Research Article

Investigating the Role of Innovation Attributes in the Adoption, Rejection, and Discontinued Use of Open Source Software for Development

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Abstract

Drawing on technology adoption research, particularly diffusion of innovations, this article analyzes organizational adoption decisions of a new ICT by organizations in Nairobi, Kenya. Through a multi-case study and interviews with potential adopters, this research assesses the influence of perceived innovation attributes on adoption decisions regarding the Ushahidi Platform, a tool designed for collecting, aggregating, and mapping information. Findings suggest that perceptions of trialability and observability, two attributes that have been found to be less predictive in past research, were influential in the decision process. Additionally, perceived flexibility is added to the list of attributes that should be considered, particularly for analyzing the adoption of free and open source technology.

Drawing on innovation adoption research, this article analyzes organizational adoption decisions of a new information and communication technology (ICT)—the Ushahidi Platform—by civil society organizations in Nairobi, Kenya (Chigona & Licker, 2008; Flight, Allaway, Kim, & D'Souza, 2011; Moore & Benbasat, 1991; Rogers, 2003). This research focuses on adoption decisions related to an innovative open source technology: the Ushahidi Platform, a tool designed to collect, aggregate, and map user-submitted information. The Ushahidi Platform permits data collection from multiple sources, including mobile phones via SMS (short message service) and online forms, data aggregation, and visualization on an interactive map. At the time of this research, the Ushahidi Platform was a new tool and one of the early innovations used in the growing field of "crisis mapping" (Ziemke, 2011). Ushahidi started as a volunteer effort to report and record incidents related to the 2007–2008 postelection violence in Kenya and resulted in a map "mash-up" of violent hotspots throughout the country (Tully, 2011).

Based on data collected during 12 months of fieldwork in Kenya, this article analyzes the adoption decisions of seven organizations that adopted or rejected the Ushahidi Platform. The article draws on interviews with technologists and civil society workers in Kenya to uncover how perceptions of the software (Ushahidi Platform) and the organization (Ushahidi Inc.) influenced organizational adoption decisions regarding the software. Drawing on diffusion of innovations theory, this article focuses on the perceived attributes of the innovation, which have been shown to affect adoption (Rogers, 2003). Consistent with previous technology adoption research, the findings from this research suggest that perceptions of the technology's attributes (relative advantage, compatibility, complexity, trialability, observability) influence organizational adoption decisions (Chigona & Licker, 2008; Rogers, 2003; Roman, 2003). Research consistently shows that perceptions of relative advantage, compatibility, and complexity are significant predictors, while trialability and observability are often found to be less predictive (Liao & Lu, 2008; Rogers, 2003). In contrast to previous research, however, perceptions of trialability and observability were found to be important influencers in adoption decisions regarding the Ushahidi Platform. Additionally, I propose another attribute—perceived flexibility—be considered among other innovation attributes as potentially influential during the adoption process.

This research also offers insights into how perceptions of the technology company influence adoption, an area that is understudied, considering the number of technology organizations involved in ICTD (information and communication technologies for development) practice. Ushahidi's position as a Kenyan technology startup with a mission tied to social change affected some potential adopters' perceptions of the organization and software, which in turn influenced their adoption decisions. The study of perceived attributes is usually restricted to the actual innovation (e.g., mobile phones, telecenters, business software) without a discussion of the organization responsible for developing the innovation. However, in the case of ICTD, organizations such as Ushahidi, Benetech,[1] and FrontlineSMS[2] often play a role in the adoption process. As such, examining adopters' perceptions of these organizations provides additional insight into the adoption process. This analysis of adoption decisions regarding the Ushahidi Platform offers insights into the decision-making processes of organizations as they develop and prepare to launch ICTD initiatives using open source software.

The next two sections discuss organizational adoption decisions and perceptions of innovation attributes with a focus on ICTD. This is followed by a discussion of the methods and context for understanding Ushahidi's position in Kenya at the time of this research. Next, the findings discuss how perceptions of Ushahidi influenced organizational decision-making regarding adoption in the cases analyzed. Finally, the discussion offers insight into the larger implications of these findings in Kenya and for other ICTD implementations.

Organizational Adoption Decisions

An *innovation* is "an idea, practice, or object that is perceived as new by the individual or other unit of adoption" (Rogers, 2003, p. 12). The decision to adopt or reject an innovation is part of the innovation-decision process. Diffusion of innovations has been used to explain individual-level innovation adoption decisions (e.g., the decision to use telecenters or community computing facilities; Chigona & Licker, 2008; Roman, 2003) and organizational-level adoption decisions (e.g., the decision to adopt IT solutions for small businesses; Premkumar & Roberts, 1999). The innovation-decision process can lead to either *adoption* or *rejection,* and this decision can be changed at a later point. For example, an initial decision to adopt an innovation can lead to *discontinuance,* the decision to reject a previously adopted innovation. According to Rogers (2003), discontinuance can occur because a new innovation has been adopted to replace the previous innovation (*replacement*) or because of dissatisfaction with the innovation (*disenchantment*).

