

A Comparative Study of User Experience on Major Banking Websites in New Zealand

Evie Cheung

Contents

1. Introduction.....	1
2. Research Review and Framework	2
2.1. Integrated Assessment	2
2.1.1. Assessment Model	2
2.1.2. Evaluation Scale.....	7
2.1.3. Data Collection Methods	7
2.1.4. Calculation Methods	8
2.2. A Simplified Version of Bank Website Research.....	9
2.2.1. Development Status and Opportunities	9
2.2.2. Evaluation Methods and Frameworks	13
2.3. AI Application of Bank Website Research.....	17
2.3.1. Development Status and Opportunities	17
2.3.2. AI Technology Applies Evaluation Methods and Frameworks.....	19
3. Comparison and Discussion.....	21
3.1. Integrated Analysis	21
3.1.1. Factor Analysis	21
3.1.2. General Analysis.....	23
3.1.3. Comparative Analysis.....	25
3.2. Evaluation and Research of Simplified Bank Website	26
3.2.1. High-Frequency Business Processes Evaluation	26
3.2.2. Webpage Element Selection	27
3.2.3. Quantitative Analysis of NZ Bank Websites' UX	29
3.3. Compare and Evaluate AI Usage in Bank Websites.....	32
3.3.1. Home Page Recommendation Information Evaluation	32
3.3.2. Search Function Evaluation	33
3.3.3. Navigation Function Evaluation	35
3.3.4. Help Function Evaluation	37

3.3.5.	Analytics and Predictive Evaluation	38
3.3.6.	Identity Security Evaluation	39
3.4.	Brief Summary.....	40
4.	Conclusion	41
4.1.	Integrated Assessment Conclusion	41
4.1.1.	Improvements	42
4.1.2.	Supplements.....	42
4.2.	Demonstration and Suggestions for Simplified Versions of Banks.....	42
4.2.1.	Basic Template Website Design for a Simplified Version of Bank	42
4.2.2.	Suggestions for Improving the Simplified Version of the Bank Website	45
4.3.	AI Application Conclusion and Improvement Suggestions.....	45
4.3.1.	Overall Evaluation and Conclusions.....	45
4.3.2.	Improvement Suggestions.....	46
4.4.	Reflection and Outlook	48
4.5.	Learned from the Project	48
	References.....	49

1. Introduction

This study aims to compare the websites of three major banks (ANZ, ASB, and BNZ) in New Zealand (NZ) from the perspective of user experience (UX), from different levels and perspectives such as integrated evaluation, simplification evaluation and artificial intelligence (AI) evaluation, and then propose improvement suggestions, aiming to provide actionable insights for practitioners and researchers in retail banking sector.

NZ banking sector is different from other banking markets in three aspects: high concentration, lagging technological adoption, and long customer tenure but low customer loyalty. Firstly, The NZ banking sector is extremely concentrated, with the top five players accounting for 94% of the market share ("New", n.d.). ANZ, ASB and BNZ are the most prominent players, with ANZ leading in current account customers across all age groups. Despite this dominance, reports suggest that NZ is falling behind in adopting new technologies such as financial technology (FinTech) solutions compared to other markets, which could affect its competitiveness in the future ("NZ ", 2023). In addition, although banks maintain long customer relationships, customer loyalty, as measured by net promoter score (NPS), remains relatively low, leaving them vulnerable to customer churn and loss of market share ("New" n.d.).

Various assessments exist for evaluating the quality of banking websites. For instance, the most commonly used assessment tool for comparing websites is Quality Evaluation Method (QEM), a quantitative evaluation approach first proposed in 1999 (Miranda et al., 2006). It consists of five parts: categories, factors, weights, ratings, and scores. The first two components comprise the assessment model, also known as the Web Assessment Index (WAI). While numerous papers have studied banking websites comparison, none comprehensively evaluate them from a UX perspective. Integrating UX considerations into website assessments can provide valuable insights into user satisfaction. Therefore, this study seeks to conduct an integrated assessment of the top three banking websites in NZ, focusing on UX aspects and website quality evaluations.

With the further increase in online banking penetration in NZ, it is imperative to continuously optimize banking websites. Complaints about banking services, especially from people over 65, account for a large proportion of all bank-related complaints (Cycles & Text, n.d.). Minimalist website design can address these issues by facilitating easier navigation and improving the user experience (Dang, 2020).

With the increasing development of FinTech, the retail banking industry has undergone significant changes. Existing banks have been facing growing threats and challenges, which can lead to customer loss and market share loss for traditional banks ("Analysis", n.d.). In response, traditional banks are partnering with FinTech service providers to use technologies such as AI to enhance their digital offerings and fend off challengers ("Analysis", n.d.; Victor et al., n.d.). By introducing AI technology, banking websites can improve user experience, enhance security, competitiveness,

and innovate (Chanchamnan et al., 2023).

This paper consists of four parts: introduction, research summary and framework, comparison and discussion, and conclusion. The introduction provides an overview of the project's purpose and organization. The second part systematically describes the literature review and methods. The third part presents a comparison of the findings obtained and their critical discussion. In conclusion, the authors review the existing work, summarise the limitations of the research, and put forward the future research direction. It is worth noting that the last three parts are organized according to the three aspects of integrated evaluation, simplified evaluation and AI application evaluation.

2. Research Review and Framework

2.1. Integrated Assessment

There are various papers researching the comparison of the website's quality in the banking sector. The prevalent procedures are:

- 1) Defining and choosing the evaluation categories and factors.
- 2) Adopting an evaluation scale for each factor.
- 3) Verifying a data collection method and employing this process.
- 4) Selecting a calculation method and performing the calculations.
- 5) Comparing and analyzing the results.
- 6) Making conclusions and giving recommendations for improvements to banking website design.

Four components regarding research methods are identified according to the general procedures, namely assessment model, evaluation scale, data collection methods, and calculation methods, which will be described in detail in the following sections 2.1.1, 2.1.2, 2.1.3, and 2.1.4.

2.1.1. Assessment Model

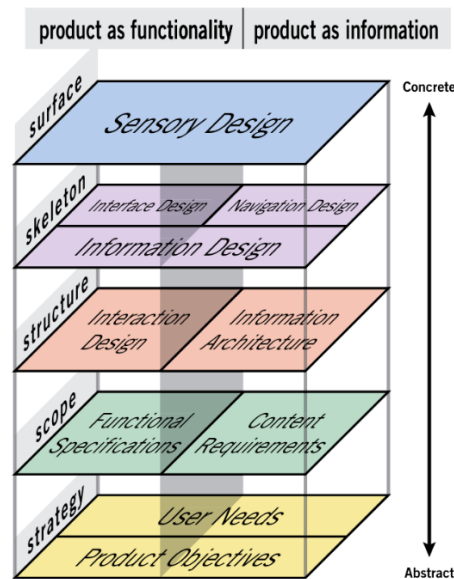
This section mainly describes the conceptual framework for UX, the quality assessment model for banking websites and a new assessment matrix model, as shown in sections 2.1.1.1, 2.1.1.2 and 2.1.1.3.

2.1.1.1. User Experience Conceptual Framework

One famous conceptual framework of UX was proposed by Garrett in 2011 (Garrett, 2011), which contains two categories—product as functionality and as information, as well as five planes---strategy, scope, structure, skeleton, and surface, as shown in Figure 1.

Figure 1

The Elements of Use Experience(Garrett, 2011, p. 29)



Regarding the two categories, “product as functionality” refers to the elements of the web as a platform, while “product as information” refers to those specific to the web as an information medium. The reason for splitting the user experience elements into two categories is that the evolution of the web began with a focus on information sharing but gradually expanded to include complex features allowing for data manipulation and interactivity. Therefore, many websites became hybrids, combining attributes of both functional applications and information resources.

Regarding the five planes, the sequence of analysis is from bottom to top, becoming more concrete and specific with the former layer’s conclusion.

- The strategy concerns both the user needs from the customer respect and product objectives from the organization’s respect. Companies must define their targeted user segmentations before clarifying the user needs. The product objectives are often measured by success metrics, indicators of how effectively the user experience is meeting strategic goals, such as the number of visits per registered user per month, retention rate or NPS to measure loyalty.
- The scope is determined by the strategy of the website. In terms of functionality, the strategy is implemented by defining the scope through the development of functional specifications, which provide a comprehensive outline of the product’s feature set. On the informational front, the scope is expressed through content requirements, detailing the necessary content elements for the project.
- The structure delineates users’ navigation paths to and from a page, in which functionality side focuses on interaction design by specifying how the system reacts to user actions,

while the information side emphasizes information architecture, the arrangement of content elements to enhance human comprehension.

- The skeleton outlines the positioning of interface elements, such as checkboxes, text, or buttons. It comprised three key components: interface design on the functionality front focusing on organizing interface elements to facilitate user interaction with the system's features, navigation design on the information front enabling users to navigate through the information architecture, and information design on both fronts crucial for presenting information in a manner that aids comprehension.
- The surface plane consists of a sequence of web pages, in which sensory design is the primary focus.

Overall, decisions at the strategy level have a ripple effect up the chain. Specifically, the distinguished strategies determine the scope, structure, skeleton and surface. For instance, digital banks target millennials, Gen Z and Alpha, they typically choose a bright UI (“Disruptive”, n.d.). Therefore, it is meaningless to evaluate the functionality of the scope or the interactivity of the structure without considering the business strategies.

2.1.1.2. Quality Assessment Model for Banking Websites

Many researchers have proposed various models for assessing the quality of banking websites. Among these, four methods are commonly adopted: a model based on extensive research, one based on Hersey's model, the creation of a new model, and the models that only consider specific factors. Firstly, Chiou et al (2010) proposed a web marketing mix model by collecting representative factors from 83 research papers from 1995 to 2006, processing through eliminating repetitive ones, merging and extracting from similar ones, and dividing 53 criteria into 5 marketing categories (product, place, promotion, price, and customer relationship). Chmielarz & Zborowski (2020) adopted a model consisting of 18 attributes in 3 groups (economic, technical, and anti-crisis) by comparing large amounts of papers. Secondly, Achour (n.d.) proposed a new combined model of 6 categories and 41 criteria based on Hersey's model (Whiteley, n.d.) by dropping non-relevant and adding specific criteria critical to the banking industry when evaluating internet banking in Tunisia. Chung & Paynter (2002) also used this method to compare internet banking in NZ. However, Hersey's model is not the most appropriate model to be used as an evaluation baseline in the banking sector as it focuses on the e-commerce industry. Thirdly, Guru et al.(n.d.) created a functionality-interactivity matrix model by dividing functionality into 3 categories (informational, transactional, and customer relationship), and interactivity into 3 levels (basic, intermediate, and advanced). Finally, some authors even don't use categories but use different combinations of factors instead (Diniz et al., 2005; Miranda et al., 2006; Selz & Schubert, 1998).

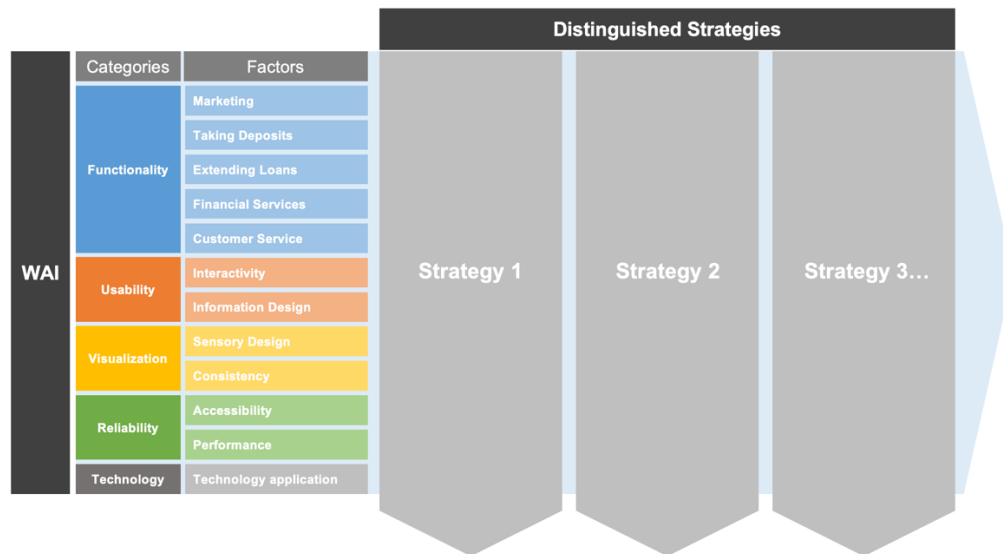
Most importantly, proposing a new model for evaluating banking websites from the user point of view in NZ should consider and balance factors such as alignment with industry standards, assessment effectiveness, appropriate complexity for simplicity of interpretation, and ease of implementation.

2.1.1.3. New Assessment Matrix Model

Based on the user experience conceptual framework and literature review on the quality assessment model for banking websites, we propose a new assessment matrix of banking websites comparison, as shown in Figure 2. The first step is to identify different business strategies since they play an important role in product design, such as the scope of functionality or design of interactivity. Then, bank websites are evaluated in combination with strategies and WAI.

Figure 2

A New Assessment Matrix of Banking Websites Comparison



We collected and analyzed these categories and factors, dropped off the repetitive or non-relevant factors such as trust, fulfilment, or playfulness, merged highly related components such as advertising and timeliness, and expanded components that are crucial to banking sectors. As a result, 5 categories containing 12 factors are determined: functionality, usability, visualization, reliability and technology (Diniz et al., 2005; Miranda et al., 2006), as shown in Table 1. The following sections describe the categories in detail.

- Functionality refers to the basic functions provided by the products or services (Diniz et al., 2005), like the concept of scope in the user experience conceptual framework. It should include content requirements such as front-end marketing and functional specifications such as middle-end products and back-end customer service. The main activities or products of the banks in NZ are taking deposits, extending loans, and providing financial services ("Preliminary", n.d.). Therefore, five sub-factors are suggested in the functionality category: marketing, taking deposits, extending loans, financial services, and customer service.
- Usability focuses on how user-friendly and highly-performing the website is for visitors, ensuring that users can easily navigate the site, find the information they need, and

efficiently accomplish a task (Diniz et al., 2005). Considering the functionality and information aspect of a product, it consists of interactivity and information design.

- Visualization refers to the aesthetics and design elements of the website, including colour schemes, fonts, images, and overall visual appeal (Chiou et al., 2010).
- Reliability defines the website's ability to function consistently without errors or downtime, ensuring that users can access their accounts and perform transactions securely (Diniz et al., 2005).
- Technology extends to the latest AI-based applications such as chatbots, personalized recommendations, intelligent assistants and more to improve bank user experience (Chanchamnan et al., 2023).

Table 1

Assessment Categories and Factors of Banking Websites Comparison

Categories	Factors	Factor Description
Functionality	marketing	Marketing shows the content aimed at persuading customers to buy or switch to the brand, such as promotional content, suggested products, recommendation, and incentives.
	taking deposits	Banks accept deposits from customers, which primarily involves activities like opening accounts, term deposits, and applying for debit cards.
	extending loans	Banks provide various types of loans to individuals and businesses, such as personal, home, and business loans.
	financial services	Banks in New Zealand offer a broader range of financial services, including insurance, KiwiSaver, investment, and foreign exchange.
	customer service	Providing excellent customer service is a key aspect of core banking activities, ensuring that customers receive assistance, guidance, and support for their financial needs.
Usability	interactivity	It describes how the system accommodate and respond to user behaviour.
	information design	It means how easy to locate targeted information, including navigation and searching mechanism.
Visualisation	sensory design	The aesthetics of the website, including colour schemes, fonts, and overall design.
	consistency	Ensuring a consistent design across pages for a seamless user experience.
Reliability	accessibility	Ensuring the website functions consistently without errors or downtime.
	performance	How quickly pages load to prevent user frustration.
Technology	technology application	New technology application and integration

2.1.2. Evaluation Scale

The evaluation scales of each factor are usually binary scales and Likert scales. Binary scales use 0 and 1 to represent the absence and presence of each element, as shown in the internet banking evaluation in Tunisia, NZ, Islamic countries, and Spanish (Achour, n.d.; Chung & Paynter, 2002; Guru et al., n.d.; Miranda et al., 2006). Likert scales are also a popular method used in surveys or questionnaires to measure attitudes, opinions, and behaviours with a greater degree of nuance than simple 'yes/no' questions. Likert scales can be divided into odd numbers and even numbers. Odd numbers are typically 5 or 7-point scale where respondents rate their agreement or disagreement with statements, ranging from one extreme attitude to another. These scales often include a neutral option as it would be a mistake to force respondents to either position themselves positively or negatively ("Likert", n.d.). Selz & Schubert (1998) use interval 0-4 as five scales while Chmielarz & Zborowski (2020) use a 5-point Likert scale to evaluate criteria where 0 represents failure to meet the conditions and 1 means complete fulfilment with the same distance between each scale. Even numbers scale is often used to measure the intensity of a feeling or a problem. It is crucial to keep a consistent scale in the questionnaire to compare all the elements reasonably.

