



Performance-Centered Design for Developing Countries: Emphasizing Context

by Sonia Arias

The ability to design software, including web-based systems that are performance-centered, is a critical success factor to any e-business endeavor. As the Internet and the concomitant access to software applications have rapidly expanded throughout the world, so too has the importance of creating performance-centered design that is mindful of international users. Most often, when addressing the issue of software applications for international users, the concepts of internationalization and localization (I&L) are brought up. Nielsen (2000) defines the two: *internationalization* is "...having a single [software] design that can be used worldwide and *localization*... making an adapted version of that [software] design for a specific locale" (p. 315).

Issues that are most often cited when addressing issues of I&L include, for example, ensuring that system design can accommodate different units of measure, currencies, and date formats. For more examples of this type see Battle and Degler, 2001; Lu, 1998; and Kearsly, 1990.

Battle and Degler (2001) however, argue that the process of I&L needs to go further and state that there is a need "...for more holistic checklists of what to think about when designing for the international user" (p. 1). They address this need from the viewpoint of performance-centered design (PCD).

Based on the three-element model of performance design introduced by Dickelman (1996), Battle and Degler bring to bear all of the key factors of I&L as they relate to performer, information, and process. For example, they argue that if the design process neglects to take into consideration key I&L factors when designing for the performer, the performer becomes disconnected from the model and does not achieve optimal performance. The same applies to the information and process components of the model.

This article adds in three ways to the discussion of I&L and PCD. First, the term *international* will be further defined by making the distinction of whether the international users hail from a developed or developing country. This distinction is important because depending on the country's level of development, web designers, for example, need to consider the bandwidth that is available to the user and factor this into the design process.

Second, this article will describe the unique nature of developing country contexts and how that necessarily has an impact on the design process. In other words, it broadens the holistic checklist for the international user by discussing in further detail the economic, human capacity, and infrastructure factors and overall *context* that need to be taken into account when striving for performance-centered design in international environments.

Third, based on this description, this article proposes that when being applied to a developing country context, the PCD model should *explicitly* include a fourth element, namely that of context.

Those familiar with the three-element model will know that context is already implicit within the model. However, when working in developing country environments the process of analyzing context needs to be made even more explicit because there are characteristics that a performance-centered designer with limited experience in working with developing countries might miss. For example, a U.S.-based designer could safely assume that a US institution acquiring a new system has a functioning information technology department to support and maintain the new system. In a developing country environment, however, this would not be a safe assumption to make. This article therefore proposes that a fourth element of context be made explicit in Dickelman's (1996) three-element model when working in developing country environments. Finally, this article will briefly analyze an example of a *low-fidelity* developing country system.

Definitions

International

When reviewing the U.S. literature on internationalization and localization, it is important to ask what type of country is being addressed. Is it Japan, which differs vastly from the United States when it comes to language and culture, but not necessarily when it comes to telecommunications infrastructure or human capacity? Or is it India, with a much lower per capita income, where the levels in available bandwidth or expertise to maintain systems are significantly lower than in more developed countries? Essentially, the distinction that needs to be made lies along the lines of whether the country in question is a developed or developing country.

The first category includes the countries that most of the I&L literature indirectly refers to, such as Australia, Canada,

Japan, Korea, or western European countries such as the United Kingdom, Germany, France, Holland, or Sweden. The International Bank for Reconstruction and Development (the World Bank) defines this group as *high-income* countries. The second category, namely the group of developing and newly industrialized countries is made up of countries and regions such as India, China, Latin America, and Southeast Asia (World Bank, 1999). According to the World Bank's categories, this group would fall into low- or middle-income countries. As the literature on I&L mostly focuses on high-income, developed countries, this article will focus on the low- to middle-income, developing countries.

Developing Country Contexts

Developing countries' economic, social, human capacity, and infrastructure characteristics are markedly different than those in developed countries. These contexts in turn will necessarily have an effect on how one goes about designing performance-centered systems that need to be internationalized or localized. A list of contextual factors especially unique to developing countries follows.

Socioeconomic Factors. There is not necessarily an incipient culture of participation. A culture of participation, information sharing, and open discussion should not be assumed to exist in all developing nations. This implies that knowledge management systems, which are very much predicated on an open information culture, need to be based on a thorough analysis of the degree to which users are actually willing to share information on a routine basis. Additionally, institutional change will most often involve a top-down process, and thus commitment to change and to adopting new procedures on the part of lower levels of the institution might be low.

Decisionmaking is centralized. Designers will find that many decisions are made by a potentially unstable, central authority who may or may not take into account the needs or desires of local constituents. The implications of this are that performance-centered designers will need to go out of their way to ensure that system users have the opportunity to provide input and feedback to the design process.

There needs to be resources for learning and support. If the system being designed requires developing country users to undergo a learning curve, users' motivation, release time, and compensation for learning the new system need to be addressed during the design phase. Failure to do this might lead to the design and implementation of a powerful system that users will not incorporate into their daily routine.