Compared to individual adoption, the organizational adoption process is more complex. According to Rogers, the innovation-decision process:

> is the process through which an individual (or other decision-making unit) passes from gaining initial knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision. This process consists of a series of choices and actions over time through which an individual or a system evaluates a new idea and decides whether or not to incorporate the innovation into ongoing practice. (2003, p. 168)

Rogers (2003) identifies five stages in the organizational adoption process. The first two stages are under the broader *initiation stage*. During *agenda-setting* an organizational problem is identified, creating a perceived need for innovation. *Matching* involves fitting an innovation to the problem/need and planning for adoption. The *implementation stage* begins with *redefinition and restructuring* as the innovation is adapted to fit the specific needs and structures, which may also be altered in the process. *Clarifying* occurs when an innovation gains more widespread use and its use becomes clearer to individuals in the organization. Finally, *routinizing* is when the innovation is incorporated into normal activities and is no longer perceived as new.

Innovation decisions can be grouped into three types: (1) *optional innovation-decisions,* where adoption choices are made by an individual independent of others' decisions; (2) *collective innovation-decisions,* where adoption decisions are made by a consensus of group members; and (3) *authority innovation-decisions,* where choices are made by "relatively few individuals in a system who possess power, high social status, or

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1. http://benetech.org/
2. http://www.frontlinesms.com/

technical expertise" (Rogers, 2003, p. 403). The cases in this article are all examples of either collective or authority decisions regarding the Ushahidi Platform.

Perceived Technology Attributes and Adoption Decisions

Previous research on technology adoption suggests that individuals' perceptions of the technology's attributes are important predictors of attitudes toward possible adoption and ultimately adoption decisions (Chigona & Licker, 2008; Datta, 2011; Davis, 1989; Flight et al., 2011; Rogers, 2003; Roman, 2003). As Davis (1989) notes, "beliefs are seen as meaningful variables in their own right, which function as behavioral determinants" (p. 335). Rogers (2003) proposes that adoption is influenced by perceptions of five innovation attributes: *relative advantage, compatibility, complexity, trialability,* and *observability.* In addition, I propose that *flexibility* be added to the perceived innovation attributes to address issues of technology adaptation and modification that are critical to ICTD adoption and the open source software movement (Hawari & Heeks, 2010; Heeks, 2002; OSI, n.d.).

Rogers (2003) defines *relative advantage* as the perception of how much better the innovation is than the idea that precedes it. Relative advantage has been found to influence adoption and is often found to have the most significant influence on adoption decisions (Flight et al., 2011; Rogers, 2003). Building on Rogers' attributes, research suggests that relative advantage can be divided into two concepts: *perceived usefulness* and *image* (Karahanna, Straub, & Chervany, 1999; Mao & Palvia, 2006; Moore & Benbasat, 1991). Because previous research has shown that perceived usefulness and image are distinct concepts, they are addressed individually in this analysis. *Perceived usefulness* is "the degree to which one believes that a particular system would enhance performance" (Datta, 2011, p. 7). Research has consistently found perceived usefulness to be a strong predictor of information system adoption (Davis, 1989; Legris, Ingham, & Collerette, 2003). In their study of community computing facilities, Chigona and Licker (2008) found that perceived usefulness motivated users, particularly when compared with other Internet access options in terms of cost and travel, but was not seen as more useful when compared with the technology available at other locations. *Image* is "the degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore & Benbasat, 1991, p. 195). For example, potential adopters may perceive a social advantage to adopting an innovation because of a perceived increase in prestige associated with being "cutting edge" (Flight et al., 2011).

Compatibility is also a multifaceted concept that addresses the perception that an innovation is "consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 2003, p. 240). Compatibility with values and beliefs takes into account the larger sociocultural context in which the innovation adoption decision occurs. According to Rogers, innovations that are perceived as compatible with values and beliefs are more likely to be adopted than innovations that are perceived as incompatible. Innovations can also be compatible or incompatible with a potential adopter's previous experience or prior adoption decisions. Rogers notes, "Individuals cannot deal with an innovation except on the basis of the familiar. Previous practice provides a standard against which an innovation can be interpreted, thus decreasing its uncertainty" (2003, p. 243). Finally, an innovation can be perceived as compatible if it meets a felt need and as incompatible if it does not address a need of a potential adopter. An innovation can be perceived as compatible with certain facets of the concept and as incompatible with others. For example, an innovation may be compatible with one's values but incompatible with past experience (Musa, 2006).

Complexity refers to perceptions of how difficult an innovation is to use or understand. According to Rogers, "Any new idea may be classified on the complexity-simplicity continuum. Some innovations are clear in their meaning to potential adopters while others are not" (2003, p. 257). Innovations that are easier to use or understand are more likely to be adopted than ones that are difficult (Rogers, 2003). Rogers suggests that complexity may not be as useful a predictor of adoption as relative advantage and compatibility. However, in their study of e-service adoption in Saudi Arabia, Al-Ghaith, Sanzogni, and Sandhu (2010) found complexity to be the best predictor of adoption among Rogers' proposed attributes.