Since this paper tries to analyze users' attitudes towards the evaluation factors of the banking website, the 5-point Likert scale is adopted to design the questionnaire due to its ability to provide a rich data set and accurate measurement.

2.1.3. Data Collection Methods

The most frequently used data collection methods are surveys, experimental evaluation, content analysis, case studies, automatic evaluation and expert evaluation. Firstly, the survey ranks as the most commonly used method in the 83 studies regarding website evaluation during 1995-2006 (Chiou et al., 2010). 42% of the studies use surveys. It involves using email or questionnaires to gather both qualitative and quantitative data from subjects. It can be conducted physically or digitally, providing insights into opinions, preferences, and behaviours. Additionally, 23% studies conducted experimental evaluation (Chiou et al., 2010). It is generally conducted under controlled settings where respondents are asked to accomplish a specific task with detailed instructions. It is efficient in evaluating the website's usability since the data is automatically collected through the designing demos. Regarding content analysis, 17% papers used this in understanding the design and functions of websites (Chiou et al., 2010). It involves analyzing textual, visual, or audio content to identify patterns in communications (Erlingsson & Brysiewicz, 2017). Regarding the case study, 10% authors adopted this method (Chiou et al., 2010). It is an in-depth analysis of a specific problem. Conducting a case study involves defining the scenario, identifying the main problems, relating them to key theories, researching relevant theories and approaches, recommending realistic solutions, and presenting findings clearly and concisely ("15+", 2023). Automatic evaluation refers to the use of software, algorithms or predefined criteria to evaluate the features and characteristics of the websites without human intervention (Chiou et al., 2010).

Finally, expert evaluation lets the users regard the benchmark as a baseline or experts to identify possible usability issues ("How", n.d.). It is often used in the situation of limited resources ("9", n.d.).

This paper employs expert and automatic evaluation due to efficiency and cost-effectiveness. Specifically, compared to large sample sizes in surveys, detailed instructions of experimental evaluation and content analysis, and complex operation in case studies, it is faster to adopt these two data collection methods. Specifically, expert evaluation involved 10 experts with backgrounds in UX, product management, business analysis, and development in the financial sector. After a brief pre-introduction, they individually evaluate the three banking websites. The data were then collected and analyzed. Additionally, Google's automatic evaluation tool, PageSpeed Insights (PSI), was used to assess the web page's accessibility and performance.

2.1.4. Calculation Methods

The problem of evaluating banking websites meets the situation of the Multi-Criteria Decision Analysis (MCDA), a structured method to evaluate and compare options based on multiple complex and poorly structured criteria (Chmielarz & Zborowski, 2020; "Multi-criteria Analysis", n.d.). There are three types of methods: simple methods, pairwise comparison, and parametric methods. Firstly, simple methods include scoring without preference (equal weights) and with preference or weights. These approaches rely on a clear scoring scale to evaluate diverse qualitative attributes, enabling the establishment of a unified value for all criteria. They are widely applied since it is easy to apply, not requiring additional instructions to respondents, and easy to interpret. However, it could be subjective for the selection of criteria and division of weights. The subjectivity is mitigated when the scale of the survey increases. In addition, pairwise comparison is a technique where criteria are compared two at a time to determine the relative importance (Chmielarz & Zborowski, 2020). The most famous methods are Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP). The advantage is more objective due to the measurement of the relationship between individual criteria, while the disadvantages lie in the fact of complicated education to the users, difficulty of application, and lack of transparency to the findings (Chmielarz & Zborowski, 2020). Finally, parametric methods are techniques using statistical models with specific parameters to analyze relationships, such as Preference Ranking Organization METHod for Enrichment Evaluations (PROMETHEE) and PROMETHEE for Sustainability Assessment (PROSA) (Chmielarz & Zborowski, 2020). PROMETHEE has a limited effect of linear compensation of criteria, while PROSA minimizes the problem. While these methods are relatively objective, it is troublesome to conduct due to complications in the pre-instructions and completing the questionnaire. All these approaches enable the derivation of a single score when assessing the banking websites from the perspective of the end-user.

Regarding the comparison of these methods, Chmielarz & Zborowski adopted five methods (simple scoring method with/ without preference, PROMETHEE with/ without preference, and PROSA) in the 22 bank websites comparison in Poland. The final result of bank ranking shows

that the ranks of the scoring method without preference, PROMETHEE, and PROSA are almost the same. This empirical result shows the effectiveness of the scoring method without preference. The author also conducted a pilot study of the preference for these methods from the bank client's standpoint. The results show 94% of clients like to apply a simple scoring method with preferences, 90% of clients prefer a simple scoring method without preferences, while the values decrease to 72% and 69% occurring to PROMETHEE and PROSA. Therefore, this paper chooses to employ an effective and easy-to-implement method—a simple scoring method without preferences instead of the ones based on sophisticated methodology, requiring expert knowledge, complicated pre-education instructions, or even costly software for making calculations.

2.2. A Simplified Version of Bank Website Research

With companies paying attention to UX, banks should keep up with current trends and design and develop official websites with excellent user experience. An efficient and concise user interface can significantly improve user satisfaction, which increases user attention, loyalty and the bank's market competitiveness. However, the design of many current bank websites still has issues such as information overload and complicated navigation. These problems may prevent users from quickly finding the information they need, thus affecting the overall user experience (Dang, 2020).

Most individual users have an insufficient understanding of the banking business, which makes it difficult for them to quickly locate or obtain information. For corporate users, professional accounting and legal personnel are hired to perform related banking operations normally. They often have extensive banking knowledge, and corporate business always need to go to branches or communicating with banking managers. Therefore, the simplified version of the website in this study will focus on the simplified version of bank website design in the field of personal banking.

2.2.1. Development Status and Opportunities

2.2.1.1. Challenges of Bank Website Design Evaluation

The bank system plays a vital role in the bank. It is a complex system, including the official website for the public, online banking and mobile banking for customers, counter and ATM systems for employees, the underlying core accounting system, and various external communication systems. In addition, there are various security systems and service support systems (Georgescu & Jeflea, 2015). Due to the funds involved, banks focus on security and accuracy in the system. It led banks to have a conservative attitude to use new technologies. Some popular technologies and designs are difficult to apply quickly in bank systems (Khera & Verma, 2014).

From a bank's perspective, customer systems mainly include the bank's official website, online banking and mobile banking. The official website faces all people, while online banking and mobile banking are for existing customers. Therefore, banks should pay attention to the user experience of these systems, especially the bank's official website, because this system is face to

the public, and it does not involve specific banking business or funds. This website can usually use physical isolation of servers to ensure security issues and use static pages to ensure access efficiency and user experience (Li & Xue, 2014).

Therefore, when developing their official websites, banks can consider using popular design methods and elements in a safer manner, and regularly update their official websites to provide users with a better user experience. This ensures the attraction of users and the acquisition of more business.

2.2.1.2. Changing User Behaviors and Innovation

According to Nisar & Whitehead's (2016) study, users tend to obtain information from official websites because the information from official websites is more comprehensive and reliable. In addition, the official website plays a publicity role, letting potential consumers understand the brand better and increasing user loyalty. However, it requires a website with a simple interface, high efficiency, and excellent user experience. Because designing a complex website will increase the user's cost of use, they need to spend more time finding information (Savioja, Liinasuo, & Koskinen, 2014).

With the development of technology, businesses are paying attention to user experience. Various excellent design concepts and technical frameworks are rapidly iterating, such as simplicity and flatness. Use guidance, quick positioning can let users respond quickly and a low-cost website facilitates users to obtain information.

The bank's official website is the main channel for the bank to face the public. Thus, banks need to develop an official website with excellent user experience. However, there are some hidden costs for both banks and websites. For example, customers need to understand the banking business before they can handle related business. There are also various risks and legal issues involved, and the banking business is not deposits and payments. A true understanding of the banking business requires high learning costs (Correa & Goldberg, 2022). Computer use also has some hidden costs. Although technology is developing rapidly, some people cannot use computers and the Internet. For example, some undeveloped areas and the elderly who are slow to accept new things are unable to use computers proficiently and conveniently (Ramón-Jerónimo, Peral-Peral, & Arenas-Gaitán, 2013). To optimize these issues, the bank's official website design can meet the needs of the public by adopting and implementing new design trends and techniques.

2.2.1.3. Advancements in Interaction Design and Technologies

Excellent user experience and website design can improve user satisfaction and bring more business to the bank. Banks not only consider excellent interactive experience but also ensure network security. The website needs to improve efficiency and meet the interactive experience expected by users. It is not a single interaction design that can be achieved, needs a complex user experience design and optimization project.

- Minimizing User Input

When users visit a website, providing sufficient options is more in line with users' usage, which can reduce users' cognitive load (Hussain et al., 2018). In addition, from the perspective of service providers, the risk of dirty data generated by keyboard input is greater, and there are more security issues, such as SQL injection attacks in the early years of the Internet (Alwan & Younis, 2017). Reducing input and providing more options is good for both user experience and server-side maintenance.

- Simplified Navigation Structure

An excellent navigation structure can improve navigation efficiency, allow users to locate the required information, and reduce erroneous operations quickly, which requires a clear menu and logical structure. In addition, the web page's location and the UI's design are equally important. According to research by Fang and Holsapple (2007), excellent navigation can significantly improve user satisfaction.

- Clarity and Accessibility in Visual Design

A clear visual design is essential to ensure all users can easily use a website. This includes using a color scheme with adequate contrast, appropriately sized fonts, and clear button labels, which websites should be accessible to everyone, including people with disabilities (Lister et al., 2020)

2.2.1.4. *High-Frequency Business and Simplified Version*

With the development of the banking industry, banks provide many banking services and products. However, not all services are high-frequency services. For example, Sandhu & Arora (2022) found that the number of loan businesses is much lower than the credit card business, especially in some economically developed Western countries. In other words, the credit card-related information page on the bank's official website is visited more frequently than the loan business. Especially since COVID-19, customers prefer to obtain information and apply services online rather than going to bank branches (Dahlhaus & Welte, 2021). In addition, some banks have developed mobile banking for the elderly. Mobile banking for the elderly only displays high-frequency businesses and has larger fonts to facilitate the use of the elderly (Ubam, Hipiny & Ujir, 2021).

Caddy, Delaney, and Fisher (2020) believe that among many banking functions, transfer and balance inquiry functions are the most frequently used services. This shows that Australian consumers place great value on banking services that allow them to easily transfer funds and monitor account balances in real-time. In addition, the report notes that the use of mobile banking applications is growing rapidly, reflecting consumers' growing demand for banking anytime, anywhere. Overall, this study believes that account-related businesses and transfer-related functions are used most frequently.

Statista (2024) provides banking industry data in New Zealand and explores the current status of digital banking in New Zealand, with a particular focus on the use of personal banking applications.

It is found from the data that New Zealand consumers generally prefer to use online bill payment and transfer functions. These features are highly used in personal banking due to their convenience and efficiency. Therefore, it can be found that they believe that the transfer function and credit card function are used more frequently in New Zealand.

JPMorgan Chase Bank, New Zealand Banking Group (2023) mentioned in the disclosure statement that in the post-epidemic era, the high-frequency functions of New Zealand users are mainly focused on account business, transfer business and credit card business. However, at the same time, the demand for financial services has not increased significantly, and banks are under great pressure on capital and operations.

In the research of Azeem (2020), what New Zealand users value most is the ability to access account information and conduct transactions anytime and anywhere. These functions include account inquiries, transfers and remittances, and bill payments. They have become the most commonly used personal banking services by users because of their convenience and practicality. In addition, he also mentioned that banks and customers have different business concerns. Banks pay more attention to businesses that are highly profitable or bring more deposits. Overall, in this study, account business, transfer business and credit card business are high-frequency businesses. At the same time, attention should also be paid to other high-profit businesses so that banks can develop healthily.

Overall, the simplified version of the bank can focus on high-frequency banking services for users and develop it with convenient tools.

2.2.1.5. User-friendly web elements

According to Sundt and Eastman's (2019) research, a single-layer navigation bar helps users find the content they want more quickly while reducing page turning and side tab stacking. It can also improve user experience in related businesses, which can facilitate comparison and understanding of the business.

Maddirala (2019) proposed in the study that reducing customer typing can improve user experience. Reducing the use of and providing more options can improve user experience. Among them, and are better choices.

Ríos et al. (2021) believe that excellent search logic is of great help to users in obtaining information. Many website search functions do not allow users to obtain accurate information. For example, if the exact keywords are not entered, relevant information cannot be found. In addition, users often want to jump directly to the corresponding business page through search, rather than related articles on the website. This is also the main reason for the inefficiency of using the website search function.

2.2.2. Evaluation Methods and Frameworks

2.2.2.1. *Research Background*

This study aims to evaluate the user experience of three major New Zealand banks' websites (ANZ, ASB, BNZ), with a particular focus on the banks' high-frequency business processes. By analyzing the main problems that users encounter when using bank websites, a simplified version website of the solution is proposed to improve users' experience and satisfaction when conducting high-frequency business operations.

A mixed methods research design will be used, combining quantitative and qualitative research methods. Firstly, the website usage data is analyzed through quantitative methods to identify the business processes that users visit most frequently. Secondly, qualitative research methods such as expert analysis and task analysis are used to gain a deep understanding of the specific problems users encounter when executing these high-frequency business processes. Finally, based on the best practices of user experience design, a simplified version of the bank's website suitable for the bank's official website is proposed.

Through this study, it is expected that the user experience bottlenecks in high-frequency business operations of New Zealand's bank websites can be clarified, and a suitable simplified page model can be proposed to improve user satisfaction and optimize user experience.

2.2.2.2. *Focus Categories*

To ensure this study provides a comprehensive assessment of the user experience of simplified New Zealand bank websites, we will focus on the following key categories:

- **Usability:** Evaluate the website design is intuitive and easy to understand, and users can find the information and complete the expected operations effortlessly. Ease of use directly affects user satisfaction and website effectiveness. Efficient website design allows users to accomplish the most work with the least amount of time and effort.
- **Visualization:** The definition is shown in Table 1, in terms of research on the simplified version of the website that enhances the visual presentation of the website to ensure it is clear and accessible for all users.

When analyzing these key categories in depth, it should be considered that they influence each other. For example, improving accessibility by enhancing a website's usability. Through a comprehensive evaluation of these categories, we can identify the strengths and weaknesses of the website in terms of user experience, which design a more suitable simplified version of the website.

2.2.2.3. *Identification and Selection of High-frequency Business Processes*

According to the research scope mentioned in 2.2, the design of the simplified version of the bank's website focuses on the personal banking business. Professional businesses such as corporate banking are mostly oriented to professional financial people. To effectively identify high-

frequency banking operations in reality, we decided to analyze from two important perspectives: analysis of current literature and opinions of industry experts. These two methods approach the identity of high-frequency banking business and categorizes and summarizes it.

