MULTILINGUAL INTERNAL COMMUNICATION PRACTICES IN WEB APPLICATION DEVELOPMENT FOR EARLY-STAGE INFORMATION TECHNOLOGY VENTURES

Abstract. The article presents the results of a study of foreign language internal communication for the effective development of web applications for an IT startup project. It is noted that the era of globalization has ushered in an interconnected digital ecosystem where early-stage Information Technology (IT) ventures are not confined by geographical borders. As these startups thrive and innovate in the realm of web application development, they are increasingly encompassing a multilingual and multicultural talent pool. While this diversity is an undeniable strength, it concurrently introduces a set of challenges tied to multilingual internal communication. This article delves deep into the practices, potential pitfalls, and strategies related to multilingual communication within these ventures, specifically focusing on the context of web application development. This research unveils that linguistic diversity, while fostering creativity, can also lead to instances of miscommunication, thereby posing threats to efficiency, innovation, and product quality. Given the resource constraints and the need for rapid iterations in early-stage IT startups, these miscommunications can have outsized implications.

Through an extensive study encompassing qualitative interviews, surveys, and case studies, we unearth the prevalent strategies and protocols early-stage IT ventures adopt to navigate these multilingual challenges. The article further enumerates potential solutions, from technology-driven tools like real-time translation applications to organizational best practices, which can be employed to harness the power of multilingualism without letting it become an impediment.
In essence, this research contributes a holistic view of the symbiotic relationship between multilingualism and web application development in the unique setting of early-stage IT ventures. As these startups stand at the nexus of technological advancement and cultural diversity, understanding their communication dynamics becomes paramount.

**Keywords:** Multilingualism, Internal Communication, Web Application Development, Early-stage IT ventures, Cultural Diversity, Miscommunication, Organizational Best Practices.

Нагачевська Олена Олександрівна кандидат філологічних наук, доцент кафедри іноземних мов, Національний університет «Львівська політехніка», вул. Степана Бандери, 55, м. Львів, 79013, тел.: (096) 455-75-19, https://orcid.org/0000-0002-5200-8085

Русин Василь Іванович аспірант кафедри картографії та геопросторового моделювання, Національний університет «Львівська політехніка», вул. Степана Бандери, 55, м. Львів, 79013, тел.: (050) 060-59-06, https://orcid.org/0009-0009-7506-0132

Нагачевська Марина Вікторівна магістрантка кафедри інформаційних систем та мереж, Національний університет «Львівська політехніка», вул. Степана Бандери, 55, м. Львів, 79013, тел.: (095) 207-82-58

ІНШОМОВНА ВНУТРІШНЯ КОМУНІКАЦІЯ ПІД ЧАС РОЗРОБКИ ВЕБ-ДОДАТКІВ ДО ІТ-СТАРТАП ПРОЕКТУ

Анотація. У статті представлені результати дослідження іншомовної внутрішньої комунікації для ефективної розробки веб-додатків до ІТ-стартап проекту. Зазначається, що ера глобалізації започаткувала взаємопов’язану цифрову екосистему, де підприємства інформаційних технологій (ІТ) на ранніх стадіях не обмежені географічними кордонами. Оскільки ці стартапи процвітають та впроваджують інновації у сфері розробки веб-додатків, вони все більше охоплюють багатомовний та мультикультурні команди фахівців. Хоча це розмаїття є незаперечною перевагою, воно водночас створює низку проблем, пов’язаних із багатомовним внутрішнім спілкуванням. У цій статті детально розглядаються практики, потенційні підводні камені та стратегії, пов’язані з багатомовним спілкуванням у рамках цих підприємств, тобто з внутрішньою комунікацією, особливо зосереджуючись на контексті розробки веб-додатків. Це дослідження показує, що мовне розмаїття, сприяючи креативності, може також привести до випадків порушень спілкування, що
statement of the problem. In the present era of the worldwide digital environment, most nascent Information Technology (IT) enterprises are obligated to operate inside a multicultural and multilingual framework. These firms, known for their vibrant and fast-paced atmosphere, are propelling innovation in the field of web application development. As these business endeavors grow, they are attracting more and more talented individuals from various linguistic origins, which creates the possibility of having a diversified internal communication environment.

