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Ghassan Al Qaimari

University of Wollongong in Dubai, ghassanqaimari@uowdubai.ac.ae

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Abstract

In today's global economy, with the appearance of the Internet and the fast evolution of technology, the frontiers of local markets have been fading and blending with global markets. These markets with no boundaries have lead many companies, organizations, educational institutions, and digital libraries to develop their own websites, and to find ways to make them usable and accessible and their products saleable to customers outside their traditional markets. Going global can help corporations lower the cost of entry to international trade, increase sales, create global demands, and establish a reliable, professional and international image online.

This means that website development methodologies must be modified to truthfully reflect and accommodate the needs of a global design. This research work contributes to the study of this complex and challenging issue by proposing a practical and user-centred global website development lifecycle (Global-WDLC) that supports internationalization and localization.

Keywords

Web, Globalization, Methodology, for, Developing, Usable, Websites, for, Global, Market

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Web Globalization: A Methodology for Developing Usable Websites for the Global Market

Ghassan Al-Qaimari
College of Information Technology,
University of Wollongong in Dubai
P. O. Box 20183, Dubai, UAE
ghassanqaimari@uowdubai.ac.ae

Abstract

In today's global economy, with the appearance of the Internet and the fast evolution of technology, the frontiers of local markets have been fading and blending with global markets. These markets with no boundaries have lead many companies, organizations, educational institutions, and digital libraries to develop their own websites, and to find ways to make them usable and accessible and their products saleable to customers outside their traditional markets. Going global can help corporations lower the cost of entry to international trade, increase sales, create global demands, and establish a reliable, professional and international image online.

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Keywords: Globalization, internationalisation, localization, universal usability, local usability, user-centred web development

1. Introduction - Globalization

In approximately a decade, the Internet and the World Wide Web became an integral part of our world. The Web has grown from a theoretical concept to a daily part of our lives, and most profit companies, non-profit organizations, government agencies and academic institutions either already have websites or plan to create them. Nowadays, the Web has presence at all levels of society, and the number of web users is so huge it is impossible to give precise count. As we get more experience designing websites, the problem is no longer designing the technical components, but rather designing a usable website that meets the needs of different categories users.

Keeping in mind that the number of non-English speaking people with access to Internet is rapidly growing, and how e-commerce has changed traditional business practices by providing direct

international access to information and products, many companies are now facing the challenge of expanding their business into a global market. This in turn requires high quality multilingual localization services to make the solution work in any part of the world. To reach a wider audience, future websites will have to be multilingual. While the challenges in creating and maintaining a high quality website in a single language is considerable, working with multiple languages simultaneously creates special challenges, both culturally and technically [1].

The term global in the context of website development generally means undertaking both internationalization and localization of the website. These two terms are most critical to the success of web globalization, yet they are also most frequently misunderstood. While internationalization implies taking a global approach to web development, localization on the other hand implies just the opposite. These two terms are intimately linked, so much so that it can be difficult for website developers to tell where internationalization ends and localization begins.

Diverse cultures, regional regulatory restrictions, and languages influence how websites are perceived and used by target audiences. Organizations that develop global websites need to have design and development processes that consider these key requirements and differences. Website globalization needs to be considered from the beginning of the development process, and according to Susan Dray [2], "companies without a global design and development strategy will spend hundreds of thousands of dollars reengineering their websites to meet the needs of users around the globe."

To develop a website for the global market that supports multiple locals, designers need to follow a global website development lifecycle (global-WDLC), which utilizes the process of internationalization and localization [3]. Internationalization is the process that separates the website into two components, a culture-independent and a culture-dependent component. The culture-independent component, known as the basic template, contains the greater part of the website and is devoid of culture sensitive elements. Localization, on the other hand, is defined as the process of providing the culture-dependent

component of a particular target culture (specific locale).

For every localized version of a website, culturally sensitive elements comprising colours, graphics, images, icons and localized text (translated dialog messages, error messages, and names) are usually stored in a specific file. Therefore, if the website is required in a new language, only the localization process takes place, and no modification of the website basic template is needed. Furthermore, maintenance of a website is also easier as only the basic template is modified [3].