The academic research perspective is to review relevant academic literature and analyze which banking business processes are most commonly used by users and of greatest concern to banks themselves. In addition, an academic perspective can also reveal common problems and challenges faced by users, providing us with a scientific basis for improving website design. The expert perspective refers to experts in the banking industry, including banking practitioners, product managers, and banking system development project managers. They have an in-depth understanding of banking business processes and user needs. By interviewing and consulting with these experts, we not only gain first-hand information about which services users use and need most, but also gain insights into the design context and purpose of these business processes. Expert insights help identify issues that may have been overlooked in the design and provide targeted suggestions for improvements to optimize the user experience.

Combining these two perspectives, we were able to make full use of existing academic resources and industry experience to comprehensively evaluate the user experience of bank websites. By systematically identifying and selecting high-frequency business processes, we will recommend evidence- and expertise-based design improvements for these processes, aimed at improving user satisfaction and overall website performance.

2.2.2.4. Identification and Selection of Web Page Elements for Simplified Website

In this study, we will use a combination of citing existing research results and expert opinions to determine the most suitable simplified version of the bank's website and the web page elements that provide an excellent user experience. We will search and analyze existing academic research, select sufficient research results for statistical analysis according to requirements, and determine web page elements with excellent user experience. Secondly, we collected expert opinions, brought it into the limited scenario of the bank website, and proposed suitable web page elements. And comprehensively analyze and screen the research results of the two parts. Finalize important web page elements.

In the process of analyzing web pages, page elements play a great role in user experience, but it does not mean that our simplified version of the bank website only includes these page elements. Some basic page elements will also be applied, such as <h1/>, <table/>, etc. In addition, page frame tags such as <div/> are not within the scope of this study.

In addition to basic web page elements, we also focus on functional analysis such as pictures, flow charts, and text, as well as the usage efficiency of functional components such as navigation bars and search functions. The selection of all these elements will be based on the results of the literature review and expert feedback.

2.2.2.5. Assessment of User Experience on Three Banking Websites

To study the user experience of the high-frequency business of the bank's existing official website, this study decided to adopt a quantitative analysis method by studying the two categories of Usability and Visualization and adding the subjective feeling of Satisfaction for overall evaluation. And put forward specific quantitative measurement standards for recording and evaluation. Taking "Find Account Opening Information" as an example, we will conduct experiments on three different bank websites and record in detail the details of the user's interaction in completing this task.

Table 2

NZ bank websites evaluation criteria

Banking Service Evaluation Criteria			
Categories	Task	Detail	Score rules
Usability	The number of clicks	Record the number of clicks required for a user to complete a task, such as finding account opening information.	10 points for less than 3 times, 1 point for more points
	Number of steps back (number of incorrect operations)	The number of times the user made mistakes or went back during the execution of the task (such as clicking on the wrong link).	Award 10 points if no errors are made. Deduct 1 point for each incorrect operation beyond the first.
	Time taken to complete a task	Total time taken to complete a task, e.g., comparing two accounts. Shorter times indicate higher efficiency	Award 10 points if the task is completed within 30 seconds. Deduct 1 point for every additional 10 seconds over 30 seconds.
	Number of page turns	Record the number of page turns to gauge the efficiency of information retrieval.	Deduct 1 point for each page turn beyond the first.
Website Evaluation Criteria			
Categories	Task	Detail	Score rules
Visualization	Content readability	Assess the readability of content, including support for zooming in and out of text and images.	Award up to 5 points for text scalability, 3 points for clear illustrations, and 2 points for other content optimizations.
	Navigation aids	Evaluate the website's auxiliary navigation features, such as quick navigation and search functions.	Award 5 points for direct and concise navigation to the desired page. Deduct 1 point for each additional click required.
Satisfaction	Satisfaction with intuitive operation	Score based on the tester's subjective experience following the operation.	10 Very satisfied 7-9 satisfied 4-6 Average 0-3 bad

Through quantitative evaluation of the above projects, we can obtain the user experience results of these bank websites for high-frequency business at this stage. These data will help to discover the deficiencies of each website in this area and get attention in the later design of a universal simplified version of the website.

2.2.2.6. Application of Simplified Design Principles

A bank website with a user-friendly interface can improve user satisfaction and promote business efficiency. We will adopt user-centred simplified design principles to optimize the display of web content for high-frequency businesses. In terms of website interface design, simplified design can reduce the interference of useless information to users, allowing users to find the information they need accurately and quickly. At the same time, we also noticed that an oversimplified interface might sacrifice necessary functionality. Thus, we kept the design minimal while ensuring that all key information and functions were intuitively accessible.

- Flat Design: Use flat design to reduce unnecessary decorative elements and make the user interface clearer. This helps users identify functional buttons and navigation elements more quickly, improving website usability.
- Minimalism: Reduce the number of page elements and retain only the core functions and information. This not only reduces the user's choice burden, but also speeds up page loading time and improves efficiency.
- Visual Hierarchy: Create a clear visual hierarchy through visual means such as color, size, and layout, and guide users' attention to the most important information or operations. For example, highlight the entrance to high-frequency services such as "opening an account" or "transferring money."
- Consistency: Maintain design consistency across the entire website, including color scheme, font selection, and layout of elements, to reduce user learning time and improve overall usability.
- Feedback mechanism (Feedback): Provide immediate and clear feedback for user operations, for example, display a confirmation message when the user completes an operation or give a prompt when the input data format is incorrect. This enhances the user's operational confidence and improves satisfaction.
- Optimized Search: Improve the search function so that it can quickly and accurately return the information users need. This includes providing intelligent search suggestions and using technologies such as natural language processing to understand user query intent.

Through the above design principles, we can systematically apply simplified design principles to improve the bank website, ensuring that the final design solution can truly meet the needs of users and enhance user experience.

2.2.2.7. Demonstration of the Effects of Improving the Website

In the design preparation stage, we first determined the high-frequency business of New Zealand

bank users through the high-frequency banking business process identified in 2.2.2.3 and determined the scope of the simplified version. In addition, through the research in Section 2.2.2.4, we selected web page elements that can significantly improve user interaction efficiency. Based on the research on the application of 2.2.2.6 simplified design principles, select the appropriate web design method and apply it to the design of the bank's simplified version of the website.

During the prototyping phase, we will design a simplified, generic prototype of the website for New Zealand banks. This prototype focuses specifically on user efficiency and satisfaction when executing high-frequency business processes. Realize the design prototype through prototype drawings to ensure that the prototype is both beautiful and fully functional.

2.3. AI Application of Bank Website Research

By training computers to learn human behaviors such as learning, judgment, and decision making, artificial intelligence (AI) has already had a profound impact on various industries (Zhang & Lu, 2021).

Stige et al. (2023) propose that AI could fundamentally change the banking application landscape and elevate the user experience to unprecedented levels. In the field of user experience design of bank websites, AI uses personalized recommendation, intelligent assistant, biometrics, big data predictive analysis and other technologies to improve bank user experience (Chanchamnan et al., 2023). In the face of fierce market competition, banks need to innovate constantly to maintain competitive advantage. The application of artificial intelligence technology has brought more business opportunities and innovation possibilities for banks, and promoted the development and transformation of banking business.

Therefore, it is necessary to further study the application and impact of AI on the user experience of the major bank websites in New Zealand, based on the comprehensive assessment in Section 2.1.

2.3.1. Development Status and Opportunities

The use of AI in traditional banking is not new. Many banks have already deployed AI-driven solutions to automate tasks, reduce operational costs, and improve customer service. Accenture reports that AI is expected to make it possible for traditional banks to increase productivity by 22-30% (Banking on AI | Banking Top 10 Trends for 2024, n.d.). Many companies see AI as a key tool to provide a sustainable competitive advantage, yet fewer have developed a strategic plan for its use.

Artificial intelligence technology brings many opportunities to improve the user experience of banks, including the following:

2.3.1.1. Intelligent Customer Service

Artificial intelligence technologies such as natural language processing (NLP) and natural language generation (NLG) can make intelligent assistants available to users 24/7. These assistants can interact with users in natural language via text or voice, perform text classification and sentiment analysis, and then answer common questions, provide information such as account information, complete simple transactions, and provide personalized financial advice and notifications (Chen et al., 2021; Ardito et al., n.d.).

2.3.1.2. Personalized Predictions and Recommendations

This module provides users with a comprehensive account overview and future predictions. By analyzing trends such as historical transaction data, revenue, and expenditure, the system can show and predict the current financial situation of the user and predict future financial trends, thereby recommending customized recommendations and plans to help users better manage their money, plan spending, and achieve financial goals (Gigante & Zago, 2022).

2.3.1.3. Personalized Websites

By analyzing customers' physiological characteristics, browsing history, behavior, and preferences, banks can use artificial intelligence technology to personalize the pages of their presented websites. These pages can enhance customer engagement and satisfaction by providing personalized user interfaces, navigation, and search based on customer interests and needs (Li et al., 2024).

2.3.1.4. Biometrics and Information Security

The use of voice, fingerprint or face recognition verification when transferring money is an intelligent security measure that utilizes artificial intelligence technology. The technology uses biometrics, combined with machine learning and deep learning algorithms, to verify a user's identity. By extracting key biometric information and comparing it with pre-stored identity information, the system ensures the accuracy and security of user identity. This smart security measure can detect abnormal transactions and fraud in a timely manner, and take corresponding preventive measures to protect the security of users' accounts. By integrating biometrics with financial services, banks can improve the security and efficiency of transactions and enhance user experience (Venkatraman & Delpachitra, 2008).

2.3.1.5. Fraud Prevention and Risk Management

The application of artificial intelligence in banking makes intelligent risk management possible. Artificial intelligence by analyzing big data, real-time monitoring of user behavior, using machine learning algorithms and data mining technology, can detect abnormal transactions and fraud in a timely manner, and take preventive measures to protect the security of user funds. For example, by analyzing the user's trading pattern, geographical location, trading time and other information, the system can automatically identify transactions that are inconsistent with the user's habits or

have high risks, and issue alerts or automatically freeze accounts to prevent the loss of funds. On the other hand, intelligent risk management system can also carry out personalized risk assessment according to users' historical behaviors and preferences, and provide customized risk management schemes for different users (Rahman et al., 2021).

2.3.1.6. Credit Scoring and Loan Approval

Khandani et al.(2010) found that machine learning algorithms can effectively evaluate users' credit. Alborzi & Khanbabaei(2016) proposed a customer credit risk assessment model by analyzing customers' credit history, financial status and behavior data, and using machine learning and neural network algorithms. He and Khanbabaei believed that this model could effectively segment and classify valuable bank customers. It can be seen that by providing intelligent credit scoring and loan approval services, banks can quickly and automatically decide whether to approve loan applications, reducing credit risks and improving loan efficiency.

2.3.1.7. Data Analysis and Decision Support

AI technology can help banks analyze and predict vast amounts of financial data, providing decision support and business insights. Through data mining, machine learning, and deep learning techniques, banks can identify underlying market trends, customer behavior patterns, and risk factors, such as Olson et al. (2012), who discuss the use of AI algorithms to predict bankruptcies.

2.3.1.8. Background Process Automation and Optimization

AI technology can be applied to automate and optimize bank back-office processes, including account management, transaction processing, risk control, and compliance auditing and supervision. By automating processes and intelligent algorithms, banks can improve work efficiency, reduce costs, and ensure the safety and stability of business operations. Munoz-Izquierdo et al. (2019) studied the use of artificial intelligence to streamline internal audit reporting. Akerkar(2019) also discusses how AI can be embedded in internal processes and enable process optimization.

It can be seen from the above that AI technology has the potential to change many aspects of banking. Which AI technologies will have an impact on the bank's user experience and how to evaluate the AI technology performance of the three major New Zealand bank websites will be discussed in the next section.

2.3.2. AI Technology Applies Evaluation Methods and Frameworks

Heuristic evaluation, user research, expert review and other methods can be used to evaluate the degree of artificial intelligence of bank websites.

Since not only the artificial intelligence of bank websites, but also the AI technology itself is at an early stage (Zhang & Lu, 2021), the cost of user research is high compared to heuristic evaluation

and expert review, which usually focus on user interface design. Therefore, our expert review assessment is better suited to quickly detect early problems, provide professional advice, and evaluate from multiple perspectives.

2.3.2.1. Purpose

The assessment of the impact of AI technology on the user experience of the websites of three major New Zealand banks aims to gain insight into the practical effects of AI technology in the banking industry and identify possible problems. Through the analysis of user experience, the potential improvement space can be found, and the corresponding improvement suggestions can be put forward to improve the user experience level of the bank websites.

2.3.2.2. Methodology

Invite a group of experts in the relevant field to act as evaluators, based on design principles and experience, to examine the AI application of the bank's website, identify problems and suggest ways to improve it.

2.3.2.3. Participant

Assessment participants should have the following characteristics:

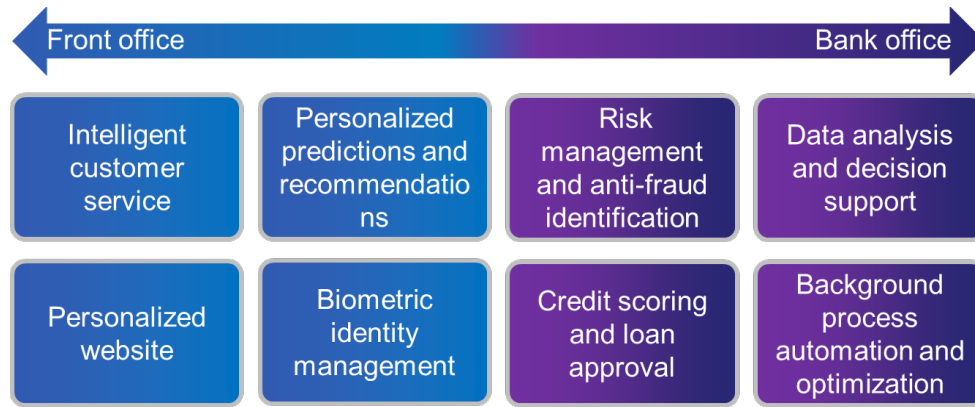
- Expertise and experience in user experience and AI technology.
- Knowledge of New Zealand banking business and user needs.
- This includes designers, user experience experts, AI experts, and front-end developers.

2.3.2.4. Dimension

As can be seen from 2.3.1, AI technology has a broad impact on both the front and back offices of banks. In this study, we mainly focus on the impact of AI technology on the front office services of bank websites, and the evaluation content includes various aspects related to improving user experience, enhancing personalization, and improving service efficiency. Some of the front and back Office AI technologies are shown below.

Figure 3

The application of artificial intelligence in the front and back office of banks



2.3.2.5. *Process*

The evaluators will independently browse and evaluate the AI application of each bank's website, document the problems and advantages found, and provide recommendations for improvement for each problem.

2.3.2.6. *Result and Output*

The evaluation results of various evaluators were collected, the AI applications of various bank websites were comprehensively analyzed and compared, and were included in the opinion table for qualitative comparison and analysis among websites. The evaluation results, existing problems and advantages of AI applications of various bank websites were introduced in detail, and suggestions for improvement were put forward.

3. Comparison and Discussion

3.1. Integrated Analysis

Three methods are employed: factor analysis, general analysis and comparative analysis, as shown in sectors 3.1.1, 3.1.2, and 3.1.3.

3.1.1. Factor Analysis

3.1.1.1. *Principal Component Analysis (PCA)*

PCA was used to analyze which factors impact UX the most. It is a multivariate data analysis method commonly used to reduce the dimensionality of a dataset (Daffertshofer et al., 2004). The data was based on scores from 10 experts who evaluated three banking websites across 12 factors. The analysis was conducted using Jupyter Notebook 6.4.12 with Python 3. The results are shown in Table 3. PC1 explains 25% of the variance and is primarily driven by marketing functionality

(loading: 0.80), indicating that marketing functionality is the primary factor influencing variations in UX. PC2 explains 21% of the variance and is primarily driven by technology (loading: 0.56), suggesting that technology is a secondary influencing factor. The result shows that the primary differences in UX stem from marketing functionality, while secondary differences arise from technology. Therefore, banks in NZ should improve marketing functionality and enhance technology to comprehensively optimize UX.