Nevertheless, whereas multilingualism may be a beneficial advantage, it also presents certain difficulties. Linguistic disparities can result in misunderstandings, leading to communication breakdowns that can impede productivity, inhibit creativity, and potentially impact the final outcome's quality. Moreover, the incorporation of various languages into the developing process may result in longer lead times, higher mistake rates, and the need for additional effort.

This article seeks to address the lack of knowledge by examining the present methods, difficulties, and prospective approaches used by early-stage IT startups to handle internal communication in several languages, particularly in the field of web application development. Gaining insight into these dynamics will not only assist startups in optimizing their communication strategies but also make a valuable contribution to the wider discussion on the significance of language in contemporary IT-driven enterprises.
Analysis of the recent research and publications. The research conducted by experts such as A.O. Kasych, A.M. Jura, N. I. Tsenkler, C. Blank, B. Dorf, N. I. Sytnyk, A. P. Heydor, T.M. Bizbiz, E. Rice, P. Thiel, P. Pukal, S. Walter, and others focuses on investigating the establishment and growth of startups in Ukraine and other countries. As for the internal communication, the analysis of the scientific literature on this issue reveals that scholars in the field have extensively discussed significant advancements in the nature and forms of communication, as well as the technological solutions associated with it. Notable contributors to this discussion include V. Bebik [1], H. Bobrul [2], A. Bodnar [3], V. Ilhanayeva [4], O. Lokotkova-Ternova [5], V. Rizun (n.d.) [6], O. Kholod [7], L. Sager [8], M. Yatsenko [9] among others.

A comprehensive evaluation has been conducted on the research completed by international scientists about communication challenges and their use in companies and institutions. We have specifically analyzed the works of Cherry, C. [10], Robert T. Craig [11; 12], J. Habermas [13], J. Haas [14], G. Galanes & K. Adams [15], J. Katzenbach & D. Smith [16], Luhmann, Niklas [17; 18], Luthans, Fred [19], H. Pocheptsov [20; 21], S. W. Smith & S. R. Wilson [22], Julia T. Wood [23], and other authors. These scientific works investigate communication theories and the capacity of communicative processes to address issues at various levels.

On the other hand, we have to point out that the problem of multilingual internal communication practices in web application development for startups in the field of information technology has not been addressed as of yet. This fact further demonstrates how important and relevant our study is.

The aim of the research is to conduct a systematic analysis of linguistic internal communication patterns within web application development processes in nascent IT ventures and discern their ramifications on project outcomes and intra-team dynamics.

Objectives are: to identify the prevalent linguistic practices and tools used in internal communication during web application development; to examine the relationship between linguistic communication practices and project outcomes such as development time, bug frequency, and overall product quality; to provide recommendations for best communication practices based on the findings.

The subject of the research: The linguistic methodologies and tools employed by early-stage IT ventures during the development of web applications. The object of the research: Early-stage IT startups involved in web application development, with a specific focus on their internal communication strategies and practices.

Methods. A mixed-method approach was employed, incorporating both qualitative interviews with developers and quantitative analysis of communication logs from diverse IT startups.
Results and Discussion. Web application development is an intricate process, particularly within the fast-paced ecosystem of start-ups. The dynamism and agility of start-ups often demand effective internal communication to ensure the seamless progression of developmental projects. This article endeavors to analyze the intrinsic link between web application development and the nuances of internal communication within start-up environments.

1. Framework of Web Application Development: A Detailed Examination

Web application development, though seemingly linear, is a multifaceted process. When dissected, each phase of development can be further expanded upon, revealing its own set of sub-processes, challenges, and requirements. This complexity is further amplified by the need for various domain experts to work in unison, emphasizing the significance of internal communication.

1. Conceptualization: This is the foundational stage where the idea of the web application is birthed and nurtured. It involves:
   • Market Research: Understanding user needs, market gaps, and potential competitors.
   • Requirement Gathering: Collaborating with stakeholders, potential users, and team members to outline the core features and functionalities of the application.
   • Feasibility Study: Analyzing the technical, financial, and operational viability of the proposed application.