Trialability—whether an innovation can be tried on a limited basis—can influence adoption decisions

because "the personal trying out of an innovation is one way for an individual to give meaning to an innovation and to find out how it works under one's own conditions" (Rogers, 2003, p. 258). According to Rogers, innovations that can be tried on a limited basis are more likely to be fully adopted than those that cannot be tested. Although trialability has been shown to influence adoption decisions, Rogers suggests that it is typically less predictive than other attributes. However, Stevens, Williams, and Smith (2000) found that perceptions of trialability had an effect on the adoption and use of the Internet by employees in a nonprofit organization. Similarly, Al-Ghaith et al. (2010) found support for the influence of trialability in their study of e-service adoption. Some innovations, including free and open source software, lend themselves to experimentation because users can try them with little risk or cost.

Observability refers to "the degree to which the results of an innovation are visible to others" (Rogers, 2003, p. 258). Some innovations are easily observable and explainable, while others are more elusive. According to Rogers, the observability of an innovation is positively related to adoption. Moore and Benbasat (1991) divided observability into two constructs: *result demonstrability,* or "the tangibility of the results of using the innovation," and *visibility,* or "the extent to which the potential adopters see the innovation as being visible in the adoption context" (Liao & Lu, 2008, p. 1407). Agarwal and Prasad (1997) found visibility to be an influential factor in user acceptance of the World Wide Web, a highly visible innovation that piqued potential adopters' curiosity.

Reinvention, "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation," is widely recognized as a part of the adoption process (Rogers, 2003, p. 180). Rogers argues that "flexibility in the process of adopting an innovation may reduce mistakes and encourage customization of the innovation to fit it more appropriately to local and/or changing conditions" (2003, p. 185). Research into technology adoption in developing countries suggests that innovations that are more easily modified and adapted for local realities are more likely to be adopted and used than more rigid technologies (Hawari & Heeks, 2010; Heeks, 2002, 2006). In their study of the adoption of enterprise resource planning systems in Jordan, Hawari and Heeks (2010) found that assumptions about data management that were built into the system did not match the actual data management practices at the organization. In turn, employees abandoned the system, opting for their old management style, wasting time, money, and resources in the process. Flexible technologies are more suitable to developing countries because implementers can change them to better match local conditions, which are often different than the conditions for which the technology was originally designed. More rigid technologies may not fit local conditions, and this lack of flexibility could inhibit adoption and implementation. Therefore, I suggest that perceptions of the ability to modify or adapt an innovation, what I term *flexibility,* be added to the list of perceived innovation attributes that could influence adoption decisions. Creators of open source software, such as the Ushahidi Platform, build their tools with adaptation and reinvention in mind. Allowing modification is a tenet of open source software development (OSI, n.d.; St. Laurent, 2004).

The following analysis considers potential adopters' perceptions of *relative advantage, compatibility, complexity, trialability, observability,* and *flexibility* regarding the Ushahidi Platform. In addition to looking at perceptions of the actual software, this analysis takes into account perceptions of the organization. Ushahidi played an active role in early implementations of its software and was heavily invested and embedded in the Kenyan technology and development sectors. Perceptions of the organization often intersected with perceptions of the software to influence adoption decisions.

Methods

The data for this study come from 12 months of fieldwork over five visits to Kenya between December 2008 and July 2012.[3] This study focuses on seven cases of small- to medium-sized organizations and the adoption decisions made about the Ushahidi Platform (see Table 1). Supplemental data from other potential adopters, Kenyan technologists, and civil society workers collected through semi-structured interviews and participant

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3. This research received IRB approval from the University of Wisconsin–Madison and the University of Iowa.

Table 1. Organizations and Adoption Decisions.

Organization/project	Adoption decision	Description
Media Focus on Africa Foundation and Butterfly Works (Unsung Peace Heroes)	Adopted	Used Ushahidi to map instances of peace and heroism during 2007–2008 postelection violence
Media Focus on Africa Foundation and Butterfly Works (Building Bridges)	Adopted	Used Ushahidi Platform to map nationwide peace initiatives
Kenya AIDS NGOs Consortium–KANCO	Adopted	Used Ushahidi Platform to create a members and services map
Voice of Kibera	Adopted	Used Ushahidi Platform for citizen reporting and community monitoring
Computer Aid International	Adopted/ Discontinued	Discontinued use of Ushahidi Platform to map organizational activities throughout Africa
Sisi ni Amani	Rejected	Did not adopt Ushahidi Platform; chose a different technology solution for project
Africa Peace Forum	Rejected	Did not adopt Ushahidi Platform; did not implement a project

observation over the course of my fieldwork also informs the analysis as a means of corroborating findings and triangulating data (Miles & Huberman, 1994). The cases included in this article represent the adoption or rejection of the Ushahidi Platform by Kenyan organizations between 2008 and 2010, key years in the early development and growth of Ushahidi (discussed below). Additionally, these cases represent some of the earliest attempts at sustainable, long-term projects using the Ushahidi Platform. These cases are all non-crisis uses, unlike the crisis-mapping roots of the software, providing insight into the adoption of the Platform to achieve longer-term goals. Through an established research relationship with Ushahidi and relationships with Kenyan development and ICT workers developed over multiple field visits to Kenya, I gained access to the people and projects included in this article.

