Web System to Optimize Information Management for Beca 18 Selection-Stage Applicants, 2025

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***Abstract*—The objective of this study was to determine whether the implementation of a web system optimizes information management by reducing the time required to access, verify, and interpret selection-stage information for applicants of the Beca 18 2025 scholarship call. The research followed an applied, quantitative, pre-experimental design with pre-test and post-test measurements in a single group. The sample comprised 361 preselected applicants from the ordinary modality in the Lima region, selected through simple random sampling. A direct observation sheet recorded the time, in minutes, required by each participant to complete 15 tasks associated with information accessibility, information currency, and information quality before and after using the web system. The mean information-management time decreased from 130.40 to 50.46 minutes, with a statistically significant mean reduction of 79.94 minutes. The three evaluated dimensions also showed substantial reductions: information accessibility decreased by 70.3 per cent, information currency by 80.2 per cent, and information quality by 52.2 per cent. The findings indicate that, within the scope of time-based task performance, the web system optimized the efficiency with which applicants accessed, verified, and interpreted selection-stage information.**

Keywords*—Web system; information management; Beca 18; information accessibility; information currency; information quality; pre-experimental design

I. Introduction

Information management represents a persistent challenge for institutions because information is often distributed across poorly organized files, duplicated documents, or outdated versions. These conditions affect the speed with which users locate relevant content and limit the reliability of the information used for decision-making. In contexts where users must make timely decisions based on official documents, traditional or disconnected information channels can increase the effort required to access, verify, and interpret critical information.

At the global level, this problem has been widely recognized. According to a global study by the Association for Intelligent Information Management (AIIM), which compared a decade of digital-transformation efforts in organizations across North America, Europe, the Middle East, and Africa, many companies still face serious deficiencies in managing their information: 33.33 per cent of surveyed companies had not yet made notable progress in their digital-transformation processes, and more than 50 per cent continued to use paper documents and manual management [1].

At the regional level, similar challenges have been reported in organizational data management. Dell Technologies reported that 95 per cent of organizations face challenges in data management, based on 6,600 respondents from public- and private-sector organizations with more than 100 employees across Latin America, North America, Europe, Asia-Pacific, and China [2].

In Peru, the National Institute of Statistics and Informatics (INEI) found, through the 2021 Annual Economic Survey, which collected information from the 2020 economic year, that 25.9 per cent of companies did not have a management system in place [3]. This shows that a significant proportion of organizations still do not use technological tools to organize, store, or process information systematically.

In the context of the National Scholarship and Educational Loan Program (Pronabec), Beca 18 applicants must consult official information related to requirements, procedures, schedules, eligible higher education institutions, and scoring criteria during the selection stage. For the Beca 18 2025 scholarship call, this information is mainly provided through extensive official documents, which can make rapid access and interpretation difficult for applicants who need to locate specific information in a timely manner [4].

This study proposes and evaluates a web system that centralizes and structures Beca 18 selection-stage information into five interactive sections: application requirements, application procedure, schedule, eligible higher education institutions, and scoring criteria. The system was designed to reduce the time applicants spend accessing, verifying, and interpreting this information.

The general objective was to determine whether the implementation of a web system optimizes information management by reducing the time required to access, verify, and interpret selection-stage information for applicants of the Beca 18 2025 scholarship call. The specific objectives addressed three dimensions of the construct: information accessibility, information currency, and information quality.

The remainder of this study is organized as follows: Section II reviews related work and the theoretical foundations of web systems and information management. Section III describes the materials and methods, including the research design, population and sample, instrument, technological implementation, and data-analysis strategy. Section IV reports the descriptive and inferential results. Section V discusses the

findings in relation to prior studies and acknowledges the study's limitations. Section VI presents the conclusions.

II. Literature Review

A. Related Work

Prior studies have shown that web systems can improve institutional information management by reducing processing time, centralizing information, and supporting more efficient consultation processes. In an organizational context, Colan [5] implemented a web platform in a transportation company in Lima and reported a reduction in information-management time from 6.42 to 2.42 minutes, with statistically significant improvements in agility, reliability, and utility. Similarly, Alvarado [6] implemented a web system for IT-incident management at UGEL Huamanga, where the mean resolution time decreased from 59.44 to 19.11 minutes.