It is possible that institutional capacity will have limited budget planning capabilities. This contextual factor could have a negative impact on the implementation of the new system if maintenance, support, and upgrades are not in the budget.

Infrastructure Factors. There are unreliable power and telecommunications grids. Users in developing countries in most cases will have access to the Internet only through low-bandwidth systems. Designers should therefore aim to design systems that are usage-centered—such as low graphics to overcome the low-bandwidth limitations.

It is possible that computer hardware and equipment will need to be imported to support the new system. When this is the case, it will be necessary to budget for high import duties and to ensure that appropriate maintenance, support, and upgrades can be secured locally or with the overseas vendor. Failure to take this into account in the analysis phase could lead to the design of unsustainable systems.

The climate in many developing countries is extremely hot and humid. System design needs to ensure that adequate cooling, ventilation, and dust control will be available.

Human Capacity Factors. There is a scarcity of qualified personnel. Qualified staff required to maintain the new system may not be available. This implies that system design for developing country contexts needs to consider the level of human capacity available for system maintenance or conversely, ensure that the design incorporates a very simple maintenance structure.

In sum, major contextual factors in the processes of I&L and PCD can be categorized as socioeconomic, human capacity, and infrastructure factors. These factors lead one to conclude that a contextual analysis takes on an even greater and more significant role in developing country environments, especially since they are not likely to arise in developed country environments and a designer from a country such as the US for example, will in all likelihood not be familiar with them. In other words, a United States or Western European designer contracted to design a knowledge management system in a developing country might assume that information sharing can be expected to occur in all types of environments. Unfortunately, this might not be the case. In environments where information is scarce, information becomes power; thus, individuals might be reluctant to share their precious knowledge, hence the need for a thorough contextual analysis.

PCD: Context Underscored

Having brought to light the importance of analyzing developing country contexts before embarking on the design of any system, it is appropriate to examine the element of context within an existing model of PCD. PCD as described by Dickelman (1996) leads to the creation of performance support systems that “... enable people to *do it* because they provide access to integrated task structuring, data, knowledge, and tools at the time of need” (p. 1)—or to use simpler terms, PCD is “... about creating representations that are

business focused and human centered” (p. 2). The performance zone is achieved when the task, the persona, and just enough information are balanced in such a way that the design is truly business and human centered. In this model, context is implicitly defined by clearly outlining the business problem and the concomitant mission, by delineating the problem workflow (process model), and by describing the users in terms of interest, styles, skills, and values (diversity model).

However, the process by which context is implicitly defined does not necessarily guarantee that the key socioeconomic, human capacity, and infrastructure factors that are peculiar to developing country environments will be identified. Thus, the system design could be flawed. Current PCD models being applied in developing country contexts explicitly need to include an element of contextual analysis (see Figure 1).

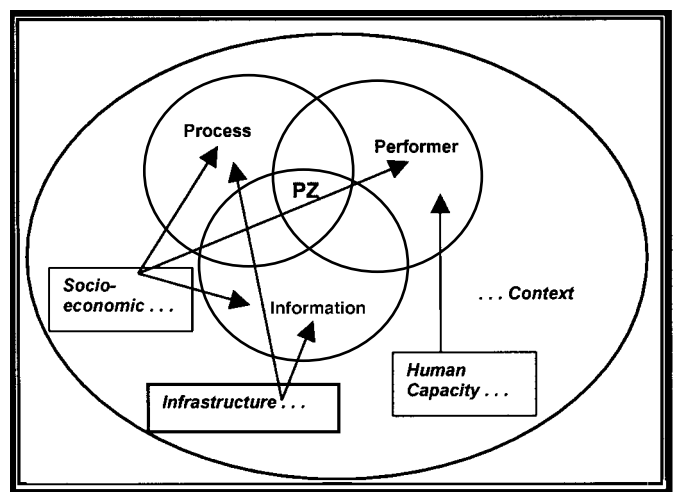


Figure 1. PCD Model for Developing Countries.

As can be seen from Figure 1, the socioeconomic, infrastructure, and human capacity elements have an impact on each other. For example, when analyzing the developing country performer and identifying his or her core characteristics, it will also be necessary to precisely gauge the performer’s capacity to use and maintain a new system. Regarding the process, the analysis will need to ascertain whether the task to be performed with the new system might be impeded by lack of incentives to use the new system or by inadequate system maintenance and support. The information element of the PCD model will need to be addressed by verifying that all users of a new knowledge management system for example, are willing to share information and that the new system can be effectively used in very low, unreliable bandwidth environments. It is by taking into account these contextual factors that the performance zone within the PCD model can be achieved in developing country environments.