Participant observation took many forms, including participating in meetings between Ushahidi and organizations, meeting with organizations as they considered ICT adoption, and working with technologists and individuals involved in Kenyan civil society at the newly opened iHub, Nairobi's first open innovation space.[4] Through participant observation I was able to engage with individuals and groups at the early stages of the adoption process, often at their initial meeting. I followed groups' progress as they adopted or rejected the Ushahidi Platform and, in some cases, I worked with groups as they used the software. During meetings, I observed interactions and discussions about the projects' purposes and goals, logistics, finances, technical issues, and other important decisions. Working closely with these groups and offering support when appropriate helped me gain the trust of members, gave me greater access to the projects and perspectives of individual group members, and allowed me to contribute my skills to the people and groups that were essential to my research.

Semi-structured interviews were used to gain insight into decision-making processes. All interviews were conducted in English and audio recorded with the permission of interviewees. To protect interviewees' confidentiality, only descriptive characteristics and pseudonyms are used when referring to them.

The triangulation of methods and data enhances the richness of this study by adding depth and breadth to the inquiry (Denzin & Lincoln, 2003). In addition to using multiple methods to gather a variety of data types from a variety sources, this study also draws on multiple perspectives from different disciplines (Janesick, 1998; Miles & Huberman, 1994). Triangulation not only adds to the strength of the study by improving the reliability of the findings (Miles & Huberman, 1994), it also increases the study's applicability to other settings and

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4. http://www.ihub.co.ke

circumstances (Marshall & Rossman, 2011). This is not to say that the findings are generalizable, but rather to suggest that the systematic method of collecting multiple data types and analyzing multiple cases offers opportunities to draw conclusions beyond the cases analyzed.

Ushahidi in Kenya, 2008–2010

Ushahidi, which means "testimony" in Swahili, began as a volunteer initiative in response to the 2007–2008 postelection violence in Kenya. On January 3, 2008 Ory Okolloh, a prominent Kenyan blogger, wrote a post on her blog that led to the development of the first Ushahidi website, a map mash-up of postelection incidents of violence throughout Kenya. The original Ushahidi site aggregated information from individuals throughout Kenya and displayed the information on a publicly viewable map. The motivation for developing the first Ushahidi site was to create a space where anyone could contribute information to create a more accurate record of the postelection violence.

Ushahidi has a broad social change mission: "[W]e build tools for democratizing information, increasing transparency and lowering the barriers for individuals to share their stories. We're a disruptive organization that is willing to take risks in the pursuit of changing the traditional way that information flows."[5] In summer 2008, Ushahidi officially became a nonprofit technology company focused on rebuilding the Ushahidi Platform as free and open source software for aggregating and mapping information.

Ushahidi began the first phase of testing a rebuilt version of the software in August 2008 with a number of organizations in Kenya. Ushahidi officially released the alpha version of the software in October 2008. This version allowed users to create reports tagged with location information, add images, video, and external links to reports, comment on reports, and subscribe to email or text alerts. The second phase of testing began in January 2009 and ran for six months. A number of Kenyan organizations participated in this testing phase but few organizations developed full-scale initiatives. Toward the end of this testing phase, Ushahidi released a version of the software for public download. However, many smaller organizations found they could not use the platform because its installation required a level of technical knowledge and server access they lacked.

As a result of these technical limitations and Ushahidi's commitment to Kenya, Ushahidi continued to support Kenyan organizations and hosted sites for various groups, a decision that affected some users' expectations and perceptions of the organization (Okolloh, 2009). In addition, some of Ushahidi's early funding was predicated on its involvement with Kenyan implementers. Through outreach in Kenya and blog posts, Ushahidi attempted to clarify and define its position in Kenya. For example, Ory Okolloh, an Ushahidi cofounder, published a blog post explaining the organization's position on implementations in Kenya:

> When we started out with the rebuild of Ushahidi, we made a strategic decision to leave the implementation of the tool to the particular organization or individual who wanted to use it. . . .
> The only exception to this rule will remain Kenya, where [we] will continue to be actively involved in installs there because that's where the idea of Ushahidi was born and because we need to "get our hands dirty" somehow in order to continue to make Ushahidi a better tool. (2009)

Because of this commitment to Kenyan projects, some potential adopters inquired about partnering with Ushahidi without a clear sense of what that partnership would entail. Many assumed that Ushahidi would provide more support than the organization actually offered. Erik Hersman, Ushahidi cofounder, noted:

> We make a platform that will help you solve problems if you use that platform in a way that's creative or that works for you. . . . We don't see ourselves as the organization that comes in there and does all that for you. (personal communication, July 7, 2010)

This approach to support and partnerships affected perceptions of Ushahidi and relationships with potential adopters in Kenya.

In December 2009 Ushahidi announced the release of "Mogadishu," v1.0 of the Ushahidi Platform.

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5. The URL from which this quote was taken (http://ushahidi.com/about-us) is no longer active and has been replaced by http://www.ushahidi.com/mission/, which has a different articulation of the organization's mission and goals. The description above was used at the time of data collection.