According to John Yunker [4] "In the end, web globalization isn't just about translating one site; it's about creating entirely new websites. The challenges extend well beyond language and require the support of your entire organization. Yet despite the obstacles, globalization is hard to resist, if not just to expand market share but to prevent others from taking your market share. In a global economy, if your company (and your website) ignores the world, the world will ignore you." In other words, it is necessary to globalize TODAY to account for the new Internet markets.

2. Internationalization

Websites typically consist of three layers: the user interface - with which the user interacts; the code - scripting at either client-side or server-side; and the content - the information which can be either static (updated rarely) or dynamic (updated frequently).

Internationalization and localization are symbiotic - without localization, there is no need to internationalize, and without internationalization, any attempt to localize will fail. Internationalization is the process of creating a global website. It is a one time investment that leads to the development of the basic design template. Therefore, Internationalization starts in the design phase and lasts until the product has been localized and released. A properly internationalized website will be easily and efficiently localized (translated) and at a reasonable cost.

Internationalization relates to the website code and user interface tiers; therefore the best time to embark on internationalization is in parallel with core site development and before localization starts. This approach helps finding and fixing errors early in the development process [5].

Internationalization isolates the graphical and textual elements of a website, which change from locale to locale, and even within the same locale. The basic template therefore remains the same, no matter what market we localize for. It can also be a collection of scripts and style sheets, or a collection of corporate specific constants, such as brand names, slogans, logos, colours, and navigation menus.

Variables, on the other hand, include things that change from market to market or within a market. The process of internationalization stage focuses on isolating the variables and modifying the website to become more easily adaptable to each market. Variables include: measurements and sizes, prices and currencies, dates, calendars, time zones, product selection, contact information, images and icons, forms and input fields, etc.

Websites that contains too many variables are usually more challenging to internationalize. However, designers do not have to offer the same variables across all locales. To simplify internationalization and localization, developers might decide to limit the number of variables available in each localized site. In fact, companies rarely provide the same level of functionality and support on their localized sites [5].

3. Localization

Localization covers anything that involves altering market specific aspects of a product before it can be competitively introduced to another market. In its simplest form, localization refers to the translation of strings within the website so that the user sees the correct language [6].

By looking the content and deciding which information is most important, decisions as to what appears at the top-level of the page can be made. Issues which should be considered for the site content include: words with multiple meanings, abbreviations, mnemonics, acronyms, telegraphic style, slang or jargon, gender, creation of new words, shortened plurals or word combinations, and anything that portrays a way of life or culture issues specific to one country.

Centralizing displayed text makes the content easier to localize. This can be achieved by using a back-end database to store the textual information for the site.

Static content which rarely changes can be held in the website pages (HTML, ASP etc.). Localization of the static content would typically be done using an HTML editor or translation tool that handles Web pages. Dynamic content, on the other hand, is best held in a database for ease of maintenance. The best way to localize dynamic content is to define a process for identifying updated content and automatically routing this through a pre-defined workflow.

If there is localizable text within the code layer of the site, it should be commented as much as possible. This makes it easier for the localizer to identify the localizable text. If the website contains scripting that needs to be localized, a localizer with sufficient experience should be involved - the script of the website should be inadvertently altered.

4. Pre-localization Software testing

Pre-localization software testing is the process of checking the localizability and stability of the site interface before attempting to localize. This is done by quickly editing all of the strings in the project to include some extended characters or Asian characters, and by increasing the length of the terms and paragraphs.

The prototype site (basic template) should undergo pre-translation testing to ensure that the design is flexible for all the terms to be translated. For more complex sites, pre-translation testing can be used to test dynamically generated data or to ensure that the controls can display extended characters correctly.

Conducting the pre-localization testing enables developers to identify and resolve international issues without wasting the time of the localizers. Pre-localization testing should be used to test: string truncation; whether all the strings are accessible to the localizers; whether keyboard shortcuts can be localized; characters displaying correctly in HTML and on all controls/elements of the Website; and whether characters displaying correctly in and out of a database [5].