	Incipient information culture (Socio-economic)	Centralized decision making (Socio-economic)	Resources for learning and performance (Socio-economic)	Lack of budget planning (Socio-economic)	Unreliable power & telecoms grid (Infra-structure)	Hardware, software, maintenance, and support (Infra-structure)	Adequate facilities (Infra-structure)	Scarcity of qualified personnel (Human capacity)
Process Analysis	What are the current mechanisms for obtaining information?	How are institutional decisions made?	How does the user currently acquire new learning?	What is current financial planning mechanism? Can current operation support new system in the long-run?	What is users' current form of e-use? Fax? PC? Telephone? Mobile? What are standard system specs.?	What is institution's current approach to maintenance and support? Is there a customer support 'culture'?	What is the nature of current physical plant? How is physical plant maintained and upgraded?	Are there systems being appropriately maintained? How?
Performer Analysis	Are users willing to share information? Is there an incentive to share information?	Who makes the decisions? What levels of the institution partake in decision making process?	Does user have interest or incentive to learn and/or change behavior?	Can new system administrator have input to budget allocation for support, maintenance and upgrades?	What is users' access level to e-mail, internet, and www? Is there user incentive to use e-tools?	Do users have ready access to support?	Is there adequate familiarity with hardware systems electrical specifications?	Who currently maintains systems? Are there incentives to maintain systems?
Information/Knowledge Analysis	Is the information reliable?	How are decisions shared and deployed?	Is the user acquiring the right amount of learning at the right time?	Does new system administrator have sufficient information about budget process?	Are users not getting information due to unreliable telecoms grid?	Does the system administrator have enough information to make informed decision regarding procurement?	Is the information available to ensure that facilities can support new system?	Is the right information available in order to ensure adequate system maintenance?

Figure 2. Developing Country Contextual Factors Applied to PCD Model.

The Devil Is in the Details

Taking the discussion further, it is necessary to juxtapose each of the contextual factors and examples described above with the three elements of the PCD model (see Figure 2).

Figure 2 also includes an initial list of questions that begin to address some of the key contextual factors to consider when applying PCD to developing country environments. Finally, Figure 2 illustrates the important level of detail required to conduct a thorough contextual analysis.

An Example

It is important to briefly examine a system intended for developing country audiences. This example will reveal how a simple neglected detail can hamper the delivery of a performance-centered, low-fidelity system.

The African Virtual University (AVU) is a university without walls that uses modern communication technologies to give sub-Saharan countries direct access to some of the highest quality learning resources available. AVU has provided more than 3,000 hours of interactive instruction in English and French to students and professionals in 17 African countries.

Because there is no land-based telecommunications backbone to speak of in sub-Saharan Africa, AVU reaches its learners by means of a satellite broadcast network that can provide digital

video and two-way audio. This delivery approach can be considered a key means toward the achievement of PCD for developing countries, because it takes into account the need to compensate for unreliable telecommunications grids. However, the same cannot be said for AVU's website.

Though the AVU website is indeed simple and downloads very quickly, the page width is too wide and cannot support smaller monitors that might be predominantly present in developing countries.

Figure 3 shows how the AVU homepage appears with a 1024 x 768 monitor display setting. The page is quite adequate when being viewed with the larger 17" monitors that are currently predominant throughout the United States, for example, but the page width is too large for smaller monitors.

Figure 4 shows how the same AVU homepage would be viewed by a user using a PC configured for a 640 x 480 display setting. As the figure plainly demonstrates, a substantial part of the information is no longer available to the user. PCD is thereby not achieved. Again, this simple example points to the importance of contextual analysis for PCD in developing countries.

More Details

Additional considerations to keep in mind when designing PCD web-based systems for developing country contexts



Figure 3. AVU Website With 1024 x 768 Display Setting.



Figure 4. AVU Website With 640 x 480 Display Setting.

include the following:

- Design for two browser levels lower than is the standard in developed country contexts.
- Design system with little to no Java, Javascripts, or plugins. Many older browser versions do not support these.
- Design for two operating systems lower than is the standard in developed country contexts.
- Design system to run on both Internet Explorer and Netscape standard browsers.

Design system to run with 640 x 480 monitor display setting. Include as few graphics as possible. If graphics are absolutely necessary...

- Warn the user.
- Keep graphics small.
- Reduce the number of colors to reduce the size of the graphic.
- Include very descriptive ALT tags with every image so that users with low bandwidth systems who disable the

graphics viewing function from their browsers to minimize download time can get an idea of what the image is showing.

- Within the HTML image tag, specify the image height and width. This will cause the browser to first display the image box and the text on the page while the image loads. Alternatively, the LOWRES attribute within the image tag can be used. This will download a low-resolution version of the graphic. This is particularly applicable for high-quality jpeg images.

This is by no means an exhaustive list. Rather, it illustrates in concrete terms the degree to which designers need to be mindful of the developing country infrastructure contextual factors. A detailed level of contextual analysis needs to occur at all levels in terms of the performer, the task, and the information. It is only by analyzing the contextual factors of all these in detail that the performance zone can begin to be attained in developing country environments.

Conclusion

If the PCD process distinguishes whether users are from developed or developing countries, a truly sustainable, performance-centered system can begin to support the working and learning processes of developing country users. 🌐

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