Mogadishu featured a number of improvements and upgrades from earlier versions. Ushahidi planned to test Mogadishu in January 2010 and to fix problems and bugs. However, when the Haiti earthquake struck, the Ushahidi team responded by supporting a site for reporting on the crisis (Okolloh, 2010). The team could not have anticipated the effects of the earthquake on the organization or the software. Instead of business as usual, the core team and hundreds of volunteers worked tirelessly on the Ushahidi-Haiti deployment. The Haiti crisis put Ushahidi in the global spotlight in ways that had not happened before (see Heinzelman & Waters, 2010 and Morrow, Mock, Papendieck, & Kocmich, 2011 for in-depth analyses of Ushahidi-Haiti). Ushahidi was featured in international news media, such as CNN and *The Washington Post,* and received increased national press coverage in Kenya as well. The publicity of the crisis in Haiti led to an increased demand for the software globally and in Kenya. To put the demand in perspective, during December 2009 the Ushahidi software was downloaded 160 times; in January 2010 it was downloaded 543 times (Hersman, 2010b).

Not only did the Ushahidi-Haiti deployment shoot Ushahidi to global recognition, it propagated the idea that Ushahidi was responsible for software implementations because the organization was a key strategic partner in this initiative (Meier, 2010). To complicate matters further, Patrick Meier, who also worked for Ushahidi, launched the site and was the face of the project. His role as Ushahidi employee and initiator of Ushahidi-Haiti created much confusion about the role of Ushahidi in the project. Ushahidi was not responsible for initiating the Haiti project. However, Ushahidi was partly responsible for propagating this view because early publicity, including blog posts by the Ushahidi team, suggested Ushahidi launched the site (Meier, 2010; Okolloh, 2010). For this analysis the most relevant outcome of the Ushahidi-Haiti initiative is the attention Ushahidi received from organizations in Kenya and around the world, which not only increased demand for the software but also demand for the organization's services.

Throughout 2010 Ushahidi continued to improve the software and hired additional developers and staff. Ushahidi released version 2.0 of the platform in November 2010, incorporating many of the features developed during the Haiti crisis. Ushahidi's strategy changed between 2008 and 2011 as the team looked to take a less hands-on approach with Kenyan implementations. The release of Crowdmap[6] and the simpler server installation of the Platform were developed to alleviate the difficulty groups had with the technical aspects of the software. Despite the organization's attempt to pull back on partnerships, as Ushahidi gained more recognition and as potential users became increasingly aware of its involvement in some implementations, the demands on Ushahidi increased.

Perceptions of Ushahidi

This section examines potential adopters' perceptions of Ushahidi, considering both perceptions of the organization and the software and of how these perceptions influenced adoption decisions (see Table 1).

Relative Advantage: Perceived Usefulness and Image

Potential adopters of the Ushahidi Platform often perceived the mapping and crowdsourcing aspects of the tool as its most useful components. Typically, potential adopters wanted to gather information from a variety of sources and visualize that information on a map because they perceived geolocated information as useful for achieving their project or organizational goals. For example, a local advocate of organic farming wanted to use the platform to map organic farmers working throughout Kenya. She planned to use the map to show policy makers and agricultural nongovernmental organizations (NGOs) how many organic farms existed in the country and to push for policies and assistance that favored organic farming. Although she maintained a database of farmers, she said that the map would be more useful when advocating for her cause and conveying information to key stakeholders. In her case, adopting Ushahidi was seen as better than her current option of using a database.

For Media Focus on Africa Foundation and Butterfly Works (Unsung Peace Heroes and Building Bridges),

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6. In 2010 Ushahidi launched Crowdmap, a cloud-based product with similar functionality to the original platform. None of the organizations in this study used Crowdmap at the time of data collection.

mapping nationwide examples of heroism and peace was a top priority for achieving their goals of showcasing heroes and peacemakers in Kenya. As such, the organization's leaders found Ushahidi's aggregation and mapping components provided an advantage over other solutions that could not support the visual display of countrywide data. Additionally, Media Focus and Butterfly Works collaborated with Ushahidi during the software's alpha testing stage to create the Unsung Peace Heroes project so they were able to provide feedback into which software aspects were most useful and user-friendly. This relationship with Ushahidi was perceived as highly valuable and useful to project development and implementation.

When mapping and visualizing information were seen as less useful or difficult to achieve, potential adopters were less likely to adopt the platform. In the case of Sisi ni Amani (We are Peace) the decision to reject the platform in favor of an SMS system came after leaders realized that mapping and visualizing information online would not serve their constituents, who rarely accessed the Internet and felt little need for a map. For Sisi ni Amani the decision to reject the Ushahidi Platform was better than adopting it because it was not the best option for meeting project goals.