5. Usability

According to the International Standards Organization, ISO 9241-11 [7], usability is defined as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." Effectiveness refers to the accuracy and completeness with which users achieve specified goals. Efficiency refers to the resources (time, money, mental effort etc.) expended in relation to the accuracy and completeness with which users achieve goals. Satisfaction refers to freedom from discomfort, and positive attitudes to the use of the product. Context of use refers to the users, goals, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used.

Another very broad, catchall definition is "universal usability." According to Shneiderman [8], "Universal usability will be met when affordable, useful, and usable technology accommodates the vast majority of the global population: this entails addressing challenges of technology variety, user diversity, and gaps in user knowledge in ways only beginning to be acknowledged by educational, corporate, and government agencies." Universal usability, however, does not imply a system that is well-designed for one culture will necessarily be usable in a different culture. The term 'local usability' has also been introduced to acknowledge that diverse cultures, languages, and regional regulatory restrictions influence how the targeted audience perceive and use interactive systems.

Identifying the usability attributes is crucial to producing high quality instructive systems [9]. Interaction designers and usability specialists need to model the targeted users, analyse the system hierarchy of tasks, understand the potential and limitations of the technology, and consider the context (conditions) in which the system will be used before they could articulate the usability attributes relevant to the system under development. The usability attributes usually evolve to become the usability requirements of the interactive system, which in turn are translated into quantified usability specifications [10]. Usability requirements greatly impact the development process - in one hand, it is a considerable challenge for the interaction designer to convert the usability requirements into a successful interaction design that supports the best interaction styles. On the other hand, it is also a considerable challenge for the usability specialist, at every stage of the development process, to select the most appropriate usability activity for assessing the relevant usability requirements and to ensure that the system meets the usability specifications.

Articulating the usability attributes becomes even more crucial when some of these attributes compete, or even conflict, with each other within the same design [9]. For example, if you are developing a car website, you might find within a set of user tasks two usability attributes that could potentially compete with each other - one attribute might be "promoting" the cars, while the other might be "providing technical information at the appropriate level for the users." The designer needs in this case to consider the right balance between promoting the car (which might involve animation and sound effects) and providing technical information. Consequently, the usability specialist might have to devise some usability evaluations specifically for the purpose of ensuring that the targeted users would not be distracted by excessive use of animation and sound effects when they are trying to find some technical information about the car they would like to buy.

6. User Centred Design

Producing highly usable interfaces on the first attempt is rare - even when the skilled usability specialists are involved. An iterative and user-centered approach is usually required, with the results of usability evaluations being fed back into the development process, steering the development effort towards an acceptable level of usability.

Traditional software development methods, such as the waterfall and spiral lifecycles, do not allow for this type of user-centered and iterative process. Users are typically involved in contributing to the early stages and late delivery/acceptance stages of the cycle, while the steps from specification to delivery are treated as a linear progression of

development, with only limited iterations between adjacent stages. With such a methodology, an incomplete assessment of the users needs during the specification or design stages will not be detected until the product is delivered and the users find it does not fit their tasks [11, 12].

In HCI literature, user-centered design and development (UCD) methodologies, such as the Star lifecycle [12], have been proposed for interactive systems. The Star lifecycle is highly iterative and self-correcting through placing usability evaluation in the center of the lifecycle, and emphasizing the importance of prototyping. Therefore, usability activities become an integral part of the development process. The Star lifecycle is also multi-disciplinary, as it recognizes the need to involve different skills, such as human factors and instruction theory, in the design and development process. UCD is perceived as knowledge intensive because there are too many constraints associated with the practice of its activities. Generally, in an organization, knowledge necessary to execute the UCD activities is often missing or not readily available. With no knowledge to serve as a baseline, the organisational effort is estimated as excessive. In addition, shortage in time, cost and work resources is also used to justify the exclusion of user-centred activities during software development [13].

As far as website development is concerned, following a user-centred web development methodology requires a paradigm shift from traditional software development. To date, none of the proposed user-centred web development methodologies (example, Lynch and Horton Model, Fleming Model, Burdman Model and Jonathan Lazar's User-Centered Web Development Lifecycle) have been devised with globalization in mind [14, 15]. None of them address website development from a global perspective, specially integrating localisation and localization in the development process. They also fail to place proper emphasis on usability, as in the case of the Star lifecycle, and fail to identify the need for special usability activities to assess whether the website underdevelopment have been effectively internationalized and localized, and to eliminate inconsistencies.