Other studies have reported improvements not only in time reduction but also in information registration, consultation, and reporting. Lopez [7] proposed a web application for occupational safety and health information management, increasing registration from 29.4 per cent to 94.1 per cent, consultation from 35.3 per cent to 88.2 per cent, and report generation from 23.5 per cent to 94.1 per cent. In the educational context, Chaupez and Rojas [8] reported that a web system reduced attendance-processing time from 42 to 11 seconds. Expósito and Gamboa [9] developed a web page to support information management in an educational direction system, reporting improvements in organization, task monitoring, and decision-making processes. Pinedo [10] also found statistically significant improvements across evaluated dimensions of hospital administrative information management.

Recent peer-reviewed studies provide additional evidence on the effect of information and web systems in institutional and educational contexts. Aranda-Manchay and García-Estrella [11] implemented an information system for document management in an engineering faculty using a pre-experimental design and reported a statistically significant improvement after the intervention, with $p = 0.000$ and 80 percent user acceptance. In a closer educational context, Huaman-Yupanqui et al. [12] implemented a web information system to improve academic management at UNAMAD and reported significant reductions in process times, including user registration and certificate issuance, with a Student's t-test result of $t = -78.32$ and $p < 0.001$. From a broader information-management perspective, Șandor [13] showed that web-based information management systems commonly incorporate search engines and user-management features to support information storage, retrieval, and interaction with users.

These studies support the use of web systems as tools for improving information-management processes in different institutional contexts. However, most prior work has focused on organizational, administrative, health, or academic management environments. In contrast, the present study evaluates a web system designed for applicants of a public scholarship program, focusing specifically on the time required to access, verify, and interpret official selection-stage information.

B. Theoretical Framework

A web system is a software application accessible through a browser via the internet or an intranet, allowing users to interact with services hosted on a remote server [14]. In this study, the web system functions as a technological tool for centralizing, organizing, and presenting official Beca 18 selection-stage information in a structured digital environment. This is relevant because web-based solutions can improve access to information and support decision-making when they reduce response times and provide users with clearer and more reliable content [15].

From a design perspective, usability, web accessibility, and interactivity are relevant principles for web systems because they influence how users navigate, understand, and interact with digital information environments [16], [17], [18]. In this study, these principles informed the design of the web intervention; however, the empirical evaluation focused on the dependent variable, information-management efficiency, measured through task-completion time across information accessibility, information currency, and information quality.

Information management is understood as a process that provides the resources needed for decision-making and for improving organizational processes, products, and services [19]. Effective information management also supports more accurate decision-making by ensuring that users rely on useful and reliable data [20]. In the context of this study, information management refers to the applicant's ability to access, verify, and interpret official information required during the Beca 18 2025 selection stage. Therefore, the construct was operationalized through three dimensions: information accessibility, information currency, and information quality.

Information accessibility refers to the possibility of accessing, understanding, and using available content without physical, sensory, or technological barriers. In digital environments, accessible web interfaces are essential to ensure effective access to information [21]. In this study, accessibility is associated with the time required by applicants to locate key information such as requirements, procedures, schedules, eligible higher education institutions, and scoring criteria.

Information currency refers to the degree to which available information remains updated, reliable, and useful in changing contexts. This dimension is important because official scholarship information may involve deadlines, requirements, eligible institutions, and scoring rules that applicants must verify before making decisions [22]. In this study, information currency is associated with the time required to identify whether the consulted information is current and corresponds to the valid version of the selection-stage content.

Information quality refers to the accuracy, reliability, and absence of uncertainty in data, allowing users to interpret and apply information more safely and effectively [23]. In this study, information quality is associated with the time required by applicants to interpret the meaning of requirements, procedures, schedules, eligible institutions, and scoring criteria. Thus, the three dimensions provide the conceptual basis for

evaluating the effect of the web system on information-management efficiency.

III. Materials and Methods

The study followed a sequential workflow that began with problem identification and process analysis, continued with the design and implementation of the web system, and concluded with pre-test/post-test measurement and statistical analysis. Fig. 1 presents the overall research workflow.