Table 3

Loadings in PCA

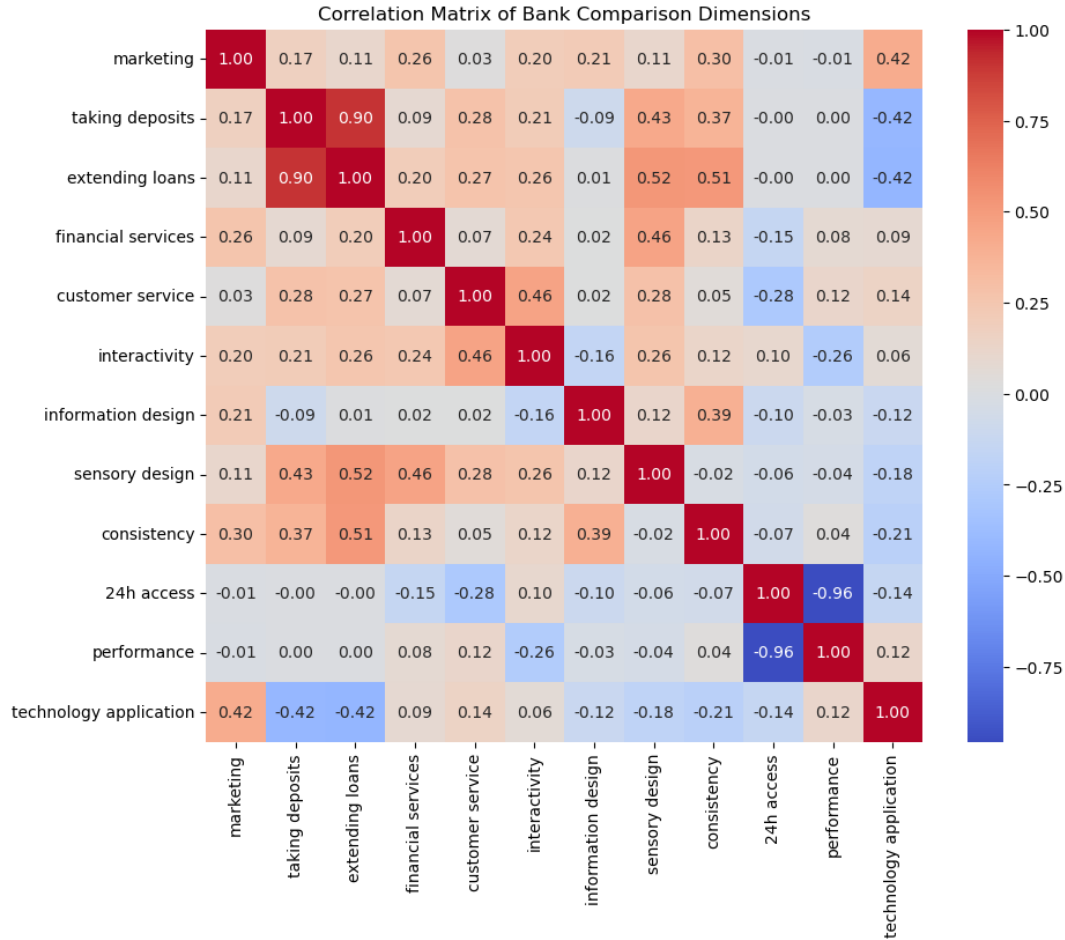
Explained variance ratio of each component: [0.2512, 0.2106]		
Factors	PC1	PC2
marketing	0.803981	-0.069416
taking deposits	0.037777	-0.297414
extending loans	0.050051	-0.440821
financial services	0.219276	-0.174618
customer service	0.08406	-0.081741
interactivity	0.125788	-0.148505
information design	0.109269	-0.144069
sensory design	0.115685	-0.411119
consistency	0.175985	-0.341144
24h access	-0.092693	-0.083956
performance	0.076686	0.148557
technology application	0.45601	0.563831

3.1.1.2. Correlation Analysis

Correlation analysis is employed to determine if there is a significant correlation between these factors, as shown in Figure 4. The result shows that there is a strong positive correlation between "taking deposits" and "extending loans" functionality, with a correlation coefficient of 0.90. This suggests that banks offering deposit services also provide quality loan services. In contrast, a strong negative correlation of -0.96 between "performance" and "accessibility". This implies that banks offering 24-hour access may require substantial resources, such as security measures, which could potentially impact overall performance. If a regression model is built in the future to classify UX, it is necessary to consider reducing the linear correlation of these factors.

Figure 4

Correlation Matrix of Banking Websites Evaluation Factors



3.1.2. General Analysis

Using expert and automatic evaluation, along with the simple scoring method without preferences calculation method, a bank ranking table can be established based on the scores, as shown in Table 4.

Table 4

Banking Websites Comparison in NZ

Banks	Net Score Percentage	Rank
ANZ	73%	1
ASB	72%	2
BNZ	67%	3

Based on the new integrated assessment matrix model, business strategies are analyzed first, followed by the evaluation categories and factors. Regarding the strategy, these three banks adopt different approaches. ANZ targets the B2C market, focusing on families with children, evident from the picture of a harmonious family in their homepage advertisements. ANZ also demonstrates

a commitment to cultural diversity through rainbow activities shown on platforms like Facebook and Instagram, alongside a simplification strategy ("ANZ ", 2024). ASB, on the other hand, targets the B2B market with a strong emphasis on the business owner on their social platform. It also supports cultural diversity through rainbow activities and shows an innovative digital banking strategy (Dofadar et al., 2022; "Planit", n.d.). BNZ's focus is also on the B2C market ("New", n.d.), particularly unmarried customer segmentation. It highlights sustainability strategy with initiatives such as marine biodiversity protection and Guide Dog Puppy Appeal. Additionally, BNZ demonstrates a digital strategy through the implementation of digital transformation projects ("2023", n.d.).

Concerning functionality, these three banks have relatively comprehensive functionality and information provision regarding taking deposits and extending loans, but they all lack advertising or incentive policies in marketing. BNZ is relatively weak in financial services because it cannot provide quotes for insurance on its websites. In terms of customer service, BNZ is also relatively weak due to the difficulty in finding the portal.

Regarding the interactivity aspect of usability, ANZ excels in three areas: simplification of steps, comprehensive and clear structure design, and user-friendly interface button design. Firstly, taking the account opening process as an example, ANZ streamlines it into three steps for online application due to its simplification strategy, whereas ASB requires seven and BNZ, ten. Additionally, in the design of multi-step forms' structural interactivity, ANZ separates sections into individual pages, offering users a comprehensive view of the entire process. ASB, however, only displays the current and next steps, limiting users' visibility of the whole process. In contrast, BNZ presents a lengthy, structured form on a single page, potentially overwhelming users. Finally, ANZ enhances user-friendliness by employing buttons for choice questions, unlike BNZ's use of radio buttons.

On the information design side of usability, ANZ excels in navigation design, while ASB performs well in information search. Firstly, navigation design must achieve three objectives: providing a pathway for users from one point to another, conveying the relationship between the elements it contains, and indicating the relationship between the elements and the current page. ANZ employs a business classification in the navigation bar design, separating business-to-customer (B2C) and business-to-business (B2B) into distinct categories, with personal and business options delineated. Moreover, the secondary menu hovers on the screen, enabling users to view the content clearly. ASB, however, integrates personal and business options into the secondary menu of navigation. BNZ follows a similar business classification as ANZ but embeds the secondary menu directly onto the page. On the other hand, ASB's innovative strategy includes a creative information search design, with a search box prominently displayed on the homepage, enabling users to find specific information flexibly and accurately. In contrast, ANZ and BNZ adopt a more traditional approach to information search design, with a small search box positioned in the upper right corner of the page.

In terms of visualization, both ANZ and ASB prominently feature their signature blue and yellow

colours, representing their brand identity. However, BNZ's use of light blue and yellow lacks the same clarity and distinctiveness. It's essential to note that while each bank has its unique colour scheme, consistency in colour application is crucial for establishing a cohesive and recognizable brand image. Indeed, it is evident that all three banks excel in maintaining consistency in their visual presentations.

Speaking of reliability, ANZ and BNZ perform well in accessibility, while none excel in performance. Specifically, both ANZ and BNZ score high in accessibility, while ASB scores relatively low due to issues with image elements and links. However, all three banks score very low due to long blocking times and large image files.

When discussing technology, none of them apply AI-based applications such as chatbots or personalized recommendations. This aspect will be described in detail in section 3.3.

3.1.3. Comparative Analysis

The comparative analysis of ANZ, ASB and BNZ is based on the preceding general analysis. The strengths, weaknesses and deficiencies are summarized in sections 3.1.4.1, 3.1.4.2 and 3.1.4.3 respectively.

3.1.3.1. *Strengths*

Six strengths are detected in the three banking websites: deposits taking and loans extending functionality, information design, sensory design, consistency, and accessibility. Firstly, they cover all the functionality related to deposit taking and loan extending. Next, in information design, they exhibit well-articulated navigation design and innovative information search capabilities. Moreover, they prominently and consistently showcase their brand colour scheme in visualization. Finally, all three demonstrate relatively good accessibility.

3.1.3.2. *Weaknesses*

Four weaknesses are identified: financial services and customer services in functionality, along with interactivity in usability and performance in reliability. Specifically, financial services like obtaining insurance quotes are lacking and the customer service portal is difficult to locate in BNZ. Additionally, there are shortcomings in interactivity, such as complexity of steps, lack of clear structure design and unfriendly interface element button design. Finally, the performance score detected by PSI is relatively low due to large image files or long blocking time.

3.1.3.3. *Deficiencies*

Two deficiencies are indicated, namely lacking marketing information in functionality and lacking AI-based application in technology, which is in line with the results of PCA. Firstly, marketing information such as promotional content, suggested products, recommendations, and incentives are absent in these three banking websites. Furthermore, AI-based applications in technology such

as chatbots and personalized recommendations are difficult to find.

3.2. Evaluation and Research of Simplified Bank Website

3.2.1. High-Frequency Business Processes Evaluation

3.2.1.1. *Summary of Existing Research Findings*

Based on mentioned in 2.2.1.5, we analyze that account business, transfer business and credit card business are high-frequency businesses. At the same time, attention should also be paid to other high-profit businesses so that banks can develop healthily.

3.2.1.2. *Consolidation of Expert Opinions*

Expert A, a senior employee in the banking industry, believes that although account management, loan applications, payment transfers and other services are frequently used by users, bank website design should not ignore services that have strategic promotion significance for the bank. He pointed out that although the current frequency of use of these services is not high, such as new product introductions, specific financial planning services, or special promotions, it plays an important role in attracting potential customers and increasing the bank's profits. Expert A proposed that by displaying and promoting these businesses more prominently on the website, more users can be encouraged to understand and use these services. This is not only attractive to users but also helps banks capture more profit opportunities and form a virtuous cycle of promotion and profit.

Expert B has extensive experience in developing bank online banking systems. Based on the production environment data analyzed in previous projects, he found that users have high-frequency interaction needs in account management, online payment and bill payment. During the development phase, he realized that ensuring these features flowed smoothly was critical to maintaining user engagement. He suggested that the simplified version should focus on the highest frequency functions.

As a product manager, Expert C starts from the perspective of end users and products. He believes that account management and complex businesses such as insurance, investments and loans need to be displayed to users in a simplified version. He suggested optimizing the interface and interaction design of these functions based on user research to reduce users' cognitive load. At the same time, although the basic transfer function is a high-frequency function, everyone is using it, so there is no need to simplify it. The album focuses on services that are difficult for users to understand.

Based on the opinions of experts A, B, and C, we can see that in the simplified design of the bank website, priority should be given to functions frequently used by users, such as account services, to improve user activity and satisfaction. However, it is also necessary to highlight those services

of strategic importance, such as new product introductions and specific financial planning services, which are used less frequently but are crucial to increasing the bank's revenue and attracting potential customers. In addition, attention should be paid to the simplification of complex business processes, especially those services that are difficult for users to understand, such as insurance and investment, to reduce user cognitive load and improve the overall experience. In general, the design of a simplified version of the bank website needs to balance the optimization of high-frequency use functions and the effective promotion of strategic business.

3.2.1.3. Integrated Analysis

In the comprehensive analysis of high-frequency business processes, based on our research findings and comprehensive consideration of expert opinions, account business (Accounts) and credit card business (Credit Cards) are the areas with the most frequent user interactions. Although the loan business (Loans) is crucial to the bank's profitability, its interaction frequency is slightly lower, so the display in the simplified version of the website needs to be more refined and prominent. Investments usually target specific user groups. Although not all users interact frequently, for those who use such services, simplifying the information acquisition process can significantly improve the user experience.

Therefore, our comprehensive conclusion is that the simplified version of the website should focus on and simplify the operating procedures of account and credit card-related businesses to adapt to the daily use needs of the majority of users. For the two fields of lending and investment, although they occupy an important position in the banking business, they can be appropriately adjusted when designing the website to highlight key information clearly and concisely, which not only meets the in-depth needs of specific user groups, but also does not appear on the page. Causing information overload. In the overall design, maintaining an efficient and intuitive user experience will be our core goal.

3.2.2. Webpage Element Selection

3.2.2.1. Application of Existing Research

Based on the literature in 2.2.1.5, we conclude that to obtain a better user experience, users should reduce content input, and provide users with clear logical options, and intelligent search tools, thereby improving user satisfaction and efficiency of the website.

3.2.2.2. Feedback on Expert Recommendations

Expert A believes that visual elements, such as pictures, can be added to the simplified version of the website. Because visual elements can intuitively convey information to users. Secondly, he also believes that although the simplified version of the information can display the content more intuitively, it may also miss some information. Therefore, in order to avoid legal disputes and meet regulatory compliance, links to the full content page should be added. Besides, the simplified

version of the homepage can add carousel images to display bank product information, such as financial management, insurance, etc. This will not only give users more opportunities to learn about bank products, but also provide more profit opportunities for banks.

Expert B pays attention to the overall structure and logical layout of the website. Based on user habits and his software development experience, he believed that a better user experience could be achieved by dividing the page into upper and lower parts, while limiting the height of the page and avoiding page turning. At the same time, taking into account the special circumstances of banking business, he believed that the height of the upper part should be set within 20% to display the bank's logo, major business, search bar, and common functions such as switching to the ordinary version of the bank website. The lower part should be switched through the left tab. Specific business content, displaying secondary menu content can provide a better user experience. This not only makes the logic clear, but also facilitates users to switch to obtain content and improves user experience.

Expert C believes that the display of charts and images on web pages is very important. The fonts can be reduced and enlarged to facilitate the elderly and people with poor vision. Secondly, too much typing will affect the smoothness and convenience of user operations. Therefore, try to use tags such as <select/> and <button/> to turn the page. In addition, when some websites provide search content, the search results are always unsatisfactory, including the inability to accurately display the keywords searched by users, and the search does not provide specific business function pages, but focuses on article and news searches. It is recommended to increase the distinction of search fields and search content associations and tips.

3.2.2.3. *Selected Elements and Improvements*

- Text content and readability: Keep necessary text to a minimum while ensuring that font sizing is provided so that older and visually impaired users can read it easily. Use simple and clear language to directly point to the information points that users care about most.
- Simplification of user input: Minimize the number of occasions where user input is required, such as using multiple selections instead of text box input. This reduces the user's workload while also reducing the possibility of input errors.
- Use of images and diagrams: Conveying complex information through charts, flowcharts, and comparison tables helps users quickly understand different account types, loan options, and other financial products. These visualization tools should be designed to be intuitive and easy to understand.
- Auxiliary search function: Provides a powerful search function so that users can easily find the information or services they need, such as opening an account, applying for a credit card, etc. It ensures that the search results page has a clear layout and users can intuitively enter the relevant process from the search.
- Navigation and use of tags: Design a clear navigation system, not just the navigation bar at the top, but also tags inside the page that can help users quickly jump to related content.