7. Usability Evaluation

The benefits of conducting usability evaluations throughout the development lifecycle of a software product have been well demonstrated through many case studies [16]. These benefits include increasing productivity of the users, increasing the likelihood of a product being used to its full potential, reducing training costs and increasing the marketability of a product.

Usability testing can be achieved by carefully examining and video taping a number of test users attempting to accomplish a pre-determined series of tasks using the interactive software (or a mock-up of the software) to be tested. The video recording is then analysed by logging the actions the users perform as well as the time each action takes. From this detailed study, the analyst can choose the best approach to take in an interface design, and can identify key problem areas in the usability of the system [10, 17].

This technique provides good results if undertaken correctly, but requires a number of sample users, specialized video equipment for both recording and playing back (with accurate time information), and takes a significant amount of time for a skilled usability specialist to analyse [17]. Because of the expense in both time and equipment required to undertake this form of empirical user testing, other techniques have been devised for faster, cheaper evaluations. These techniques fall into two categories: analytical and inspection.

Analytical techniques rely on a skilled usability expert to understand and simulate the way a user would attempt to accomplish tasks using the interface under test. Two such techniques are Cognitive Walkthrough and GOMS [18, 19]. The Cognitive Walkthrough evaluates systems by analysing the mental processes required of users. This technique helps determine how easy it is to explore and learn a system, identifies potential problems and reasons for these problems. The technique is useful for evaluating the usability of systems which users have not yet seen. It reveals how successfully a particular design guides the unfamiliar user through to the completion of their task. GOMS attempts to evaluate how efficient an interface will be by looking at the actions required to achieve goals and summing the estimated duration for each action. This technique helps decide between different interface options and can detect potential problems, however it does not identify the reasons behind these problems. GOMS methods are applicable in cases where users have already become familiar with the system, and they have the required cognitive skill [18].

Inspection techniques [20], on the other hand, use a set of guidelines or rules with which an interface design is compared, and are usually performed by one or more usability experts. One such technique is a Heuristic (or Expert) evaluation, in which a number of evaluators compare the interface to a set of nine heuristics or design principles. This technique can uncover potential usability problems and the reasons for these problems, but it does not effectively reveal user confusion, nor does it measure user speed of performance.

Although faster and cheaper, analytical and inspection techniques have two main problems:

Firstly, neither of the techniques utilizes test users, instead relying on a simulation of the user. This may lead to problems if the usability expert did not fully understand the users of the system, which may lead to major problems being undetected. Secondly, they both require the use of skilled usability specialist whose time and availability is usually limited.

Due to the expense and difficulty involved in conducting usability activities, usability evaluation of any kind is often left out of the software development lifecycle or performed only towards the end of the cycle where its usefulness is limited. For usability evaluations to have a significant affect on the quality of an interactive system, they must be conducted throughout the entire software development lifecycle, whenever crucial design decisions must be made.

8. Proposed Model: A Global Website Development Lifecycle

Our proposed Global-WDLC is a highly iterative and self-correcting lifecycle. We would like to think of this lifecycle as a specialization of the Star lifecycle [12] where usability evaluation can be conducted at any phase - whenever the developers need to ensure that they are making the right decision. In our view a global website development lifecycle should include the following stages:

- Define the **goals (mission)** of the website. Developers must be clear about the mission of the web site.
- Identify **target markets and potential users** of website:
 - **Split the audience into different locals.** The world is composed of many countries and languages, and the localized versions of the website need to be tailored to each country individually. Developers should start by combining countries that speak the same language, and then look at each country individually.
 - The user profile should clearly describe the targeted users, including geographic area, cultural background, age group, education, interests, computer skills, etc. Without defining the target market users, developers will not be able to develop a successful website that meets their needs. In many cases, a targeted market does not need to be only one group of people; a website could possibly be targeting three or four categories of users. In this case it is best to determine them at the beginning of the Website development, in order to be able to take their respective needs into consideration.
 - The **business model** should indicate whether the website is expected to advertise a product, provide an online catalogue, provide information on upcoming events, collect names to add to a mailing list, collect survey questionnaires, process financial transactions, etc.
 - The interaction designer should be able at this stage to articulate the **usability attributes** that could potentially make or break the system, and the components of the system where different usability attributes could potentially compete or conflict with each other.