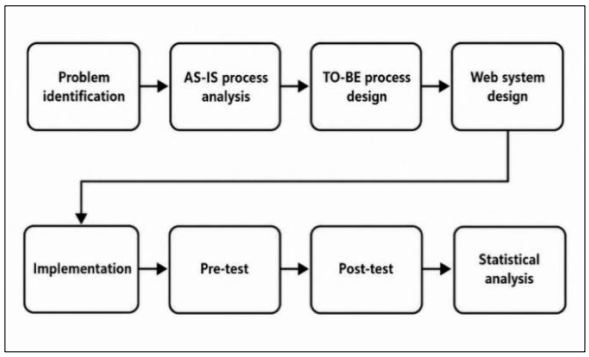

Fig. 1. Overall research workflow

A. Research Design and Study Workflow

The study was applied, quantitative, and pre-experimental. Applied research seeks to address specific problems through the use of scientific knowledge in a practical context [24]. The study followed a single-group pre-test/post-test design, O1 -> X -> O2, where O1 is the pre-test measurement, X is the web-system intervention, and O2 is the post-test measurement [25]. The explanatory scope sought to assess the changes associated with the web-system intervention in information-management outcomes; the implications of the absence of a control group are addressed in Section V. Fig. 2 summarizes the pre-experimental study process, including the sample and instrument, pre-test measurement, web-system intervention, post-test measurement, and statistical analysis.

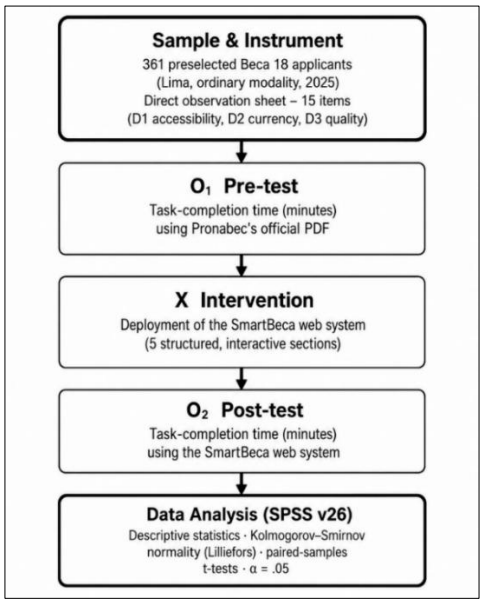

Fig. 2. Overall study process (pre-experimental single-group design).

B. Population and Sample

The target population comprised all pre-selected applicants from the ordinary modality of the Lima region for the Beca 18 2025 scholarship call. According to Pronabec [4], this population consisted of 5,830 applicants. The sample size was calculated using the finite-population formula:

$$n = (Z^2 \cdot p \cdot q \cdot N) / (e^2 (N - 1) + Z^2 \cdot p \cdot q) \quad (1)$$

With Z = 1.96, p = q = 0.5, e = 0.05, and N = 5,830, the resulting sample was 361 participants, selected through simple random sampling. Inclusion criteria required participants to be preselected applicants from the ordinary modality, from the Lima region, and from the Beca 18 2025 scholarship call.

C. Instrument

The instrument was a direct observation sheet that recorded, in minutes, the time each participant spent completing 15 observable tasks across three dimensions: information accessibility, information currency, and information quality. Times were recorded in two moments: the pre-test, in which participants used Pronabec's official PDF documentation, and the post-test, in which participants used the web system. Table I summarizes the structure of the observation instrument.

TABLE I. Observation Instrument Structure

Dimension	Items	Measurement focus
D1 — Information accessibility	1–5	Time required to locate requirements, procedures, schedule, eligible higher education institutions, and scoring criteria.
D2 — Information currency	6–10	Time required to identify whether requirements, procedures, schedule, eligible higher education institutions, and scoring criteria were current.
D3 — Information quality	11–15	Time required to interpret requirements, procedures, schedule, eligible higher education institutions, and scoring criteria.

Content validity was established through expert review by four specialists with complementary professional backgrounds in cybersecurity and information management, systems engineering, IT-project design, and public or industrial management. Because the dependent variable was operationalized as task-completion time, the instrument captures the efficiency with which applicants accessed, verified, and interpreted the required information. Complementary measures of accuracy and comprehension are discussed as a limitation in Section V.

D. Technological Implementation

The web system was built on a three-tier architecture. The frontend used Next.js, a React-based framework, to support hybrid rendering and an optimized user experience. Data persistence relied on MongoDB, a non-relational document-oriented database that provides flexible modeling and scalability. The system was deployed on Vercel, with file storage on Supabase Storage and version control through GitHub. The domain smartbeca.com was registered through Hostinger for public access, and the administrative interfaces were built with Payload CMS for structured content management. Fig. 3 shows the applicant dashboard, which centralizes the five selection-stage information sections in a single structured interface.