Regarding image perceptions, those related to increased social status also influenced potential adopters. Groups were more interested in adopting the Ushahidi Platform as it became more well-known and respected in Kenya and worldwide. The ability to be seen using Ushahidi motivated some users to adopt the tool despite other factors, such as lack of compatibility, that suggested they should not adopt it. As Ushahidi became globally known, particularly after the Haiti earthquake, the social status of being associated with the organization and the product became increasingly attractive. Potential adopters wanted to work with Ushahidi, even if they lacked a clear sense of a project or purpose and were often under the impression that Ushahidi was available for partnerships or to do the technical work for them. Ushahidi could rarely provide these services, an issue that is also relevant to perceptions of compatibility. In the case of Africa Peace Forum (APF) the final decision to reject the software in favor of continuing with the organization's existing work came after months of deliberation and meetings with Ushahidi and other potential partners. Despite a clear interest in the possible prestige associated with using the Platform, APF leadership realized that adopting it would not be feasible with its limited resources.

Compatibility

Compatibility refers to the perception that an innovation is consistent with one's values, beliefs, experiences, and needs. The multidimensional nature of compatibility is evident in the adoption of the Ushahidi Platform as users often perceived the tool to be compatible in one area and incompatible in others. For many potential adopters, the Ushahidi Platform was compatible with their values and beliefs about the importance and effectiveness of ICT in supporting their mission and goals. However, at the same time, adopting the platform was often inconsistent with potential adopters' past experiences or actual organizational needs. Potential users often had little or no experience with ICT and, therefore, little knowledge about how to successfully develop a project that used Ushahidi. The discrepancy between attitudes/beliefs and experiences/needs was common among organizations that wanted to tap into the potential of ICT to achieve their goals but had been focused on other areas in their work.

The social climate in Nairobi was one in which ICTD was a hot topic. As the government continued to invest in ICT, with the goal of becoming a top-10 global ICT hub, the technology sector continued to grow.[7] Nairobi is a global center for NGOs, many of which focus on development. According to Taylor (2004), Nairobi is "the number one NGO connectivity city" (p. 272). In this environment many organizations felt pressure to pursue ICT projects even if those projects were incompatible with previous experiences and felt needs. Additionally, the fact that Ushahidi is a Kenyan-born technology company often led potential adopters to conflate it with ICT for development, despite the platform's myriad uses (Hersman, 2010a).

Media Focus on Africa and Butterfly Works collaborated with Ushahidi during the alpha testing stage to create the Unsung Peace Heroes project. Their previous experience with Ushahidi meant the leadership and some staff were familiar with the platform when it came time to plan, design, and execute the Building Bridges

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peace-mapping project. Again, the organizations worked with Ushahidi to customize the software and create a site that aligned with their goals and built on previous practice. In short, the previous experience developing Unsung Peace Heroes was beneficial during the adoption process and implementation of Building Bridges.

KANCO, another early adopter, worked closely with Ushahidi and other partners to develop its project and to customize the health map of KANCO member organizations. In this case, the organizational goals aligned well with the product and testing conditions because the users had the technical support of Ushahidi. Using an online mapping tool that supported user-submitted contributions aligned well with KANCO goals; however, the project did not align with staff resources and time commitments, making it difficult to get full staff buy-in and support. In this case, the adoption was compatible with the leadership's vision, but incompatible with the staff's work.

Staff members at Computer Aid International expressed hesitation about adopting the Platform to map their work throughout Africa, in part because they were unsure why they needed it to achieve organizational goals. The project leader developed the concept based on her perceptions of how the organization would use the tool, but these did not align with the staff's perceptions. As a result, Computer Aid adopted Ushahidi, but discontinued use after a few months due to incompatibility with needs, limited support, and insufficient staff commitment. This decision is consistent with disenchantment discontinuance described by Rogers (2003). For Computer Aid, the initial authority-driven decision to adopt resulted in a decision that was met with resistance by others within the organization.

In the case of Africa Peace Forum, adopting Ushahidi was incompatible with previous practice and needs, leading the organization to reject the software. APF's initial interest in adopting was not based on an assessment of compatibility, but was pushed by an external funder interested in promoting ICTD projects and working with Ushahidi.

Complexity

Complexity is a useful concept for understanding the adoption of the Ushahidi Platform because, as the findings from this study suggest, people's perception that Ushahidi was easy to use influenced them to adopt the tool, often without consideration of implementation and long-term maintenance responsibilities. After KANCO leadership decided to adopt the Platform—an authority-driven decision—staff felt that it was difficult to use and update, leading the organization to hire a consultant to manage the project and train staff on how to use the Platform. Despite this effort to train staff, the KANCO project had limited success within the organization. Staff members did not work to update the site, so the job was relegated to the IT person who was also responsible for a number of other tasks. Additionally, KANCO offered training sessions to individuals from its member organizations to clarify its purpose and reduce perceptions that it was difficult to use. Despite their efforts, adoption was not as widespread as hoped.

Sisi ni Amani leadership chose not to adopt the Platform for a large outreach project because its constituents found the tool difficult to understand and incompatible with their needs, as discussed previously. The software's perceived complexity led Sisi ni Amani to opt for a different technology solution for its project. For Sisi ni Amani, the perceived difficulty of using the software and the mismatch between the tool and the organization's needs led to a positive decision to not adopt.

