in the analysis. Considering the importance of the reliability of such DR concepts, within the framework of the research, we paid special attention to establishing a framework for determining realistically expected reliability level for the organizations information systems.

## II. INTELLECTUAL CAPITAL AS A CORE ASSET OF THE DIGITAL ORGANIZATIONS

In the modern digital economy, intellectual capital has emerged as one of the most valuable and strategic assets of any organization. It encompasses the collective knowledge,

expertise, data, organizational processes, and relationships that drive innovation, competitive advantage, and long-term sustainability. Unlike physical assets, intellectual capital is intangible, yet its loss due to system failures or data breaches can lead to irreversible damage.

Protecting this form of capital requires not only resilient data backup strategies but also a comprehensive understanding of how reliability, availability, and continuity planning impact knowledge preservation. As digital transformation accelerates, organizations must align their business continuity efforts with the protection of these non-physical, yet mission-critical resources.

Intellectual capital constitutes the intangible assets of an organization and represents a critical portion of its total value. This form of capital uniquely enables the transformation of various types of internal knowledge, skills, structures, procedures, processes, and technologies into products and services of tangible value. Intellectual capital (Fig. 1) is typically divided into three interrelated components: human capital, structural capital, and relational capital[5][6][7].

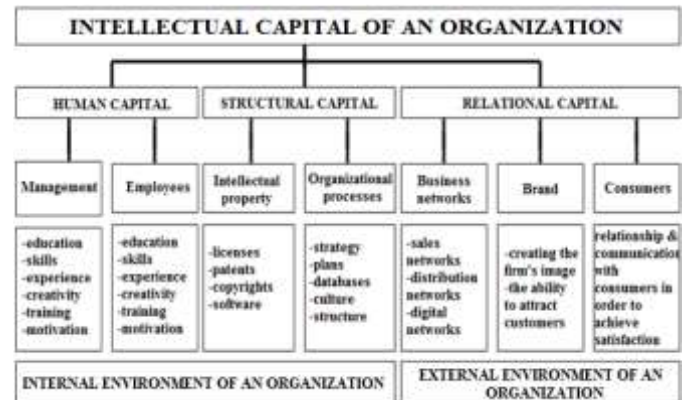


Fig. 1 The intellectual capital structure of a modern organization [8]

Human capital encompasses the knowledge, skills, experience, and training of employees and managers. Structural capital refers to organizational assets such as licenses, patents, proprietary software, databases, operational procedures, and internal culture. Relational capital includes the organization’s relationships with customers, suppliers, distributors, investors, and the market identity represented through brands and trademarks. Each of these components plays a crucial role in supporting innovation, maintaining competitiveness, and achieving sustainable success in today’s digital business environment. Therefore, it is essential to recognize that intellectual property, as a key component of intellectual capital, represents a critical factor in the development and sustainability of modern organizations. Moreover, the market value of an organization can be

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