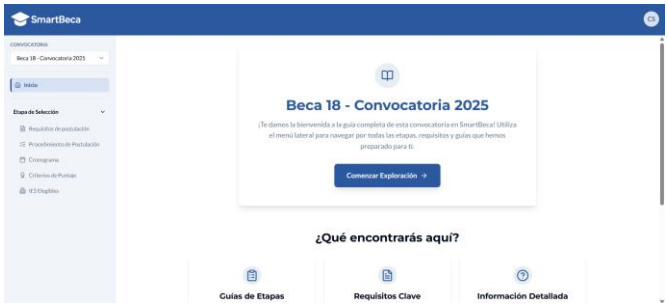

Fig. 3. SmartBeca applicant dashboard centralizes the five selection-stage information sections.

E. Data Analysis Strategy

Descriptive statistics, including mean, standard deviation, variance, minimum, and maximum values, were computed for both pre-test and post-test measurements. Normality was assessed using the Kolmogorov-Smirnov test with Lilliefors correction because the sample size was greater than 50 participants. Since normality was confirmed, paired-samples t-tests were applied to compare pre-test and post-test means for the dependent variable and each dimension. Statistical analysis was performed in SPSS v26, with the significance threshold set at $\alpha = .05$.

IV. Results

A. Descriptive Statistics

Table II presents the descriptive statistics for each dimension across both measurements. Substantial reductions were observed across all dimensions following web-system deployment. Overall information-management time decreased from a mean of 130.40 minutes in the pre-test to 50.46 minutes in the post-test, representing a 61.3 per cent reduction. The standard deviation also decreased from 11.707 to 4.216 minutes, indicating greater consistency in post-test performance.

TABLE II. Descriptive Statistics By Dimension

Dimension	*N*	*Mean*[a]	*SD*	*Var.*	*Min*	*Max*
Pre-test						
D1 — Accessibility	361	15.996	1.168	1.365	12.66	19.65
D2 — Currency	361	32.035	1.612	2.597	27.76	36.39
D3 — Quality	361	82.370	11.542	133.229	50.56	120.50
Post-test						
D1 — Accessibility	361	4.755	0.816	0.666	2.13	6.84
D2 — Currency	361	6.341	0.932	0.869	3.79	8.84
D3 — Quality	361	39.360	4.098	16.790	30.24	52.59

[a] All times are reported in minutes.

B. Normality Testing

Table III reports the Kolmogorov-Smirnov normality test results with Lilliefors correction. All eight distributions, corresponding to the three dimensions and the dependent variable in both pre-test and post-test measurements, yielded significance values above .05. Therefore, the normality assumption was met, supporting the use of parametric tests.

TABLE III. Kolmogorov-Smirnov Normality Test (Lilliefors)

Variable / Measurement	*Statistic*	*df*	*Sig. (p)*
D1 Pre-test[b]	0.033	361	0.200[a]
D1 Post-test[b]	0.032	361	0.200[a]
D2 Pre-test[b]	0.026	361	0.200[a]
D2 Post-test[b]	0.027	361	0.200[a]
D3 Pre-test[b]	0.043	361	0.098
D3 Post-test[b]	0.044	361	0.096
DV Pre-test[c]	0.044	361	0.096
DV Post-test[c]	0.037	361	0.200[a]

p-value lower-bounded at 0.200 by SPSS (Lilliefors correction)
D1, D2, D3 = dimensions of information management (Accessibility, Currency, Quality)
DV = dependent variable (Information Management)

C. Hypothesis Testing

Table IV summarizes the paired-samples t-test results. All four comparisons yielded significance values below .001, indicating statistically significant reductions in the dependent variable and the three evaluated dimensions after the web-system intervention.

TABLE IV. Paired-Samples T-Test Results (Pre-Test – Post-Test)

Comparison	*Mean Diff*[a]	*SD*	*SE*	*95% CI*	*t*	*Sig.*
DV: Information Management	79.945	12.869	0.677	78.613–81.277	118.035	<.001
D1: Accessibility	11.240	1.385	0.073	11.097–11.384	154.221	<.001
D2: Currency	25.694	1.900	0.100	25.497–25.890	256.951	<.001
D3: Quality	43.011	12.649	0.666	41.701–44.320	64.608	<.001

Mean difference reported in minutes (pre-test minus post-test); positive values indicate reduction.