In other cases, organizations and groups launched websites using Ushahidi and never used them, reflecting a process of initial adoption followed by discontinuance (Rogers, 2003). Because of Ushahidi's involvement with Kenyan organizations, it often set up sites on its servers to carry the technical burden of the installation for interested organizations. But even if the installation was completed for them, many potential adopters still did not use their sites. In these situations, users often perceived the Platform as simple to use from a technical perspective, but they did not account for the difficulty of maintaining and sustaining their project, leading to sustainability failures (Best & Kumar, 2008; Heeks, 2002). Consistent with innovation adoption research, the perception that the Ushahidi Platform was simple to use often led to an initial adoption. However, the difficulty of sustaining projects often led to discontinuance or project failure.

In cases where perceptions of complexity and adopter skillsets were more closely aligned, adoption was more successful, which is consistent with previous research on ICTD implementations (Hawari & Heeks, 2010;

Heeks, 2002). For example, leaders at Voice of Kibera had the previous knowledge and experience to gauge the complexity of the Ushahidi Platform for their purposes and successfully adopted the tool to map citizen reports and monitor the community. However, as the project grew and community members began to submit reports and work with the website, the website's "fit" needed reassessment as these individuals typically had limited experience with technology and perceived the tool to be more complex than did the leadership who implemented it (Heeks, 2002).

Trialability

Trialability is the extent to which something can be tested or experimented with before full adoption. Despite previous research that has found perceptions of trialability to be less influential than other attributes (Rogers, 2003), findings from this study suggest that trialability is an important factor influencing adoption decisions regarding the Ushahidi Platform. Potential Ushahidi users often wanted to try the software to become more familiar with its functionality before deciding if they wanted to implement it. On one hand, Ushahidi has a high degree of trialability because it is free and available for anyone to download. On the other hand, it was difficult for potential adopters who lacked technical expertise to test the Platform because the software had to be installed on a server or hosted on Ushahidi servers, yet most potential adopters had little or no knowledge about website administration.

In certain circumstances Ushahidi set up websites for users on its servers for them to try and also arranged meetings and training for potential users. For example, Ushahidi set up a site for Africa Peace Forum after the organization showed interest in the software. After a testing period, APF realized it would need additional technical support to administer the site. The trial period saved them the expense and time of launching a project without the necessary support. Voice of Kibera had an extensive trial period after the founders set up the initial site. They worked with community members to test and customize the site to meet the goals of their community-reporting project. After the initial experimentation, Voice of Kibera leaders tested the site with additional community members, leading them to reassess the project plan and confirm their decision to adopt Ushahidi. The new project plan relied on trained volunteers to submit reports rather than asking all community members to submit reports. The trialability of the tool allowed Sisi ni Amani to test the software with its members and constituents. This testing proved invaluable as the organization's leadership learned that the tool was incompatible with their goals and perceived as complex by many potential users.

A number of potential adopters were trained on the administrative side of the site, giving them a chance to try the tool before deciding to adopt or reject it. Ushahidi staff also gave interested users login information for a demo website so they could familiarize themselves with the site administration before making an adoption decision. The ability to try Ushahidi before deciding to adopt or reject provided potential adopters with experience to make more informed decisions. Because the software was free to use and the initial investment was low, organizations often experimented with Ushahidi but never proceeded to full adoption.

Observability: Result Demonstrability and Visibility

As discussed, between 2008 and 2011 Ushahidi's visibility in Kenya and worldwide grew significantly. In 2008 when Media Focus and Butterfly Works developed and launched Unsung Peace Heroes, Ushahidi was still a relatively unknown organization and product. The project leaders responsible for Unsung Peace Heroes knew about the original Ushahidi effort during the postelection violence and were able to tap into an existing technology and development network to foster their relationship with Ushahidi. At this time Ushahidi was visible to a small but dedicated community of technology enthusiasts, crisis mappers, and individuals interested in the technology's potential for ICTD applications. By the time Media Focus and Butterfly Works were ready to launch *Building Bridges,* Ushahidi was a highly visible organization beyond its original community. Not only was Ushahidi gaining popularity in the Kenyan technology sector and civil society, it was receiving national and international media coverage, making it a highly visible organization and product. Media Focus and Butterfly Works tapped into this visibility by associating with Ushahidi through participating in Ushahidi-sponsored events, showcasing their previous work with Ushahidi and connecting online, particularly through the Ushahidi

blog. For Media Focus and Butterfly Works, the observability of the results—their two nationwide maps and publicity for the winners of their peace projects—was another motivator for using Ushahidi. The website is a tangible result that could be easily communicated to others, a key factor when asking for user submissions and showing the success of the implementation.

For some potential adopters, having donors or other key stakeholders see them use Ushahidi was a compelling reason to adopt. This was especially apparent in the case of Africa Peace Forum. APF staff had little previous experience with technology, and the mapping project was outside the scope of the organization's typical work; however, pressure from a major international funding agency to develop an ICT project prompted APF's initial interest in Ushahidi. APF leaders attempted to develop a project to satisfy the donors, but incompatibility and complexity ultimately proved to be insurmountable hurdles in the adoption process.