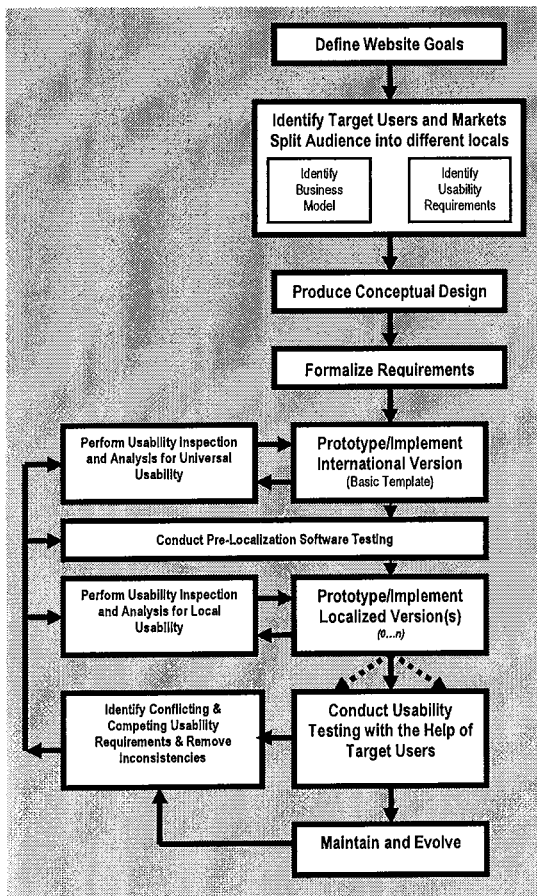


Fig 1. A Global-WDLC

Splitting the audience, identifying the different categories of users, and articulating the usability attributes will impact the requirement gathering, usability

testing and design phases, in addition to how the site is advertised and promoted.

- Produce a **conceptual design** (independent of the visual appearance). The conceptual design is a quasi-hierarchical structure that describes the main components of the system – at least three levels of user tasks and subtasks.
- Formalise **requirements** – including usability requirements.
- **(Re)prototype-(Re)evaluate-(Re)implement the international version** of the website. During this iterative process extensive usability evaluation should be conducted – at this stage website design standards and guidelines should be used to inspect the systems, and cognitive walkthrough analysis should be performed to ensure that the culture-independent and high-level design decisions in the basic template are correct.
- Conduct **Pre-localization software testing** in order to check the localizability and stability of the site interface before attempting to localize. This should include testing: string truncation; whether all the strings are accessible to the localizers; whether keyboard shortcuts can be localized; characters displaying correctly in HTML and on all controls/elements of the Website; and whether characters displaying correctly in and out of a database.
- **(Re)prototype-(Re)evaluate-(Re)implement the localized version(s)** of the website. During this iterative process extensive usability evaluation should be conducted – at this stage specific website design standards and guidelines, related to the intended local(s), should be used to inspect the systems, and cognitive walkthrough analysis should be performed to ensure that the culture-dependent and high-level design decisions in the localized version are correct.
- Conduct **usability testing**: with the help of targeted users to ensure that the logical progression of user tasks is correct, the speed of performance meets the predefined usability specifications, and the different components of the website integrate smoothly with no inconsistencies.

9. Conclusion

To develop a website for the global market, designers need to follow a global website development lifecycle that utilizes the process of internationalization and localization and endorses usability evaluation and iterative refinement.

We have proposed in this paper a Global-WDLC that is a highly iterative and self-correcting, and explicitly highlights the need for specialized

usability evaluations to assess the quality of the internationalized as well as the localized implementations.

The proposed model is based on the author's academic as well as industry experience. The anecdotal feedback from colleagues so far is very encouraging. However, the effectiveness of our Global-WDLC will be evaluated in the near future with the help of professional developers.

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