The role of strategists and product managers is predominant here. Their ability to communicate the gathered insights to the rest of the team sets the tone for subsequent phases.

2. Design:

The visual and functional blueprint of the application is crafted in this phase.

• Wireframing: Creating a skeletal framework of the application to establish the user flow.
• UI/UX Design: Deciding the look and feel, ensuring the application is user-centric and intuitive.
• Prototype Development: Creating a mock version of the application to get a tangible sense of functionality and design.

At this juncture, UI/UX designers play a pivotal role. Their continuous interaction with both the conceptualization team (to understand requirements) and the development team (to ensure technical feasibility) highlights the essence of effective communication.

3. Development: This phase transforms the design into a working model.

• Front-end Development: Building the user interface of the application.
• Back-end Development: Setting up servers, databases, and ensuring that data processing and retrieval functions seamlessly.
• Integration: Ensuring all components of the application communicate effectively with one another.
Software developers and system architects are the key players here. Their need to constantly relay information, clarify doubts, and ensure alignment with the design underscores the perpetual need for clear internal communication.

4. Testing: Before the product reaches the end-user, it undergoes rigorous evaluation.
   - Functional Testing: Ensuring every feature works as intended.
   - Performance Testing: Assessing the application's responsiveness, stability, and scalability.
   - User Acceptance Testing (UAT): A select group of users test the application in real-world conditions.

The quality assurance (QA) personnel are central to this phase. Their feedback loops with developers, highlighting bugs or discrepancies and ensuring they are addressed, is a testament to the critical role of communication in refining the product.

5. Deployment: Post-testing, the application is made available to the end-users.
   - Staging: A pre-production environment where the final product is placed before actual deployment.
   - Launch: Releasing the application to the public, often in phases to gauge user reactions and handle any unforeseen issues.
   - Maintenance and Updates: Continuous monitoring and updating of the application based on user feedback and changing needs.

System administrators and DevOps engineers are the torchbearers in this phase. Their need to relay information about server health, user traffic, potential downtimes, and deployment strategies once again brings to light the indispensable nature of internal communication.

Conclusion: The labyrinthine process of web application development is not just about moving from one phase to the next; it's a dance of collaboration, understanding, and iteration. At every step, effective internal communication acts as the glue, binding teams together, and ensuring the final product is a harmonious blend of strategy, design, functionality, and quality.

2. The Imperative of Clear Communication Channels: An In-depth Exploration

Clear communication channels are not just an operational nicety for startups but an unequivocal necessity. The iterative and collaborative nature of the developmental cycle necessitates that information is relayed promptly, accurately, and comprehensibly. This section delves deeper into the implications and examples underscoring the significance of such communication within the web application development ecosystem.

1. Transition from Conceptualization to Design: As startups navigate from the ideation phase to actual design, the need to articulate nuanced requirements becomes crucial.
Example: Consider a feature like user authentication. A lapse in communication might result in a designer envisioning a simple email-based login, while the product manager might have intended for multifactor authentication due to heightened security concerns. This mismatch can lead to redesigns, increased development hours, and potential project delays.

*Data Point:* According to a study by the Project Management Institute (PMI) in 2020, unclear requirements, which often stem from poor communication, were found to be the primary cause for project failures in 37% of sampled projects.

2. **Collaboration during Development:** The development phase witnesses developers, designers, and product managers working in tandem. Misunderstandings or lack of clarity can snowball into technical debt or rework.

Example: A developer might interpret the requirement for a 'search feature' as a simple string-matching function. However, if the product manager intended for a more sophisticated, AI-driven semantic search, the disconnect could result in wasted development hours and potential reimplementation.

*Data Point:* A survey by U.K. firm Geneca found that almost 75% of business and IT executives anticipated their software projects would fail, with miscommunication being a significant contributing factor.

3. **Navigating from Development to Testing:** Clear communication is pivotal when handing over the product from developers to quality assurance (QA) teams.

Example: Without explicit communication, a QA professional might test the application under limited conditions, assuming certain parameters to be out-of-scope. Such assumptions can lead to undiscovered bugs, eventually affecting the user experience post-deployment.