For multi-step processes, such as account opening, using tabs to separate different steps can provide a smoother user experience.

- Promotion and expansion: For services that banks want to promote, such as financial management, insurance, and investment, special promotion areas can be designed. These areas should be designed not to interfere with the main operating processes, but to attract users' attention. This content can be presented in the form of small sliding charts or dynamic banners to avoid interrupting the user's current task flow.

Through these design considerations, the simplified version of the bank website will be a platform that is accessible, easy to navigate and beneficial to enhance customer relationships. The key to correctly applying these principles and elements is testing and feedback, which means that the design process should be iterative and include user testing and research to ensure that the improvements made truly meet the needs and expectations of users.

3.2.3. Quantitative Analysis of NZ Bank Websites' UX

We researched three websites to apply for a student account, learn about the platinum credit card annual fee information, obtain the monthly repayment information for a 36-month loan for an NZ\$20,000 car purchase, and inquire about the conservative fund performance provided by the bank.

3.2.3.1. ANZ UX Data

Table 5

ANZ's official website simplified test score

Operations	Check how to open student account	Check platinum credit card annual fee	Check monthly repayment for a 20,000 dollars vehicle	Check the conservative fund performance
Count of clicks	6/10	10/10	3/10	8/10
Count of steps back	9/10	10/10	8/10	10/10
Time to complete the task	9/10	10/10	0/10	8/10
Count of page turns	9/10	10/10	5/10	6/10
Content readability	5/10			
Navigation and other functions	10/10			
Satisfaction with intuitive operation	8/10			
Total score	144/190			

Overall, ANZ's website can meet most of the testing functions. However, when it comes to checking monthly repayment for a 20,000 dollars vehicle, the tester conducted a lot of searches. After more than 3 minutes of searching, they finally found only the option to contact the bank. ,

unable to obtain accurate data. In addition, in the investment and loans modules, a large number of pages are required to query information, and the content is complex, making it difficult to obtain information and understand the content quickly.

3.2.3.2. ASB UX Data

Table 6

ASB's official website simplified test score

Operations	Check how to open student account	Check platinum credit card annual fee	Check monthly repayment for a 20,000 dollars vehicle	Check the conservative fund performance
Count of clicks	0/10	9/10	7/10	8/10
Count of steps back	8/10	10/10	10/10	9/10
Time to complete the task	3/10	10/10	10/10	7/10
Count of page turns	3/10	9/10	10/10	6/10
Content readability	3/10			
Navigation and other functions	5/10			
Satisfaction with intuitive operation	3/10			
Total score	130/190			

ASB mixes personal bank and business bank together, which may confuse users. In terms of page design, ASB displays content relatively clearly, but too much white space leads to excessive page turning and incoherent user reading. In addition, in the account sector, the ASB design is messy, making it difficult for testers to find relevant information smoothly.

3.2.3.3. BNZ UX Data

Table 7

BNZ's official website simplified test score

Operations	Check how to open student account	Check platinum credit card annual fee	Check monthly repayment for a 20,000 dollars vehicle	Check the conservative fund performance
Count of clicks	5/10	10/10	9/10	9/10
Count of steps back	10/10	10/10	10/10	10/10
Time to complete the task	8/10	9/10	10/10	10/10
Count of page turns	9/10	7/10	9/10	4/10
Content readability	2/10			
Navigation and other functions	10/10			

Satisfaction with intuitive operation	5/10
Total score	145/190

Since the page design of the BNZ website is different from that of most websites, users need to find the location of the service link when they use it for the first time. In addition, the homepage of the BNZ website and most other pages, including secondary pages and introduction pages, always place a large size of picture in the main position without any promotional effect. Users always need to turn pages to find the content.

3.2.3.4. Comparative Data Analysis

Table 8

Summary of scores of three New Zealand banks

Bank	Task score	Website score	Total score
ANZ	121/160	23/30	144/190
ASB	119/160	11/30	130/190
BNZ	128/160	17/30	145/190

Overall, this test can be divided into two parts: task and website. Through four different tasks, we can understand the usability of these bank websites. From the data, it is found that ANZ and ASB scored lower than BNZ. This is because both banks failed to complete a task. But in terms of overall banking experience score, ANZ is significantly better than ASB and BNZ. However, BNZ has the highest overall score, ANZ is second, and ASB is the worst.

All three banks can meet the needs of users. The website designs of the three banks have their characteristics, which will lead to differences in their final user experience. Additionally, none of the three banks offer font adjustment.

The ANZ Bank website uses a traditional website design template, which is in line with the usage habits of most users. In addition, ANZ separates personal bank and business bank to avoid confusion among users. However, in some business page versions and homepages, the secondary menus are inconsistent and cannot provide user information well, so they need to be optimized.

ASB Bank mixes personal bank and business bank, which can confuse users. On the home page, all menus are hidden in the icon in the upper left corner, which is not in line with the usage habits of most people. Additionally, the bank provides scattered information and vague descriptions, making it difficult for users to use.

BNZ Bank completed four tasks. A comparison page is provided in the business menu to facilitate users to obtain key information. However, BNZ places large pictures in the main position of the page and cannot provide any effective information. Users need to turn pages to view the information.

Overall, the bank designs of ANZ and BNZ are in line with the usage habits of most users, but

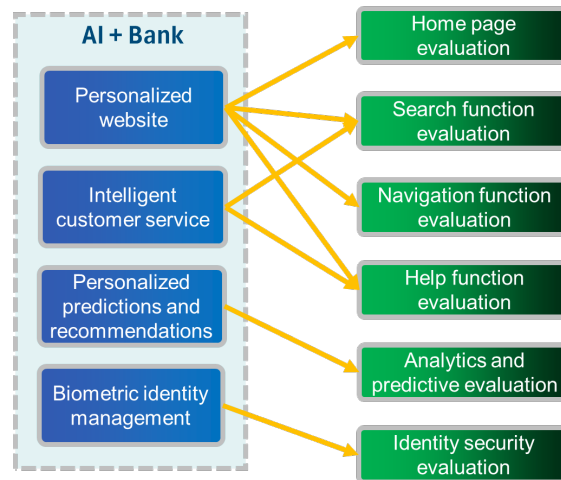
some parts need to be optimized. ASB's website design will confuse users, so it is recommended to separate personal bank and business bank and redesign the homepage.

3.3. Compare and Evaluate AI Usage in Bank Websites

In accordance with the scope determined in part 2.3.2, we invited 3 technical experts in relevant fields to conduct a evaluation of the application of artificial intelligence technology to the above three bank websites. Through the evaluation of experts, we can summarize the evaluation results into the following six aspects, and the corresponding relationship between them and the front office of the bank is shown in the figure below.

Figure 5

The corresponding relationship between expert review dimension and bank front desk business



3.3.1. Home Page Recommendation Information Evaluation

Home page recommendation information is crucial to guide user behavior, improve satisfaction, increase transaction volume, improve page stay and strengthen brand image (Krupar, 2021). Personalized recommendation content can meet user needs, promote transaction behavior, and enhance user experience and loyalty. At the same time, accurate recommendation information is also an important part of the bank's brand image, showing the bank's service level and social responsibility. Therefore, banks should pay attention to the design and optimization of homepage recommendation information. Combining the opinions of three experts, we get the table below.

Table 9

Comparison of home page information of three banks

Bank	ANZ	ASB	BNZ
Home page recommendation	Unified recommendation information for all users	Lack of referral information	Images take up too much space, with unified recommendations for all users.
Diversity	Information is covering all aspects of the bank's business	Insufficient information	Information is covering all aspects of the bank's business
Real-time	Changes in real time based on current business requirements	Insufficient information	Changes in real time based on current business requirements
Degree of individuation	Lower, there is no personalized information specifically provided for different users		
Recommendation algorithm	No personalized recommendation algorithm is used		

Table 10

The problems and suggestions of the home pages of three banks given by the experts

Problem	Bank	Suggestion
Recommendation information lacks personalization	ANZ, ASB, BNZ	Implement personalized recommendation algorithms to tailor suggestions based on user preferences and past behavior, diversifying recommendations across various banking activities.
Home page lacks recommendations	ASB	Enhance homepage recommendations with comprehensive banking content, expanding coverage across all business aspects.
Image takes up a large portion of the page	BNZ	Minimize image dominance on the page, reallocating space to prioritize recommendations.

As can be seen from the above table, ANZ and BNZ can use the home page space to provide diversified and real-time recommendation information. However, BNZ wastes space on the layout of the home page, and ASB's home page lacks recommendation information, which makes them give up the home page, an important window to recommend users. In terms of real-time, ANZ and BNZ can update recommendations in real time based on current business needs, while ASB's home page content changes little.

In addition, the personalized degree of recommendation information of the three banks is low, and no customized information is provided for different users after user login. Therefore, it is suggested that banks should strengthen the diversity and real-time of homepage recommendation content, and consider introducing personalized recommendation algorithms to improve user experience and satisfaction.

3.3.2. Search Function Evaluation

The search function of bank website provides a convenient way for users to search information

quickly. With the search function, users can easily find the banking products, services or related information they need without having to manually navigate the entire website. This not only saves users time and effort, but also improves the accessibility of website content.

Table 11

Comparison of search function of three banks given by the experts

Bank	ANZ	ASB	BNZ
Navigation bar location	In the top navigation bar, it is not easy to find	Prominently displayed on the home page	In the top navigation bar, it is not easy to find
Accuracy	Lower	Lower	Intermediate
Correlation ranking	Lower	Lower	Intermediate
Search suggestion	Provides suggestions for "Your searches", "Popular searches"	Provides simple search recommendations	Provides "Popular searches" suggestions
Search range	All results, Support information and Download are provided	No different search scope options are provided	All BNZ, Support, Branches and ATMs were provided
Filtration and screening	No filtering and filtering function	No filtering and filtering function	Three different search areas
User feedback function	No user feedback on search results is provided	No user feedback on search results is provided	Provides user feedback on search results
AI large model	No		
voice search function	No		

Table 12

The problems and suggestions of the search function of three banks

Problem	Bank	Suggestion
Search accuracy and relevance ranking	ANZ, ASB	Improve the accuracy and relevance ranking of search results and consider adopting smarter search algorithms.
Lack of filtering and filtering functions	ANZ, ASB, BNZ	Add filtering and filtering features that allow users to refine search results based on specific criteria.
Lack of user feedback	ANZ, ASB	Introduce a user feedback feature that allows users to evaluate search results and suggest improvements to continuously optimize the search experience.
Voice search is not provided	ANZ, ASB, BNZ	Explore adding a voice search function to enable users to search by voice input, improving the convenience of the search experience.

Lack of options for search ranges	ASB	Add different search scope options so users can filter search results as needed.
-----------------------------------	-----	--

As can be seen from the above table, ANZ and ASB provide search recommendations, but the search function is low in accuracy and relevance ranking, and neither bank provides filtering and user feedback functions. In contrast, BNZ has a moderate ranking of search accuracy and relevance, offers Popular searches suggestions, offers multiple search scope options, and offers user feedback capabilities, but still doesn't use AI Large language models or offer voice searches. To sum up, compared with ANZ and ASB, BNZ is more comprehensive in terms of search functions, but there is still a lot of room for improvement for all banks. They do not introduce more accurate search algorithms and increase user interaction functions based on AI models or voice search, so as to improve search efficiency and user experience.

The expert evaluation found that the search modules of the three major banks in New Zealand were based on traditional keyword search methods. Keyword search is the technical framework of the early Internet development stage, with origins dating back to the mid-1990s to the early 2000s. Early keyword search techniques relied mainly on simple indexing and matching algorithms, ignoring context and intent and returning results based only on the occurrence of the user's entered keywords in the text. This technical framework was considered a very efficient way to Search for information on The Internet at the time because of its simplicity and ability to return results in a relatively short time (The Complete History & Evolution of Web Search, n.d.).

However, with the continuous development of the Internet and the continuous improvement of users' requirements for search experience, the keyword-based search technology has gradually revealed many limitations, such as low matching degree, difficulty in handling complex queries, no support for natural language, no personalized recommendation, semantic ambiguity, and insufficient ability to predict user needs, which affect the accuracy and integrity of search results. With the development of artificial intelligence and natural language processing technology, new search technology frameworks continue to emerge, such as semantic search, voice search and image search, which will gradually replace the traditional keyword based search technology.

3.3.3. Navigation Function Evaluation

The role of web navigation is to help users quickly access different pages or content of a website, provide a clear structure, save time and effort, and improve the user experience. The navigation module for comparing the three banks is shown in the following table.

Table 13

Comparison of navigation function of three banks given by the experts

Bank	ANZ	ASB	BNZ
Navigation	Navigate through the main	Highlighting the search function	In main menu

mode	menu or drop-down menu at the top, while using ICONS at key locations to navigate to different services.	aims to make it the primary navigation entry. However, the main page conceals the navigation menu in the upper left corner, hindering customers' prompt discovery.	navigation mode, the first and second level navigation items are presented simultaneously in the web page
Navigation style	The style of the navigation bar on some pages is inconsistent	The navigation bar has a consistent style	The navigation bar has a consistent style
Navigation entry popularization	Standard terminology that requires some knowledge of banking	Easy to understand and friendly to new users	Standard terminology that requires some knowledge of banking
Intelligent navigation	Navigation menus cannot be presented according to user preferences		
Voice navigation	No		

Table 14

Advantages and disadvantages of different types of navigation

Type	Advantage	Disadvantage	Bank
Text link	Simple and clear, easy to understand and use. Fast loading and SEO friendly.	Limited space makes it difficult to display a large number of navigation options. The visual effects are weak and unattractive.	
Icon style	The ICONS are intuitive and can quickly convey information. Beautiful, enhance the visual appeal of the page.	There may be a barrier to understanding, requiring the user to have some understanding of the meaning of the icon. Not suitable for displaying a large number of navigation options.	ANZ,ABS, BNZ
Drop-down	Space-saving, able to display a large number of navigation options. The structure is clear and easy for users to browse.	Users may need additional actions to see more options. Not easy to operate on mobile devices.	ANZ

Table 15

The problems and suggestions of the navigation function of three banks

Problem	Bank	Suggestion
Navigation entries are not particularly easy to understand	ANZ, BNZ	Further simplifying the language of navigation entries, using more easy-to-understand terms and ICONS, and lowering the threshold for users to understand banking services.
Hiding the navigation Menu in the upper left corner, which is not conducive to timely discovery by customers	ASB	Redesign the navigation mode, placing the navigation menu in a more prominent position, while highlighting the search function, balancing search and traditional navigation methods, and improving the user navigation experience.

Navigation menus cannot be presented according to user preferences	ANZ, ASB, BNZ	Explore the function of intelligent navigation menu, personalize the navigation menu according to the user's historical operation and preference, and improve the intelligent level of user navigation experience.
Voice navigation is unavailable	ANZ, ASB, BNZ	Consider introducing the voice navigation function, so that users can navigate through voice commands, and improve the diversity and convenience of navigation methods.

It can be seen that the three banks adopt different navigation methods. ANZ and BNZ adopt the traditional main menu navigation combined with icon navigation and other modes, which is more intuitive. ASB, on the other hand, tried to use the search function as the main navigation entry, but the results were modest. Search as the main entry may increase user learning costs, and the accuracy and completeness of search results affect user experience. Relying too heavily on search may neglect other important features. It is recommended that ASB consider the combination of search function and traditional navigation in website design.

To sum up, the three banks can consider the use of AI technology for personalized and intelligent navigation improvement, and present navigation items to users in a targeted way to improve user experience and website navigation efficiency.