For the dependent variable, overall information management, the mean difference was 79.945 minutes, with a 95 per cent confidence interval from 78.613 to 81.277 minutes. For D1, information accessibility, the mean difference was 11.240 minutes, representing a 70.3 per cent reduction. For D2, information currency, the mean difference was 25.694 minutes, representing an 80.2 per cent reduction, the largest proportional improvement. For D3, information quality, the mean difference was 43.011 minutes, representing a 52.2 per cent reduction. These results provide statistical evidence that the web system significantly reduced the time required to access, verify, and interpret selection-stage information.

V. Discussion

The findings show statistically significant reductions in the time required to complete information-management tasks after the implementation of the web system. The overall mean time decreased from 130.40 to 50.46 minutes, which is consistent with Lopez [7], who reported improvements in information registration, consultation, and report generation after deploying a web system in an occupational-safety context. Both studies

suggest that structured web interfaces can reduce the effort required to locate and use institutionally held information.

The largest relative improvement was recorded in information currency, with an 80.2 per cent reduction. Before the intervention, applicants invested considerable time verifying whether the consulted information was current, a challenge associated with static PDF-based delivery and the difficulty of identifying updated versions. This finding is consistent with Pinedo [10], whose web application for hospital administrative information yielded significant improvements in data update management. It also relates to Colan [5], who reported gains in the timeliness of information availability, a concept closely associated with information currency.

For information accessibility, which showed a 70.3 per cent reduction, the results are consistent with Alvarado [6], who reported a reduction in incident-resolution time from 59.44 to 19.11 minutes in a comparable pre-experimental design. They are also aligned with Colan [5], who found improvements in agility during information retrieval. Across these studies, centralized and structured web interfaces appear to reduce barriers that impede direct access to required information.

The information-quality dimension showed a 52.2 per cent reduction and the highest individual variability in the pre-test. This variability may be associated with differences in applicants' digital literacy and prior familiarity with the Beca 18 selection process. The result is consistent with Chaupez and Rojas [8], who reported heterogeneous improvements in an academic information-management context after the implementation of a web system. In the present study, the organized and structured presentation of information appears to have reduced the time required to interpret requirements, procedures, schedules, eligible institutions, and scoring criteria.

Several limitations qualify these findings. First, the dependent variable was operationalized solely as task-completion time. While this captures the efficiency of information retrieval and interpretation tasks, it does not establish whether applicants retrieved accurate information or interpreted it correctly. Therefore, the construct of information-management optimization is evidenced within the scope of time-based task performance, and future studies should incorporate accuracy, comprehension, and user-satisfaction measures alongside time.

Second, the single-group pre-experimental design included no control group, so threats to internal validity cannot be fully ruled out. In particular, the Hawthorne effect, the testing effect, and maturation are plausible partial explanations for the observed reductions, especially for tasks requiring longer interpretation time. Quasi-experimental designs with matched control groups and counterbalanced task orders would strengthen causal attribution in future research.

Third, the sample was restricted to ordinary-modality applicants in the Lima region, so generalization to other regions or modalities warrants caution. Rural areas of Peru face heterogeneous connectivity and device availability, which could affect both system adoption and the magnitude of the time savings reported here. Evaluating the system under diverse connectivity conditions, including low-bandwidth and mobile-first scenarios, is a relevant direction for future work and would broaden the practical interest of the solution.

VI. Conclusion

This study showed that implementing the web system significantly improved the efficiency of information management for preselected applicants of the Beca 18 2025 scholarship call. Overall mean time decreased from 130.40 to 50.46 minutes, supporting the general hypothesis. The system functioned as a tool for centralizing, organizing, and presenting selection-stage information, enabling applicants to access, verify, and interpret it in less time and with greater autonomy.

Information currency recorded the greatest relative improvement, indicating that the permanent availability of updated and centralized content is a relevant factor in information-management efficiency within high-stakes application contexts. Information accessibility also improved substantially, showing that structured web navigation helped reduce the barriers associated with PDF-based information delivery. Information quality improved as well, indicating that the way a system organizes and presents information can reduce the time required for users to interpret and apply it.

The findings support recommending that Pronabec adopt web-based information platforms as a primary information channel for future Beca 18 calls, with protocols to ensure periodic content updates. Future studies should replicate the research using quasi-experimental designs with control groups and incorporate complementary measures such as accuracy, comprehension, and user satisfaction to strengthen the evidence base for this type of intervention in educational-inclusion programs.

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