*Data Point:* Research by the Consortium for IT Software Quality (CISQ) indicated that poor software quality – often stemming from miscommunication during the development and testing phases – cost U.S. organizations an estimated $2.08 trillion in 2020.

**Conclusion:** The myriad examples and data points underline the indispensable nature of clear communication channels. For startups, especially those with constrained resources and tight timelines, ensuring seamless and transparent communication is not just a best practice but a critical determinant of project success. By prioritizing and fostering a culture of clear communication, startups can mitigate risks, ensure alignment, and drive optimal product outcomes.

3. **Agile Methodologies and Communication: A Comprehensive Analysis**

The Agile framework, a staple in contemporary software development, fundamentally hinges on adaptive planning, evolutionary development, and early delivery, all of which underscore the importance of constant and clear communication. Let's delve deeper into the interplay between Agile methodologies
and communication by examining its core practices and correlating them with real-world examples and data.

1. Daily Stand-Ups: Daily stand-ups, or daily scrum meetings, are brief sessions where team members discuss their tasks for the day and highlight any challenges or impediments.

Example: If a developer encounters a roadblock with a specific module's code, addressing it during the stand-up can rapidly facilitate inputs from peers or allow the scrum master to reallocate resources to expedite a solution.

*Data Point:* According to a report by VersionOne, 83% of Agile practitioners utilize daily stand-ups as part of their routine, indicating its integral role in Agile communication.

2. Sprint Reviews and Retrospectives: At the end of each sprint (typically a 2-4 week period), the team gathers to review the work accomplished and discuss what went well and what needs improvement.

Example: If the team consistently misses sprint goals due to external dependencies, a retrospective can bring this to light, prompting the team to devise strategies like aligning sprints with external teams or refining the estimation process.

*Data Point:* The 14th State of Agile report suggests that 82% of organizations found sprint retrospectives to be beneficial in improving team dynamics and refining processes, underscoring their role in fostering effective communication.

3. User Stories and Backlog Refinement: In Agile, requirements are often expressed as user stories, which are then broken down into tasks. Regular backlog refinement sessions ensure that these stories are clear, prioritized, and ready for development.

Example: A vaguely defined user story like "Improve app login" can lead to varied interpretations. Through backlog refinement, it can be expanded into specific tasks such as "Implement two-factor authentication" or "Reduce login page load time by 50%".

*Data Point:* As per a study by Scrum Inc., teams that regularly engage in backlog refinement tend to meet their sprint goals 10-20% more often than those that neglect this practice, showcasing the importance of clarity and communication in Agile processes.

4. Pair Programming: This is an Agile practice where two developers work together on the same code. One writes the code while the other reviews it, and they often switch roles.

Example: Two developers working on a complex algorithm can catch and rectify errors in real-time, ensuring not just code quality but also knowledge transfer and immediate feedback.

*Data Point:* A research study published in the IEEE Transactions on Software Engineering found that pair programming can improve code quality by reducing
defects by up to 15% compared to solo programming, emphasizing the value of direct communication during the coding process.

Conclusion: Agile, by its very ethos, is rooted in adaptive response and iterative progress. Such adaptability can only be actualized when communication channels within the team are fluid, transparent, and consistent. The array of practices within Agile, supported by empirical data, manifestly underscores that effective communication isn't just a peripheral aspect but central to Agile's success.

4. Multifaceted Challenges in Start-ups: A Deeper Dive into Communication Dynamics. Start-ups, by their very nature, operate in a milieu replete with uncertainties and rapid changes. Unlike established corporations with defined protocols and stable structures, start-ups are in a constant state of flux. This unique ecosystem, while fostering innovation, also brings forth a myriad of challenges that hinge critically on communication. Let's elucidate these challenges with detailed examples and supportive data.

1. Evolving Team Structures: Start-ups frequently undergo structural transformations, with roles often overlapping or evolving based on immediate needs.

Example: In the early stages, a single individual might wear multiple hats - from product management to customer relations. As the start-up grows, these roles may become more specialized, requiring the individual to communicate their knowledge and processes to new hires.