3.3.4. Help Function Evaluation

The "Help" module of a traditional website usually consists of a series of static or dynamic web pages that provide information about banking services, products, frequently asked questions (FAQs), contact details, etc.

Table 16

Comparison of help function of three banks given by the experts

Bank	ANZ	ASB	BNZ
Mode	Use the online help center to provide documentation, FAQ and operation guide, customer service phone and email	Through search help information access, at the same time, according to the switchable viewer, popular, latest, helpful recommendations	Obtain help information through search, and combine different modules with ICONS or text links to obtain help
The search function of the help module is consistent with that of the search module	No	Yes, both results match	Yes, both results match
Phone or Email service	Yes		
Smart assistant or voice help	No		

Table 17

The problems and suggestions of the help function of three banks

Problem	Bank	Suggestion
help and search independently of each other	ANZ, ASB, BNZ	Integrate into a unified platform or system to share search frameworks and resources.
Lack of intelligent assistants	ANZ, ASB, BNZ	Establish a unified knowledge base, including frequently asked questions, operation guidelines and other information, for both to call together to ensure the consistency and accuracy of information.
Lack of voice help	ANZ, ASB, BNZ	This can be addressed by introducing virtual assistants, integrating third-party platforms, providing self-service capabilities, and continuous improvement.

It can be seen that the traditional web page help module has some shortcomings. For example, the information update may not be timely, the help module in the form of static web pages is difficult to achieve real-time interaction, users need to manually browse the help document, personalized service is limited, lack of interaction and visual appeal and other problems, resulting in a relatively poor user experience. These shortcomings may affect the efficiency and satisfaction of users in obtaining help and solving problems. It is suggested that banks improve the quality and user experience of help modules by updating information, increasing interactivity, optimizing search function and providing personalized services.

In terms of module division, compared with the search function in 3.3.2, the functions of "help" and "search" in the traditional banking business model have different purposes and use scenarios. "help" mainly provides help documents, frequently asked questions and other information, while "search" is used for users to quickly find specific information. While separating them allows for better management and maintenance of their respective functions, modern users prefer a simplified and integrated user experience, they want to find the information they need in a single search, and they want the search results to be personalized and intelligently matched to their needs, and combining them may be a better choice. As can be seen from the above table, the search modules in the "help" and "search" modules of ASB and BNZ Bank have adopted a common search framework, but ANZ is still a separate technical framework. In order to improve the user experience, simplify operations, and make better use of team resources, the three banks can consider making more improvements in the user "help" and "search" modules.

3.3.5. Analytics and Predictive Evaluation

Table 18

Comparison of analytics and predictive function of three banks given by the experts

Problem	Bank	Suggestion
----------------	-------------	-------------------

Lack of personalized intelligence analytics and predictions	ANZ, ASB, BNZ	Use machine learning algorithms to build predictive analytics models to analyze customer transaction history, behavior patterns, and preferences to meet customer needs ahead of time.
---	---------------	--

While intelligent analytics and predictive services have been shown to provide more accurate personalized services and enhance customer satisfaction and loyalty, they have yet to be fully implemented by the three banks. This may be due to technical implementation challenges, data privacy and security issues, and concerns about the potential risks of the service. However, as technology continues to advance and the need for personalized services increases, banks may need to step up and actively adopt intelligent analytics and predictive technologies where permitted by law to improve service levels and customer experiences.

3.3.6. Identity Security Evaluation

Bank authentication is critical, and biometric AI technology provides a safe and convenient solution for this. By using an individual's physical characteristics for authentication, banks can improve account security and prevent unauthorized access and fraud (Venkatraman & Delpachitra, 2008). The statistics of bank identification functions are shown in the following table.

Table 19

Comparison of identity security function of three banks given by the experts

Bank	ANZ	ASB	BNZ
User name and password authentication	Yes		
SMS verification	Some functions require SMS verification		
Email verification	Some features email alerts and confirmations		
Biometric verification	Yes, Use voice authentication for large transfers		
Geolocation verification	No		

Table 20

The problems and suggestions of the identity security function of three banks

Problem	Bank	Suggestion
Insufficient biometric verification	ANZ, ASB, BNZ	Introduce a two-factor authentication mechanism, combined with passwords, SMS verification codes, biometrics and other authentication methods to improve security.
No geolocation verification	ANZ, ASB, BNZ	Reduce the risk of identity theft and fraud by using geolocation verification technology to ensure that a user's login or transaction behavior is consistent with their regular location of activity

It can be seen that the three banks use the same authentication method, and this traditional password, SMS and email authentication method has shortcomings in terms of security and convenience. Passwords, text messages and emails are vulnerable to theft or mobile island cyber attacks. To improve the security and user experience of authentication, banks can adopt biometrics to improve the accuracy and security of authentication and reduce the risk of password leakage and fraud. On the other hand, a two-factor authentication mechanism can be implemented to combine multiple authentication methods such as password authentication and biometrics to improve security.

3.4. Brief Summary

By synthesizing 3.1, 3.2 and 3.3, we can get the advantages and disadvantages of the three banks in 5 different categories

Table 21

Advantages and disadvantages of the three banks in 5 different categories

Category	Bank	Advantage	Disadvantage
Functionality	ANZ	– Comprehensive functionality regarding taking deposits and extending loans	– Lacking marketing information – Some features are more complex and have a learning curve for initial use
	ASB	– Comprehensive functionality regarding taking deposits and extending loans	– Lacking marketing information – Some service functions are insufficient and need to be handled offline
	BNZ	– Comprehensive functionality regarding taking deposits and extending loans	– Lacking marketing information – lack of insurance quoting in financial services – Difficult in finding the customer service portal – Some high-end services are limited to a specific clientele
Usability	ANZ	– Simplification of operation steps (3 steps for account opening) – Comprehensive and clear structure design – User-friendly and intuitive interface design – Excellent navigation design	– Some secondary menus are inconsistent and cannot provide user information well
	ASB	– Creative information search design	– Limiting users' visibility of the overall process in the design of multi-step forms' structural interactivity – Lack display information in the home page – Non- intuitive navigation design – Scattered information and vague descriptions
	BNZ	– Clear navigation design	– Complicated structure in interactivity – Unfriendly interface design (radio buttons) – Some services are not easy to find

Visualization	ANZ	– Brand colour bright (blue), most of the web visual presentation is consistent, uniform style page style, responsive page design	– The interface design is a little stale – There are two systems, and some functional modules linked to older versions bring instability
	ASB	– Brand colour bright (yellow), visual presentation is consistent, modern interface design, visual pleasure. Style uniform page style.	– Poor UI design experience – Some of the chart details are not concise and detailed
	BNZ	– Good consistency	– Brand colour lacks brand clarity and distinctiveness. – The interface design is slightly outdated, pictures occupy too much of the page, and some page design styles are scattered
Reliability	ANZ	– The websites of these three banks operate stably and meet most of their business needs	– Insufficient use of biometrics for account security
	ASB		– Some regions, users, or devices may have abnormal access
	BNZ		
Technology	ANZ	– All three banks offer a variety of online banking services using relatively mature technology	– Technology updates are slow and new features such as AI take a long time to roll out (such as chatbots or personalized recommendations)
	ASB		– Some new functions have minor problems that need to be improved, and the introduction of new technologies and functions is lagging behind
	BNZ		– The introduction of new technologies and new functions lags

4. Conclusion

This study aims to compare the top three banking websites in NZ from the user's perspective to enhance the websites' user experience. We first conduct an integrated assessment of banking websites, then focus on the simplification and AI application of the website's design, as shown in sections 4.1, 4.2, and 4.3.

4.1. Integrated Assessment Conclusion

In the integrated assessment, we propose a new assessment matrix model with dimensions of strategies and 5 evaluation categories containing 12 factors. We evaluate ANZ, ASB and BNZ websites based on this model, using a 5-point evaluation scale, adopting expert and automatic data collection methods, and employing a simple scoring without preferences calculation method. Simultaneously, PCA is used to find the key factors affecting UX, while correlation analysis is employed to examine the relationship between these factors. The results show that the banking websites in NZ excel in aspects of deposits taking, loans extending, information design, sensory design, consistency, and accessibility, but are weak in aspects of financial services, customer services, interactivity and performance, and lacking in marketing and technology aspects. Through

the integrated and comparative analysis, banking websites need to improve in four aspects: financial services, customer services interactivity and performance, and supplement in two aspects: marketing and technology, as shown in sections 4.1.1 and 4.1.2.

4.1.1. Improvements

Banking websites need to improve in financial services, customer services interactivity and performance. Specifically, they need to include functionality for insurance quoting and ensure that the customer service portal is prominent and easy to find. Additionally, regarding interactivity, simplification of steps, comprehensive and clear structure design, and user-friendly interface elements design should be implemented, as described in more detail in section 4.2. Finally, optimizing images by compressing or resizing could help enhance performance.

4.1.2. Supplements

Banking websites need to supplement marketing and technology aspects. Firstly, they should add marketing product information on the homepage and create incentives for customer loyalty schemes. Additionally, more cutting-edge technology applications need to be implemented, as described in more detail in section 4.3.

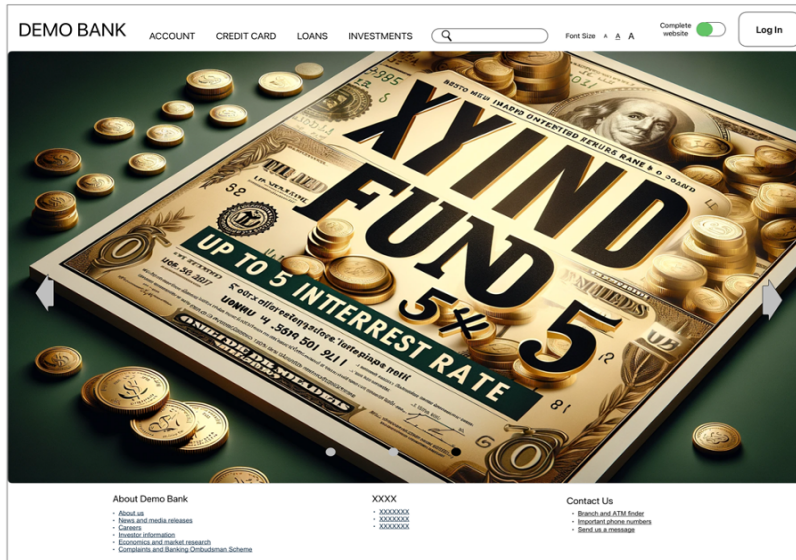
4.2. Demonstration and Suggestions for Simplified Versions of Banks

4.2.1. Basic Template Website Design for a Simplified Version of Bank

The basic template homepage includes navigation, search, font adjustment, switching between simplified and normal versions, and online banking login functions. The middle part is a carousel display, used for bank product promotion. The bottom is the common basic information of the website. In the design of the overall simplified version of the website, we set the web content on one screen to avoid page turning.

Figure 6

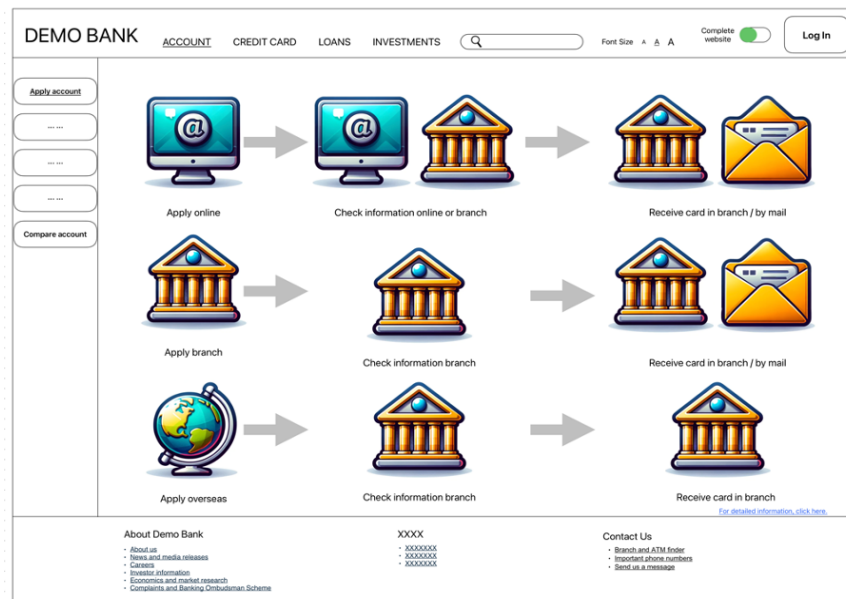
A simplified version of bank website home page demonstration



The Apply account page shows the functions of applying for an account. Based on the research results, we used pictures and less text to describe the application process to make it easier for users to understand. In addition, the header and bottom of the simplified version of the website are consistent with the homepage, and a secondary label is added on the left side of the middle to facilitate users to switch content according to business. This kind of page is mostly used for product introduction and detail pages.

Figure 7

A simplified version of bank website apply account page demonstration



The Account comparison page describes the account comparison. It uses a table to facilitate users to understand the differences between different accounts and choose the appropriate account.

According to our research, when there are multiple choices, applying table comparison can enhance the user experience. Therefore this kind of page will be mostly used for multi-product comparison pages.

Figure 8

A simplified version of bank website compare account page demonstration

DEMO BANK				
ACCOUNT CREDIT CARD LOANS INVESTMENTS <input type="text"/> Font Size: <small>A</small> <small>A</small> <small>A</small> Complete website <input checked="" type="checkbox"/> Log In				
Apply account XXX XXX XXX XXX XXX XXX Compare account		Daily account	Student account	Teens account
	Number of Cards	1	1	1
	Daily limit	50,000	20,000	5,000
	Annual fee	30	-	10
	Transfer fee	1.2%	-	0.3%
	Card network	Visa Mastercard American Express	Visa Mastercard	Visa Mastercard American Express
	Interest rate	0.65%	0.3%	0.5%
	Contactless payment	Yes	Yes	No
For detailed information, click here.				
<div> <div> About Demo Bank <ul style="list-style-type: none"> About us Press and media releases Careers Investor information Economics and market research Compliance and Banking Ombudsman Scheme </div> <div> XXXX <ul style="list-style-type: none"> XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX </div> <div> Contact Us <ul style="list-style-type: none"> Branch and ATM finder Important phone numbers Send us a message </div> </div>				

The check eligibility page displays the conditions for applying for a loan. Through these short statements, users can quickly understand the required conditions. This page style will be used on pages that display element information, such as details pages and product introduction pages.

Figure 9

A simplified version of bank website check loan eligibility page demonstration

DEMO BANK	
ACCOUNT CREDIT CARD LOANS INVESTMENTS <input type="text"/> Font Size: <small>A</small> <small>A</small> <small>A</small> Complete website <input checked="" type="checkbox"/> Log In	
Check eligibility Personal loan XXX XXX XXX XXX XXX XXX	
	<ul style="list-style-type: none"> Age 18 or older. Regular income. Sufficient post-expense funds for repayments. NZ citizen or permanent resident, or non-resident with qualifying work visa. Valid ID and income proof.
	For detailed information, click here.
	Additional for tertiary students: <ul style="list-style-type: none"> Full-time enrollment, with course duration remaining. Income directed to a Demo Bank account.
	For detailed information, click here.
<div> <div> About Demo Bank <ul style="list-style-type: none"> About us Press and media releases Careers Investor information Economics and market research Compliance and Banking Ombudsman Scheme </div> <div> XXXX <ul style="list-style-type: none"> XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX </div> <div> Contact Us <ul style="list-style-type: none"> Branch and ATM finder Important phone numbers Send us a message </div> </div>	

4.2.2. Suggestions for Improving the Simplified Version of the Bank Website

Based on the above research, the simplified version of website development can provide a better user experience and is in line with the current construction ideas of bank websites. Therefore, New Zealand Banks can consider developing a simplified version of the bank's official website while providing a complete official website. Through research on users' high-frequency businesses and combining the bank's own conditions, banks can provide appropriate simplified services. And combine it with page elements with excellent user experience, or refer to the general template of this study for development. Then quickly iterate through user feedback. Improve better online services and attract more users.