Flexibility

Perceptions of flexibility are closely tied to the previous perceived attributes. Because the Ushahidi Platform is free and open source, users can modify it to better fit their needs, increasing its compatibility. Experimenting with the software on a limited basis (trialability) increases the chance that adopters will adapt it to better suit their needs. For example, the regional office of an international media development organization launched an Ushahidi site that incorporates audio stories from journalists throughout the country. The ability to add this feature to the platform, a minor customization, was a factor in the organization's decision to use the platform. Staff experimented with Ushahidi for five months before hiring a consultant to fully adopt the platform. Without the trial period and ability to adapt and customize the platform, the organization would not have implemented the initiative.

Voice of Kibera also customized the Ushahidi Platform to create a website that promoted the organization's goals and featured videos on the homepage. The adaptability of the platform (a feature of free and open source software) and the founder's technical expertise allowed Voice of Kibera to launch its initiative. Partners in the KANCO project were interested in adopting Ushahidi because they perceived that it could be modified and customized to function as an organizational directory. KANCO perceptions and the actual site functionality did not always align, and the final product lacked the complete set of features the adopters desired. For Media Focus and Butterfly Works, the perceived flexibility of Ushahidi was influential in their decision to use it for Building Bridges because they planned to integrate it with Joomla!, another open source software solution. Their perception that the Platform could be modified to successfully integrate with Joomla! led the organizations to adopt it and create a highly customized site.

Conclusions

Assessing perceptions of Ushahidi's attributes indicates that trialability and observability, attributes that are often considered less predictive than the others, are important factors in the decision-making process. The influence of trialability and observability suggests that free, online tools might be perceived differently than more rigid ICT solutions such as hardware. The ability to try a new technology before making a decision should assist potential adopters in making the decision that best fits their circumstances. Trialability is important for ICTD initiatives because it gives implementers a chance to assess the potential of a tool, which should limit the amount of time and resources spent on large-scale projects and perhaps prevent failure (Heeks, 2002, 2003, 2006). Observability must also be considered as ICTD initiatives increasingly have a high degree of result demonstrability and visibility (Chigona & Licker, 2008). Observability becomes complicated when you consider the different stakeholder groups—donors, constituents, technology companies, etc.—that are part of the social system of adoption. More research should consider the questions of "observable to whom?" and "for what end?"

Additionally, the proposed perceived flexibility attribute is another relevant characteristic to consider, especially for ICTD initiatives, which may require modifying or adapting technologies to meet user needs and to fit diverse circumstances. Modification and reinvention have received substantial attention and support in ICTD

research (Hawari & Heeks, 2010; Heeks, 2002, 2006). Considering flexibility as a predictor of adoption and not only a success or failure factor should lead to more sound and strategic adoption decisions.

Much ICTD research has focused on project success and failure factors (e.g., Best & Kumar, 2008; Heeks, 2002, 2006), but little research has considered that perhaps *not* adopting a new technology—and making this decision early in the process—is the best outcome (see Avgerou, 2010, for a discussion of ICT not contributing to development outcomes). Perceived innovation attributes could be used to better gauge the fit between potential adopters' implementation goals and the innovation under consideration. In Rogers' (2003) formulation, having the time to try an innovation before committing to it increases the likelihood of adoption. In this view, adoption is seen as the positive outcome. However, the current research suggests that rejection can be the best adoption decision and that this decision often comes after an initial trial period. As critics of diffusion of innovations have noted, diffusion of innovations is not without limitation. In this case, most notably, its "pro-innovation bias" implies that innovation adoption is desirable and rejection is undesirable (Al-Gahtani, 2003; Avgerou, 2010; Herold, 2010). The findings discussed here seek to refute the pro-innovation bias by highlighting that rejection and discontinuance can constitute a positive decision. In ICTD research, rejection and discontinuance are typically seen as "failures" (Best & Kumar, 2008; Heeks, 2002) and have not been explored as potentially positive outcomes.

Four perceived attributes are increasingly important as open source software and online tools become simpler (complexity), more able to be tried or experimented with on a limited basis and adapted to meet local needs (trialability and flexibility), and highly visible within organizations and to the outside world (observability). Potential adopters' perceptions of these attributes are not always accurate or relevant to the adoption and, therefore, can lead to misguided adoption decisions. For example, misperceptions of the complexity of using social media and online tools are commonplace. Tools are perceived as so simple to use that potential adopters are falsely persuaded to believe that adoption and the implementation process will be straightforward. Because the sign-up process is often so simple—Create a free account!—individuals are misled into thinking that using the tool is simple, which could lead to discontinuance or project failure.

With ICTD projects, organizations such as Ushahidi, Benetech, and FrontlineSMS, among others, often play a role in the adoption process. As such, their relationship with project implementation should be explored. This research is an important step in understanding how perceptions of the organization behind a technology innovation can influence adoption decisions. As findings from this research suggest, perceptions of the organization can be as influential as perceptions of the actual technology.

As new technologies become available and implemented for ICTD projects, it is important to understand how and why they are adopted for development purposes, what can be done to increase the likelihood of successful ICTD implementations (Hawari & Heeks, 2010; Heeks, 2002, 2003), and when adopting a new technology may not be the best or most appropriate adoption decision. ∎

Acknowledgments

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