Data Point: According to a study by the Harvard Business Review, approximately 70% of start-ups undergo a role-related metamorphosis in their first three years, emphasizing the imperative of effective role transition communication.

2. Fluctuating Resources: Start-ups, especially those in the bootstrapped or early investment phase, often oscillate between resource abundance and scarcity, impacting both human and technological assets.

Example: A start-up might kick-off a project when funds are robust, only to encounter a financial crunch mid-way. Such situations demand prioritizing features, reallocating team members, or even shelving components for future development. This resource reallocation necessitates transparent communication to ensure everyone's alignment and understanding of the revised goals.

Data Point: A survey by Startup Genome reported that 29% of start-ups folded due to running out of capital, indicating the frequent resource fluctuations and the consequent communication challenges in aligning teams with changing realities.

3. Tight Timelines: Driven by investor expectations, market competition, or the innate urgency to establish a foothold, start-ups often operate under stringent timelines.

Example: To capture a seasonal market opportunity, a start-up might need to hasten the launch of a product. This expedited timeline can lead to compressed
developmental phases, requiring teams to communicate more frequently, ensuring everyone's on track and aware of the expedited expectations.

**Data Point:** According to CB Insights, 17% of start-ups fail due to being outcompeted, suggesting the importance of timely product releases and the consequent demand for efficient internal communication to meet deadlines.

5. **Tools and Technologies in Aid of Communication: An In-depth Exploration.** In today's digitized age, efficient communication transcends just interpersonal dynamics and leans heavily into the domain of digital tools and platforms. Start-ups, with their agile and adaptive structures, are particularly primed to maximize the utility of these tools. This section seeks to provide a comprehensive understanding of various communication tools, supplemented with real-world examples and data-driven insights.

1. **Real-Time Communication Platforms:** For immediate discussions, brainstorming sessions, or quick clarifications, real-time communication tools play a pivotal role.

   Example: Tools like *Slack* offer features such as channels dedicated to specific projects, ensuring that conversations are organized and easily accessible. Similarly, *Microsoft Teams* not only offers chat functionality but also integrates video conferencing, making it easier for remote teams to collaborate visually.

   **Data Point:** As per a survey by Statista in 2020, around 12 million daily active users were found to rely on Slack, emphasizing its widespread utility in facilitating real-time communication in professional settings.

2. **Task and Project Management Platforms:** To manage the myriad tasks, deadlines, and milestones, startups employ platforms that offer an organized view of the project's progression.

   Example: *Jira*, developed by Atlassian, is especially popular among tech start-ups due to its agile board, sprint planning features, and bug tracking capabilities. Platforms like *Trello* provide a more visual task management experience with its card-based system, making it easier for teams to visualize task progression.

   **Data Point:** In a 2019 report, it was estimated that Jira was used by over 65,000 companies globally, including tech giants like Cisco and eBay, highlighting its efficacy in project management.

3. **Documentation and Knowledge Repositories:** Preserving institutional knowledge, maintaining product documentation, and ensuring easy access to this information is critical for the continuity and efficiency of projects.

   Example: *Confluence*, also by Atlassian, serves as a collaborative wiki where teams can create, store, and update documentation. *Notion* is another versatile tool that combines documentation with task management, offering a unified platform for teams to work and refer to critical information.
Data Point: According to Atlassian's official figures from 2019, Confluence boasted over 60,000 customers, showcasing its prominent role in aiding organizational documentation.

4. Feedback and Review Platforms: To ensure products align with user expectations and to gather feedback during various developmental stages, startups deploy platforms specifically designed for reviews.

Example: Miro offers a digital whiteboard solution where teams can brainstorm, gather feedback, and visualize ideas. InVision, on the other hand, is tailored for digital product design, allowing designers to share prototypes with stakeholders and gather feedback directly on the designs.

Data Point: InVision, as of 2018, was used by 100% of the Fortune 100, underlining its significance in the design feedback loop for both start-ups and established enterprises.