4.3. AI Application Conclusion and Improvement Suggestions

4.3.1. Overall Evaluation and Conclusions

ANZ can use the home page space to provide diverse, real-time recommendation information, but the search function is less accurate and relevant, without filtering and user feedback. In the navigation module, the traditional main menu navigation combined with icon navigation mode is used, which is intuitive but has certain limitations.

The ASB home page lacks recommendation information, giving up an important window to recommend users, and the accuracy and relevance ranking of the search function need to be improved. It does not provide filtering and user feedback. In terms of navigation modules, they try to use the search box as the main navigation entry on the home page, but the results are mediocre.

In terms of home page recommendation, BNZ can use the home page space to provide diversified and real-time recommendation information, but there may be a waste of space in the layout of the web page. The search feature is relatively comprehensive, offering popular search suggestions and user feedback, but it still doesn't use large AI models or offer voice searches. The navigation module adopts the traditional main menu navigation combined with the secondary navigation mode, which is similar to the other two banks.

In short, the application of artificial intelligence in the three banks has started initial attempts, such as the use of voice recognition in large transfers, but it is still very limited, the three banks lack personalized services and intelligent analysis and prediction functions, and have not made full use of intelligent technology to improve the user experience and personalized service level. It is suggested that the three banks strengthen the application of artificial intelligence technology, including improving the accuracy and personalization of search and help functions, optimizing the diversity and real-time of recommendation information on the home page, improving the intelligence of navigation module, introducing intelligent analysis and prediction technology, and providing personalized services.

4.3.2. Improvement Suggestions

In the bank website, the personal panel after the user logs in is the core page presented by artificial intelligence technology. Combined with the improvement suggestions given by the experts in the evaluation, I have drawn the following sketches and actual renderings of the bank website improvement.

The page uses intelligent algorithms to analyze users' historical transaction records, preferences and behavior patterns to achieve personalized content and function presentation. Through intelligent recommendation, personalized financial advice and other functions, to help users better manage their own financial management, improve the user experience. In addition, the personal panel provides convenient operation and query functions, and users can easily view account summary, transaction records and other information, saving time and energy. Through intelligent search and recommendation technology, users can quickly find the information they need to improve user satisfaction.

Figure 10

Artificial intelligence in the bank customer personal panel page modification sketch

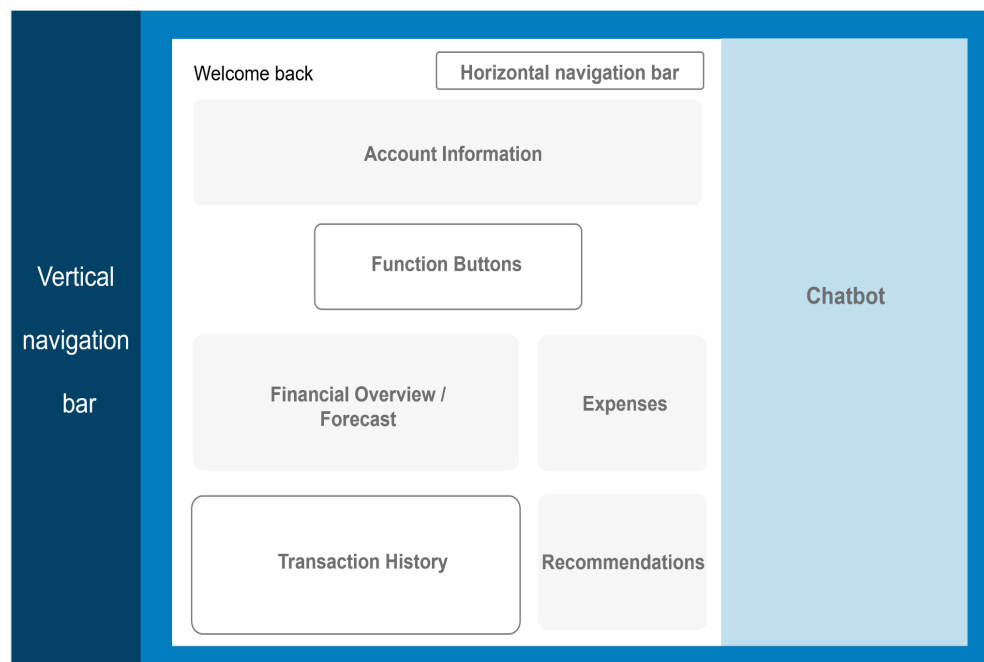


Figure 11

Actual rendering of artificial intelligence on the personal panel page of a bank customer



With Setting, you can customize the display content of the personal panel

- Top horizontal navigation bar

The top horizontal navigation bar is the user's personal information, including the avatar and user name, and displays system messages and prompts.

- Side vertical navigation bar

Provide users with navigation options such as Home, setting, logout, etc.

- Account Summary

Visual panel at a glance. Displays summary information about major accounts, such as current deposits, time deposits, credit cards, etc. Below is a row of function buttons, such as transfer, payment, financial management, bills, etc., sorted according to the user's transaction history and preferences. Provides quick links to individual account details pages.

- Smart Search / Chatbot

To the right is an intelligent chatbot, with a search box below the area where users can enter a keyword search or use voice search.

- Smart recommendations and financial advice

Displays recommended products, services or activities based on user preferences and recent transaction history. Displays personalized financial advice and portfolio recommendations, including expected returns, risk assessments, and investment recommendations. Users can click to

view details or perform related actions, such as buying funds or adjusting investment ratios.

4.4. Reflection and Outlook

Although we have compared and analyzed the websites of three major banks in New Zealand from different levels and perspectives, and given improvement suggestions, there are still many limitations in our work, including the scope of the study, multi-perspective analysis, and more comparative methods. In future work, we can proceed from the following aspects:

- Expanding the scope of the study

Considering the complexity and diversity of the banking industry, the scope of the study could be expanded to analyze more banks in the future. You can include banks of different sizes, different types of banks, and banks in different countries or regions to get a more complete understanding of the user experience of a bank's website.

- Multi-perspective analysis

In addition to user experience, consider analyzing bank websites from more perspectives. Each of these factors has a significant impact on the user experience, and by considering them together, a more comprehensive assessment can be provided.

- Adopt more comparative methods

In addition to the adopted integrated assessment, simplified assessment and AI application assessment methods, more comparative methods can be explored and adopted to obtain more specific and objective data, resulting in a deeper understanding of users' reactions and needs to the bank website.

By carrying out future work in these aspects, the depth and breadth of research on bank website user experience can be further enhanced, and more specific and effective guidance and support can be provided for the digital transformation of the banking industry.

4.5. Learned from the Project

- Fifi Zhang / 23011135

From this project, I learned a systematic method to evaluate banking websites from a UX perspective. This included developing a new assessment matrix model based on UX conceptual frameworks and quality evaluation methods. I selected a 5-point Likert scale after comparing various scaling options, ensuring a balanced approach to evaluation. The project also involved expert and automatic evaluation methods, and I adopted a simple scoring calculation method without preferences. All these are grounded in extensive literature reviews. In the analysis and discussion phase, I applied PCA and correlation analysis to explore the relationships between different factors. Additionally, comparative analysis was used to evaluate and compare the top

three banking websites. Overall, this project enhanced my ability to perform an integrated UX evaluation of banking websites.

● Tong Ren / 21009022

During the process of this research, I gained an in-depth understanding of UX-related knowledge and applied it. I was mainly responsible for the design of the simplified version bank website, which not only improved the accessibility of the website, but also optimized the user's browsing experience. By comparing several bank websites, I found some shortcomings, such as unclear navigation and scattered information. This prompted me to pay attention to user needs and optimize user experience when designing the bank website template. In this process, I combined theory with practical operations to apply UI design and UX experience in actual design. In the future, I hope to apply the knowledge learned in this study to my study and work, combine it with UX knowledge, and continue to seek innovation in the field of software development.

● Xin Xie / 23013249

Due to the complexity of banking business, analyzing bank websites is not an easy task. Through this project, I have deepened my understanding of the Bank of New Zealand website from multiple levels and angles. In addition, I gained valuable insights into the dynamics of teamwork. Each team member contributes different expertise, creating a collaborative environment.

For me, the application and comparison of artificial intelligence technology in bank websites is my research focus in this project. I first conducted a literature review to establish a basic understanding of the application of AI to banking websites. At the same time, I designed the method, invited experts to evaluate, integrated opinions, and gave sketches and renderings of improvements. Working with domain experts allows us to glean insights from different perspectives, enriching our collective understanding. The work will become valuable experience for me to conduct efficient team cooperation and user experience evaluation of IT products in the future IT work.

References

- Acharya, R. N., Kagan, A., Lingam, S. R., & Gray, K. (2008). Impact Of Website Usability On Performance: A Heuristic Evaluation Of Community Bank Homepage Implementation. *Journal of Business & Economics Research (JBER)*, 6(6), Article 6. <https://doi.org/10.19030/jber.v6i6.2439>
- Achour, H. (n.d.). AN EVALUATION OF INTERNET BANKING AND ONLINE BROKERAGE IN TUNISIA.
- Agarwal, A., Singhal, C., & Thomas, R. (n.d.). Banks are already strengthening customer relationships and lowering costs by using artificial intelligence to guide customer engagement. Success requires that capability stacks include the right decisioning elements.
- Akerkar, R. (2019). Employing AI in Business. In R. Akerkar (Ed.), *Artificial Intelligence for Business* (pp. 63–74). Springer International Publishing. https://doi.org/10.1007/978-3-319-97436-1_6

- Alborzi, M., & Khanbabaei, M. (2016). Using data mining and neural networks techniques to propose a new hybrid customer behaviour analysis and credit scoring model in banking services based on a developed RFM analysis method. *International Journal of Business Information Systems*, 23(1), 1–22. <https://doi.org/10.1504/IJBIS.2016.078020>
- Alonso-Ríos, D., Luis-Vázquez, I., Mosqueira-Rey, E., Moret-Bonillo, V., & del Río, B. B. (2009). An HTML analyzer for the study of web usability. In 2009 IEEE International Conference on Systems, Man and Cybernetics (pp. 1224–1229). IEEE. <https://doi.org/10.1109/ICSMC.2009.5345901>
- Alwan, Z., & Younis, M. (2017). Detection and prevention of SQL injection attack: A survey. *International Journal of Computer Science and Mobile Computing*, 6(8), 5-17.
- Analysis—Euromonitor: Passport. (n.d.). Retrieved March 12, 2024, from <https://www-portal-euromonitor-com.ezproxy.massey.ac.nz/analysis/tab>
- ANZ sells 16.5 percent stake in AmBank. (2024, March 11). Global Banking News. <http://global.factiva.com/redir/default.aspx?P=sa&an=GLOBAL0020240311ek3b0002y&cat=a&ep=ASE>
- Ardito, C., Secundo, G., & Spilotro, C. (n.d.). Enhancing Customer Experience in Banking: Building a Digital Human using Algho Platform and Artificial Intelligence.
- Azeem, S. (2020). Customer behaviours and online banking in New Zealand. Massey University. <https://mro.massey.ac.nz/server/api/core/bitstreams/06856a10-c42a-4073-8f86-e6ce6966fc73/content>
- Banking on AI | Banking Top 10 Trends for 2024. (n.d.).
- Biswas, S., Carson, B., Chung, V., Singh, S., & Thomas, R. (n.d.). AI-bank of the future: Can banks meet the AI challenge?
- Caddy, J., Delaney, L., & Fisher, C. (2020). Consumer payment behaviour in Australia: Evidence from the 2019 Consumer Payments Survey. Reserve Bank of Australia. <https://www.ausbanking.org.au/wp-content/uploads/2022/06/Consumer-Payment-Behaviour-in-Australia-Evidence-from-the-Consumer-Payments-Survey-RBA-2019.pdf>
- Chanchamnan, P., San, S., & Ho, C. (2023). Design in the age of Artificial Intelligence: A literature review on the enhancement of User Experience Design with AI. <https://doi.org/10.13140/RG.2.2.33028.91523>
- Chen, J.-S., Le, T.-T.-Y., & Florence, D. (2021). Usability and responsiveness of artificial intelligence chatbot on online customer experience in e-retailing. *International Journal of Retail & Distribution Management*, 49(11), 1512–1531. <https://doi.org/10.1108/IJRDM-08-2020-0312>
- Chiou, W.-C., Lin, C.-C., & Perng, C. (2010). A strategic framework for website evaluation based on a review of the literature from 1995–2006. *Information & Management*, 47(5–6), 282–290. <https://doi.org/10.1016/j.im.2010.06.002>
- Chmielarz, W., & Zborowski, M. (2018). Analysis of e-Banking Websites' Quality with the Application of the TOPSIS Method – A Practical Study. *Procedia Computer Science*, 126, 1964–1976. <https://doi.org/10.1016/j.procs.2018.07.256>
- Chmielarz, W., & Zborowski, M. (2020). The Selection and Comparison of the Methods Used to Evaluate the Quality of E-Banking Websites: The Perspective of Individual Clients. *Procedia Computer Science*, 176, 1903–1922. <https://doi.org/10.1016/j.procs.2020.09.230>
- Chmielarz, W., & Zborowski, M. (2020). Towards Sustainability in E-Banking Website Assessment Methods. *Sustainability*, 12(17), 7000. <https://doi.org/10.3390/su12177000>
- Chung, W., & Paynter, J. (2002). An evaluation of Internet banking in New Zealand. *Proceedings of the 35th Annual Hawaii International Conference on System Sciences*, 2410–2419. <https://doi.org/10.1109/HICSS.2002.994178>
- Correa, R., & Goldberg, L. S. (2022). Bank complexity, governance, and risk. *Journal of Banking & Finance*. <https://doi.org/10.1016/j.jbankfin.2020.106013>
- Cycles, T. text provides general information S. assumes no liability for the information given being complete or correct D. to varying update, & Text, S. C. D. M. up-to-D. D. T. R. in the. (n.d.). Topic: Banking industry in New Zealand. Statista. Retrieved May 16, 2024, from <https://www.statista.com/topics/11542/banking-industry-in-new-zealand/>
- Daffertshofer, A., Lamoth, C. J. C., Meijer, O. G., & Beek, P. J. (2004). PCA in studying coordination and variability: A tutorial. *Clinical Biomechanics*, 19(4), 415–428. <https://doi.org/10.1016/j.clinbiomech.2004.01.005>
- Dahlhaus, T., & Welte, A. (2021). Payment habits during COVID-19: Evidence from high-frequency transaction data (Bank of Canada Staff Working Paper No. 2021-43). Bank of Canada, Ottawa. <https://www.econstor.eu/handle/10419/247423>
- Dang, D. (2020). Developing a website with user experience. <https://urn.fi/URN:NBN:fi-amk-2020102826946>
- Designrly Understanding: Information Needs for Model Transparency to Support Design Ideation for AI-Powered User Experience | Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems. (n.d.). Retrieved April 25, 2024, from <https://dl.acm.org/doi/abs/10.1145/3544548.3580652>
- Dianat, I., Adeli, P., Asgari Jafarabadi, M., & Karimi, M. A. (2019). User-centred web design, usability and user satisfaction: The case of online banking websites in Iran. *Applied Ergonomics*, 81, 102892. <https://doi.org/10.1016/j.apergo.2019.102892>

- Diniz, E., Porto, R. M., & Adachi, T. (2005). Internet Banking in Brazil: Evaluation of Functionality, Reliability and Usability. *Electronic Journal of Information Systems Evaluation*, 8(1), Article 1.
- Dofadar, D. F., Abdullah, H. Md., Khan, R. H., Rahman, R., & Ahmed, Md. S. (2022). A Comparative Analysis of Lumpy Skin Disease Prediction Through Machine Learning Approaches. *2022 IEEE International Conference on Artificial Intelligence in Engineering and Technology (IICAIET)*, 1–4. <https://doi.org/10.1109/IICAIET55139.2022.9936742>
- Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B.
- Erlingsson, C., & Brysiewicz, P. (2017). A hands-on guide to doing content analysis. *African Journal of Emergency Medicine*, 7(3), 93–99. <https://doi.org/10.1016/j.afjem.2017.08.001>
- Fang, X., & Holsapple, C. W. (2007). An empirical study of web site navigation structures' impacts on web site usability. *Decision Support Systems*. <https://doi.org/10.1016/j.dss.2006.11.004>
- Fares, O. H., Butt, I., & Lee, S. H. M. (2023). Utilization of artificial intelligence in the banking sector: A systematic literature review. *Journal of Financial Services Marketing*, 28(4), 835–852. <https://doi.org/10.1057/s41264-022-00176-7>
- Garrett, J. J. (2011). *The elements of user experience: User-centered design for the web and beyond* (2nd ed). New Riders.
- Garett, R., Chiu, J., Zhang, L., & Young, S. D. (2016). A Literature Review: Website Design and User Engagement. *Online Journal of Communication and Media Technologies*, 6(3), 1–14. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4974011/>
- Georgescu, M., & Jeflea, V. (2015). The particularity of the banking information system. **Procedia Economics and Finance*, 20*, 268–276. [https://doi.org/10.1016/S2212-5671\(15\)00074-X](https://doi.org/10.1016/S2212-5671(15)00074-X)
- Gigante, G., & Zago, A. (2022). DARQ technologies in the financial sector: Artificial intelligence applications in personalized banking. *Qualitative Research in Financial Markets*, 15(1), 29–57. <https://doi.org/10.1108/QRFM-02-2021-0025>
- Guru, B. K., Shanmugam, B., Alam, N., & Perera, C. J. (n.d.). An Evaluation Of Internet Banking Sites In Islamic Countries. How to Evaluate a Website User Experience? (n.d.). Retrieved March 5, 2024, from <https://www.analyticodigital.com/blog/how-to-evaluate-a-website-user-experience>
- Hussain, J., Ul Hassan, A., Muhammad Bilal, H.S., et al. (2018). Model-based adaptive user interface based on context and user experience evaluation. *Journal of Multimodal User Interfaces*, 12(1), 1–16. <https://doi.org/10.1007/s12193-018-0258-2>
- Jaiwant, S. V. (2022). Artificial Intelligence and Personalized Banking. In *Handbook of Research on Innovative Management Using AI in Industry 5.0* (pp. 74–87). IGI Global. <https://doi.org/10.4018/978-1-7998-8497-2.ch005>
- JPMorgan Chase Bank, N.A. – New Zealand Branch and Associated JPMorgan Chase Bank, New Zealand Banking Group. (2023). Disclosure statement for the year ended 31 December 2023. JPMorgan. <https://www.jpmorgan.com/content/dam/jpm/global/disclosures/AU/disclosure-statements/disclosure-statement-fy2023.pdf>
- Kaur, A., & Dani, D. (2014). Banking websites in India: An accessibility evaluation. *CSI Transactions on ICT*, 2(1), 23–34. <https://doi.org/10.1007/s40012-014-0040-x>
- Khandani, A. E., Kim, A. J., & Lo, A. W. (2010). Consumer credit-risk models via machine-learning algorithms. *Journal of Banking & Finance*, 34(11), 2767–2787. <https://doi.org/10.1016/j.jbankfin.2010.06.001>
- Khera, N., & Verma, A. (2014). Development of an intelligent system for bank security. In **2014 5th International Conference - Confluence The Next Generation Information Technology Summit (Confluence)** (pp. 319–322). Noida, India. <https://doi.org/10.1109/CONFLUENCE.2014.6949339>
- Krupar, C. (2021, July 12). 6 Reasons Why Your Homepage is THE Most Important Page. Cybervise Limited. <https://www.cybervise.com/6-reasons-why-homepage-important/>
- Li, X., & Xue, Y. (2014). A survey on server-side approaches to securing web applications. **ACM Computing Surveys*, 46*(4), Article 54. <https://doi-org.ezproxy.massey.ac.nz/10.1145/2541315>
- Li, X., Zheng, H., Chen, J., Zong, Y., & Yu, L. (2024). User Interaction Interface Design and Innovation Based on Artificial Intelligence Technology. *Journal of Theory and Practice of Engineering Science*, 4(03), Article 03. [https://doi.org/10.53469/jtpes.2024.04\(03\).01](https://doi.org/10.53469/jtpes.2024.04(03).01)
- Likert Scales: How to Use it to Measure Perceptions and Behaviors—LiveInnovation.org. (n.d.). Retrieved March 18, 2024, from <https://liveinnovation.org/likert-scales-how-to-use-it-to-measure-perceptions-and-behaviors/>
- Lister, K., Coughlan, T., Iniesto, F., Freear, N., & Devine, P. (2020). Accessible conversational user interfaces: Considerations for design. In **Proceedings of the 17th International Web for All Conference* (W4A '20)* (pp. 5:1–5:11). Association for Computing Machinery. <https://doi.org/10.1145/3371300.3383343>
- Maddirala, S. (2019). Minimal Criteria: Minimizing User Input and User Interface for Faster Output in Minimalistic Mobile Applications (Order No. 27765786). Available from ProQuest Dissertations & Theses A&I. (2357368478).

- <https://ezproxy.massey.ac.nz/login?url=https://www-proquest-com.ezproxy.massey.ac.nz/dissertations-theses/minimal-criteria-minimizing-user-input-interface/docview/2357368478/se-2>
- Mesawat, S., & Nikure, M. (n.d.). Artificial Intelligence for Website Development: A Comprehensive Review and Analysis. 13(1012).
- Miranda, F. J., Cortés, R., & Barriuso, C. (2006). Quantitative Evaluation of e-Banking Web Sites: An Empirical Study of Spanish Banks. 9(2).
- Mogaji, E., Soetan, T. O., & Kieu, T. A. (2021). The implications of artificial intelligence on the digital marketing of financial services to vulnerable customers. *Australasian Marketing Journal*, 29(3), 235–242. <https://doi.org/10.1016/j.ausmj.2020.05.003>
- Multi-criteria_Analysis.pdf. (n.d.). Retrieved March 19, 2024, from https://eprints.lse.ac.uk/12761/1/Multi-criteria_Analysis.pdf
- Muñoz-Izquierdo, N., Camacho-Miñano, M.-M., Segovia-Vargas, M.-J., & Pascual-Ezama, D. (2019). Is the External Audit Report Useful for Bankruptcy Prediction? Evidence Using Artificial Intelligence. *International Journal of Financial Studies*, 7(2), Article 2. <https://doi.org/10.3390/ijfs7020020>
- New Zealand Retail Banking Competitor Benchmarking—Financial Performance, Customer Relationships and Satisfaction. (n.d.). Market Research Reports & Consulting | GlobalData UK Ltd. Retrieved March 14, 2024, from <https://www.globaldata.com/store/report/new-zealand-retail-banking-competitive-benchmarking-market-analysis/>
- Nisar, T. M., & Whitehead, C. (2016). Brand interactions and social media: Enhancing user loyalty through social networking sites. *Computers in Human Behavior*, 62, 743–753. <https://doi.org/10.1016/j.chb.2016.04.042>
- NZ “behind the curve” on banking industry changes—Report. (2023, April 3). RNZ. <https://www.rnz.co.nz/news/business/487226/nz-behind-the-curve-on-banking-industry-changes-report>
- Olson, D. L., Delen, D., & Meng, Y. (2012). Comparative analysis of data mining methods for bankruptcy prediction. *Decision Support Systems*, 52(2), 464–473. <https://doi.org/10.1016/j.dss.2011.10.007>
- Planit—ASB Case Study – Accelerating Strategy and Delivery. (n.d.). Retrieved April 16, 2024, from <https://www.planittesting.com/us/insights/2017/asb-case-study-strategy-delivery>
- Preliminary-Issues-paper-Personal-banking-services-market-study-10-August-2023.pdf. (n.d.).
- Rahman, M., Ming, T. H., Baigh, T. A., & Sarker, M. (2021). Adoption of artificial intelligence in banking services: An empirical analysis. *International Journal of Emerging Markets*, 18(10), 4270–4300. <https://doi.org/10.1108/IJOEM-06-2020-0724>
- Ramón-Jerónimo, M. A., Peral-Peral, B., & Arenas-Gaitán, J. (2013). Elderly persons and internet use. **Social Science Computer Review*, 31*(4), 389–403. <https://doi-org.ezproxy.massey.ac.nz/10.1177/0894439312473421>
- Ris, K., Stankovic, Z., & Avramovic, Z. (2020). Implications of Implementation of Artificial Intelligence in the Banking Business with Correlation to the Human Factor. *Journal of Computer and Communications*, 08(11), 130–144. <https://doi.org/10.4236/jcc.2020.811010>
- Saha, A. K. (2017). Review of Design of Speech Recognition and Text Analytics based Digital Banking Customer Interface and Future Directions of Technology Adoption (arXiv:1712.04640). arXiv. <https://doi.org/10.48550/arXiv.1712.04640>
- Sandhu, S., & Arora, S. (2022). Customers' usage behaviour of e-banking services: Interplay of electronic banking and traditional banking. *International Journal of Finance & Economics*, 27(2), 2169–2181. <https://doi.org/10.1002/ijfe.2266>
- Savioja, P., Liinasuo, M., & Koskinen, H. (2014). User experience: Does it matter in complex systems? **Cognitive Technology Work*, 16*, 429–449. <https://doi.org/10.1007/s10111-013-0271-x>
- Selz, D., & Schubert, P. (1998). Web assessment-a model for the evaluation and the assessment of successful electronic commerce applications. *Proceedings of the Thirty-First Hawaii International Conference on System Sciences*, 4, 222–231. <https://doi.org/10.1109/HICSS.1998.655278>
- Sheth, J. N., Jain, V., Roy, G., & Chakraborty, A. (2022). AI-driven banking services: The next frontier for a personalised experience in the emerging market. *International Journal of Bank Marketing*, 40(6), 1248–1271. <https://doi.org/10.1108/IJBM-09-2021-0449>
- Sheth, J. N., Newman, B. I., & Gross, B. L. (1991). Why we buy what we buy: A theory of consumption values. *Journal of Business Research*, 22(2), 159–170. [https://doi.org/10.1016/0148-2963\(91\)90050-8](https://doi.org/10.1016/0148-2963(91)90050-8)
- Sia, S. K., Weill, P., & Zhang, N. (2021). Designing a Future-Ready Enterprise: The Digital Transformation of DBS Bank. *California Management Review*, 63(3), 35–57. <https://doi.org/10.1177/0008125621992583>
- Statista. (2024). Digital Banks - New Zealand. <https://www.statista.com/outlook/fmo/banking/digital-banks/new-zealand#net-interest-income>
- Stige, Å., Zamani, E. D., Mikalef, P., & Zhu, Y. (2023). Artificial intelligence (AI) for user experience (UX) design: A systematic literature review and future research agenda. *Information Technology & People*, ahead-of-print(ahead-of-print). <https://doi.org/10.1108/ITP-07-2022-0519>

- Sundt, A., & Eastman, T. (2019). Informing Website Navigation Design with Team-Based Card Sorting. *Journal of Web Librarianship*, 13(1), 37–60. <https://doi-org.ezproxy.massey.ac.nz/10.1080/19322909.2018.1544873>
- The complete history & evolution of web search. (n.d.). Retrieved May 3, 2024, from <https://oslash.com/blog/history-evolution-of-web-search>
- The Impact of Advertising and R&D on Bankruptcy Survival: A Double-Edged Sword—Niket Jindal, 2020. (n.d.). Retrieved May 4, 2024, from <https://journals-sagepub-com.ezproxy.massey.ac.nz/doi/full/10.1177/0022242920936205>
- The impact of the FinTech revolution on the future of banking: Opportunities and risks—ScienceDirect. (n.d.). Retrieved May 16, 2024, from <https://www-sciencedirect-com.ezproxy.massey.ac.nz/science/article/pii/S1057521922000734#s0005>
- Tran, T. P., Mai, E. S., & Taylor, E. C. (2021). Enhancing brand equity of branded mobile apps via motivations: A service-dominant logic perspective. *Journal of Business Research*, 125, 239–251. <https://doi.org/10.1016/j.jbusres.2020.12.029>
- Ubam, E., Hipiny, I., & Ujir, H. (2021). User Interface/User Experience (UI/UX) Analysis & Design of Mobile Banking App for Senior Citizens: A Case Study in Sarawak, Malaysia (pp. 1-6). doi:10.1109/ICEEI52609.2021.9611136
- Vila, T. D., González, E. A., Vila, N. A., & Brea, J. A. F. (2021). Indicators of website features in the user experience of e-tourism search and metasearch engines. *Journal of Theoretical and Applied Electronic Commerce Research*, 16, 18-36. <https://doi.org/10.4067/S0718-18762021000100103>
- Venkatraman, S., & Delpachitra, I. (2008). Biometrics in banking security: A case study. *Information Management & Computer Security*, 16(4), 415–430. <https://doi.org/10.1108/09685220810908813>
- Waite, K., & Harrison, T. (2002). Consumer expectations of online information provided by bank websites. *Journal of Financial Services Marketing*, 6(4), 309–322. <https://doi.org/10.1057/palgrave.fsm.4770061>
- Williams, M. D. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 57, 101994. <https://doi.org/10.1016/j.ijinfomgt.2019.08.002>
- Windasari, N. A., Kusumawati, N., Larasati, N., & Amelia, R. P. (2022). Digital-only banking experience: Insights from gen Y and gen Z. *Journal of Innovation & Knowledge*, 7(2), 100170. <https://doi.org/10.1016/j.jik.2022.100170>
- Whiteley, D. (n.d.). E-commerce: Strategy, technologies and applications. (No Title). Retrieved March 18, 2024, from <https://cir.nii.ac.jp/crid/1130000797670105984>
- Yang, Q., Scuito, A., Zimmerman, J., Forlizzi, J., & Steinfeld, A. (2018). Investigating How Experienced UX Designers Effectively Work with Machine Learning. *Proceedings of the 2018 Designing Interactive Systems Conference*, 585–596. <https://doi.org/10.1145/3196709.3196730>
- Yildirim, N., Kass, A., Tung, T., Upton, C., Costello, D., Giusti, R., Lacin, S., Lovic, S., O'Neill, J. M., Meehan, R. O., Ó Loideáin, E., Pini, A., Corcoran, M., Hayes, J., Cahalane, D. J., Shivhare, G., Castoro, L., Caruso, G., Oh, C., ... Zimmerman, J. (2022). How Experienced Designers of Enterprise Applications Engage AI as a Design Material. *CHI Conference on Human Factors in Computing Systems*, 1–13. <https://doi.org/10.1145/3491102.3517491>
- Zhang, C., & Lu, Y. (2021). Study on artificial intelligence: The state of the art and future prospects. *Journal of Industrial Information Integration*, 23, 100224. <https://doi.org/10.1016/j.jii.2021.100224>
- 9 Tips for a Successful Website User Experience Analysis. (n.d.). Amplitude. Retrieved March 5, 2024, from <https://amplitude.com/blog/website-user-experience-analysis>
- 15+ Case Study Examples, Design Tips & Templates. (2023, January 12). Venngage. <https://venngage.com/blog/case-study-examples/>
- 2023-Sustainable-Futures-Report.pdf. (n.d.). Retrieved April 27, 2024, from <https://www.bnz.co.nz/assets/bnz/about-us/PDFs/2023-Sustainable-Futures-Report.pdf?abdac73a774d1f91310b103e3445d160a0df48de=>