Conclusion: While human elements like clarity, empathy, and openness form the bedrock of effective communication, tools and platforms act as the conduits, enabling and amplifying these elements. For start-ups navigating the complex terrain of web application development, the judicious choice and adept utilization of these tools are not merely operational decisions but strategic imperatives, wielding considerable influence over project outcomes. As technology continues to evolve, the symbiotic relationship between communication and digital tools is poised to grow even more profound, shaping the very fabric of organizational interactions.

The Advantages:
1. Diverse Perspectives: Multilingual teams bring a broader range of experiences, ensuring a more holistic approach to problem-solving and creativity.
2. Global Market Insights: Linguistically diverse teams offer insights into different markets, making global expansion strategies more informed.
3. Cultural Sensitivity: Such teams can be more attuned to cultural nuances, which can be critical when developing products for an international audience.

The Challenges:
1. Miscommunication: Language barriers can lead to misunderstandings, which might cause mistakes, extend project timelines, or even lead to internal conflicts.
2. Slower Decision-making: Translating ideas or seeking clarifications can make decision-making processes slower, which can be particularly challenging for startups racing against time.
3. Over-reliance on a Single Language: Often, to streamline communication, teams might default to a single language (commonly English). This can marginalize those who aren't fluent, leading to reduced participation or even a sense of isolation.
4. Cultural Differences: Beyond just language, different communication styles and cultural norms can cause friction. What's considered direct and to-the-point in one culture might be seen as rude or abrupt in another.
Common Practices in Addressing the Challenges Using Web Applications:

1. Language Training: Web applications have transformed how language training is delivered. Platforms like Duolingo or Babbel are now integrated into the onboarding processes of many startups. For example, a European IT venture with a mix of French, Spanish, and English speakers might offer subscriptions to such platforms, creating a customized pathway focusing on business terminologies for their team. Additionally, virtual classrooms using platforms like Zoom or Skype enable live interactions with language trainers, allowing teams to practice real-time conversations and gain fluency.

2. Translation Tools: The ubiquity of real-time translation tools has been a game-changer. Google Translate now offers an API that can be integrated into communication platforms, enabling instant translations. For instance, an Indian start-up with Hindi, Kannada, and English speakers could integrate translation tools within their internal chat applications, ensuring every message is instantly available in all three languages. Similarly, apps like Slack have integrated plugins like Mate Translate, which facilitate seamless multilingual interactions [22].

3. Clear Documentation: Web applications focused on documentation, like Confluence or Notion, allow the creation of multilingual wikis and guides. An Asian start-up with Mandarin, Korean, and Japanese speakers can maintain a centralized documentation portal where all critical documents are uploaded in the three languages. Tools like Dropbox Paper or Google Docs further support real-time collaboration, enabling multiple members to work on translations simultaneously.

4. Cultural Workshops: Beyond textual and oral communication, understanding cultural nuances is pivotal. Virtual platforms like WebEx or Microsoft Teams enable startups to conduct cultural workshops, inviting experts to talk about the intricacies of various cultures. For example, a startup in Dubai, comprising Emirati, Indian, and British nationals, might conduct a workshop where they use a web application to showcase videos highlighting different cultural etiquettes, followed by interactive Q&A sessions.

5. Hiring Multilingual Managers: While this isn't a direct application of web tools, the recruitment process for such managers is greatly aided by platforms like LinkedIn. Using its advanced search functionalities, startups can filter potential managerial candidates based on their language proficiencies. Once shortlisted, interview processes can be conducted using video conferencing tools, where language proficiency tests, involving multilingual scenario-based discussions, can be administered in real-time.

Conclusion: Multilingual internal communication practices in early-stage IT ventures present a double-edged sword. While diversity undoubtedly adds value in terms of insights and creativity, the challenges can't be ignored. However, with intentional strategies, clear processes, and the effective use of technology, startups
can transform these challenges into strengths, ensuring a cohesive and productive work environment.

Recommendations for IT Ventures:
1. Regular multilingual training sessions can be beneficial in enhancing mutual understanding among team members.
2. Ventures should consider adopting more visual tools that reduce the reliance on language and emphasize conceptual clarity.
3. Emphasizing the importance of language proficiency during hiring can preempt potential communication challenges.

References:


