### Project factsheet information

<table>
<thead>
<tr>
<th><strong>Project title</strong></th>
<th>Digitalising and Preserving Oro, A Secret Signage Language of the Nomadic Penans in the Rainforest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grant recipient</strong></td>
<td>Institute Of Social Informatics And Technological Innovations (ISITI) Universiti Malaysia Sarawak (UNIMAS) Kota Samarahan, Sarawak, 94300 Malaysia Tel: (Office) +6 082 583673 Fax: +6 082 583661 <a href="http://www.isiti.unimas.my">www.isiti.unimas.my</a></td>
</tr>
<tr>
<td><strong>Dates covered by this report</strong></td>
<td>01 – 04 – 2014 / 15 – 05 – 2015</td>
</tr>
<tr>
<td><strong>Report submission date</strong></td>
<td>24 – 09 – 2015</td>
</tr>
<tr>
<td><strong>Country where project was implemented</strong></td>
<td>Malaysia</td>
</tr>
<tr>
<td><strong>Project leader name</strong></td>
<td>Tariq Zaman <a href="mailto:zamantariq@gmail.com">zamantariq@gmail.com</a></td>
</tr>
<tr>
<td><strong>Team members (list)</strong></td>
<td>Universiti Malaysia Sarawak (UNIMAS), Malaysia: Tariq Zaman <a href="mailto:zamantariq@gmail.com">zamantariq@gmail.com</a> Alvin Yeo Wee <a href="mailto:Alvin@isiti.unimas.my">Alvin@isiti.unimas.my</a> Narayanan Kulathuramaiyer <a href="mailto:nara@fit.unimas.my">nara@fit.unimas.my</a> Polytechnic of Namibia, Namibia: Heike Winschiers-Theophilus <a href="mailto:hwinschiers@polytechnic.edu.na">hwinschiers@polytechnic.edu.na</a></td>
</tr>
<tr>
<td><strong>Partner organizations</strong></td>
<td>The University of Auckland, New Zealand: Assoc. Prof Beryl Plimmer <a href="mailto:beryl@cs.auckland.ac.nz">beryl@cs.auckland.ac.nz</a> National University of Singapore, Singapore: Kasun Thejitha Karunanayaka <a href="mailto:kasunthejitha@gmail.com">kasunthejitha@gmail.com</a></td>
</tr>
<tr>
<td><strong>Total budget approved</strong></td>
<td>AUD 22339.4</td>
</tr>
<tr>
<td><strong>Project summary</strong></td>
<td>In 200 words, please describe your project.</td>
</tr>
</tbody>
</table>
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Project Summary

**Tips:** It is recommended to complete this section once you have finalized the text of the report. It will be easier to go back through to build the summary based on the highlights of the report the project team just put together.

The Project Summary can be up to one page long.

It should include a brief justification; an outline of the project objectives to be achieved; the project real timeline and the main activities conducted.

The abstract of the project written when ISIF Asia initially approved the project and the objectives listed in the Grants Agreement signed by APNIC and your organization should be useful inputs when preparing this section of the report.

In 2013, the ISITI and Polytechnic of Namibia with the collaboration of Long Lamai community initiated a project for digitalizing and preserving of Oroo’. Oroo’ is a living cultural heritage of the Penan which from a historical, political, social and scientific perspective is of extreme value to society. The community elders acknowledge the growing interest of their young generation in Information and Communication Technologies (ICTs) and the role of technology in bridging the social and cultural intergenerational gap in Long Lamai. Therefore the main goal of Oroo’ project is to develop and design appropriate ICT tools for preservation and digitalization of sign language of the community, given that the older generation is slowly dying out, and knowledge is no longer being transferred to the younger generation within the current context. Over the last year we have assessed the number of signs known across the different age groups of the community. The elders know on average about 30 signs, while people between 30 to 41 years 10 signs, between 20 and 30 years 6 signs and the under the age of 20 years know about only 3 Oroo’ signs. Thus the project activities focus on documenting Oroo’ signs and developing ICT tools for contemporary use of Oroo’ signs as communication medium for the youth. The project outcomes include a database of Oroo’ signs, a PC based digital Oroo’ adventure game and a mobile based Oroo’ Tangibles, a learning tool for Oroo’ language. Our findings show that the digital tools are engaging and encourage intergenerational knowledge transfer and thus have the potential to help preserve this language. In addition, the project also produced high impact factor international research publications.

Background and Justification

**Tips:** The reader should be reminded of the context your organization is working, and where the project has been developed in.

This section provides a window to understand the challenges faced by the community you are working with.

Include a detailed description about the situation before the project start, describing any relevant aspects that make the project relevant in such a particular scenario.

The reader should be provided with a clear description about the problem(s) to be addressed through this project and the motivation from your organization and team members to get involved and offer a solution.

Community Background

Digitalizing Oroo’ is a collaborative project of ISITI, Polytechnic of Namibia and Long Lamai, a local Penan community in Malaysia, on Borneo Island. Penans are one of the indigenous communities living in Sarawak, Brunei and Kalimantan. The Sarawak Penan population in 2010 was estimated to be 16,281 people of whom about 77 % have settled permanently. The remaining 20 % are semi-nomadic while 3 % are still nomadic [1]. Long Lamai is one of the most progressive Penan communities in the upper reaches of Sarawak’s Baram river basin.
It is very remote, requiring one and a half hours’ flight from Miri, and then an hours’ longboat journey upriver. There are 105 households and a population of app. 500. There is no 24-hour electricity supply and limited telecommunication service. Some families have generator sets to generate power, but few families can afford this. The Penan in Long Lamai were nomads, but have settled down in the area for over 50 years. Today the communities in Long Lamai is mainly involved in subsistence farming, and thus face issues of urban migration of their youths, reduced opportunities to economic activities to improve livelihoods and loss of their indigenous knowledge. In this light the ISITI has engaged in a number of projects with the Long Lamai community, such as the e-Lamai Telecentre which was inaugurated in 2009, supporting initiatives such as the development of an indigenous botanical knowledge repository, an online Penan language dictionary and an e-health system. A number of other joint cross-disciplinary research and outreach activities are undertaken in the field of rural-based tourism, health and infrastructure in order to nurture a sustainable socio-economy.
Project Justification

"Many linguists predict that at least half of the world’s 6,000 or so languages will be dead or dying by the year 2050. Languages are becoming extinct at twice the rate of endangered mammals and four times the rate of endangered birds" ([2] as cited in [3]).

“The loss of indigenous languages is also detrimental to biodiversity, as traditional knowledge of nature and the universe, spiritual beliefs and cultural values expressed in indigenous languages provide time-tested mechanisms for the sustainable use of natural resources and management of ecosystems, which have become more critical with the emergence of urgent new challenges posed by climate change.” [4].

Countless indigenous languages have emerged over epochs of which many have already disappeared and others are at the virtue of extinction. Besides spoken and written languages much less documented and well-known are the sign and secret languages of rainforest inhabitants, which are made out of combinations of twigs, leaves and other jungle products. Penans sign language Oroo’ is one of the examples. Oroo’ is an extremely sophisticated asynchronous signage language of the nomadic Penans in the rainforests of Malaysian Borneo.

The Oroo’ signs are made out of rainforest materials, such as twigs, branches, and leaves and attached to the signage stick. Through different combinations of signs, various messages and narratives are constructed, such as call for help, warnings of danger (snakes, old branches, enemies), instructions (meeting points and times), as well as information about whereabouts of food, animals, humans and houses.

Oroo’ is a living cultural heritage of the Penan which, from a historical, political, social and scientific perspective, is of extreme value to our society. It is a unique example of convergent relationship between cultural diversity, language and bio diversity of Borneo. In initial engagement with the community elders they expressed their concerns of losing enriched Penan cultural heritage. According to them the youth and especially children are no longer interested in going to the jungle but rather spend their time with ICTs and playing digital games on computer. In this context, providing deep learning opportunities and creating learning environments for transferring cultural and traditional knowledge, is one of the biggest challenges for parents and elders in these indigenous communities. The community elders also showed their interest to explore the potentials of technology and digital games in bridging the socio-cultural and intergenerational knowledge transfer gap. The recent research also shows that the digital media provided teachers with opportunities for new learning spaces and resulted in additional unintended learning outcomes in remote Aboriginal schools of Australia [5]. We therefore embarked on a joint endeavor of documenting, digitalizing and re-introducing this rich traditional sign language to the Penan youth by different means. To the best of our knowledge, neither a formal documentation process nor a digitalization effort has been initiated for preservation of Oroo’. There is thus a need to document, preserve and sustain this language.

Project objectives

Tips: Please include here the original objectives as listed on the Grant Agreement.
If any objectives were modified, added or removed during the reported period this should be explained/justified.

The objectives of this projects are:

1) To collect a comprehensive set of Oroo’ and do a pattern and message structural analysis along the dimensions mentioned above.
2) To gain insights into this intricate informal message composition and asynchronous communication approach.
3) To co-design an educational Oro cultural heritage game based on the fundamental principles of the Oro symbolic language.
4) Designing exploring mechanisms to evaluate the preservation, transfer of knowledge -from the old to the young generation.
1): To collect a comprehensive set of Oro and do a pattern and message structural analysis along the dimensions mentioned above

Considering the extremely scares and incomprehensive Oro’ documentation in the literature, we have launched into our own collection of signs, messages and rules. We have over the last two years collected about 54 different signs during a number of jungle walks around Long Lamai. Community members demonstrated different Oro’ signs and messages. We have video recorded the process of making the signs and taken photos of each one. We have documented the name and description of each sign and combinations thereof. At each visit an elder constructed Oro’ signs and messages as they came to his mind in the real environment. The authenticity was verified by a second accompanying elder. Considering the density of the jungle, the clarity and details of the signs and messages are at times blurred on the digital photos, as other twigs, branches and leaves are all around. Thus, a local artists group was engaged to draw each Oro’ sign. The drawings helped to understand the detailed complexities of the Oro’ signs. The drawings are used alongside the photographs for further discussions, documentations and categorizations. All the drawings, photos and descriptions were reconfirmed by the community elders in community meetings.

2): To gain insights into this intricate informal message composition and asynchronous communication approach

In the absence of a documented grammar we have recently engaged in a systematic exercise to explicate the tacit rules of combining the signs forming a valid message, as well as categorizing the signs. While at this point our analysis is still incomplete, we have uncovered a number of subtle variations and meanings in the message.
composition. Firstly the ‘Batang Oroo’ (or ‘message stick’) which shows the direction where the sign maker (writer) is going and also has different positions where signs can be attached and thereby combined to a full message.

3): To co-design an educational Oro cultural heritage game based on the fundamental principles of the Oro symbolic language

Besides having created a database of current signs and messages composed of the Penan term, English translation, photo, drawing and video recording of construction and explanations, we have evaluated so far two different approaches to enhancing the learning of signs with technology.

**Oroo’ Adventure P.C game**

We have developed an Oroo’ adventure PC game with three stages for kids. On the first level the Oroo’ signs are explained in the form of stories followed by an interactive component of finding hidden signs scattered in the background picture of the rainforest. Then, the users have to distinguish between pairs of presented Oroo’ messages. And finally the kids are presented with an Oroo’ sign representing an animal and are requested to shoot the corresponding animal with a blow pipe. The game is then followed by a quiz to test the users’ Oroo’ sign knowledge. A first evaluation, with 17 kids in Long Lamai, suggests that the general interest in local content games is awakened yet the learning curve has been rather shallow. A number of improvements are required to enhance the performance and its applicability beyond kids.

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**Oroo’ Tangibles**

Capacitive sensing tangibles linked with 2D representations on tablets, were explored as a novel concept for teaching Oroo’ signs. The tangibles were constructed out of a baseplate with touch points topped with the Oroo’ sign made out of clay and natural products. Their sole function programmed was to initialize the signs on a tablet for further manipulation of the 2-dimensional digital representations of complex messages. The tangible-tablet tool was evaluated as a collaborative learning tool in the village where 6 family groups, consisting of respectively an Oroo’ conversant parent and a child engaged with the tool.
4): Designing exploring mechanisms to evaluate the preservation, transfer of knowledge -from the old to the young generation

**Oroo' Adventure P.C game**

We engaged 17 children, 9 girls and 8 boys between the age of 10 and 11 in the evaluation of the game. All the sessions were guided by two local Penan youths as tester (one lady age 21 and one teenage boy of age 19).

Firstly, a pre-game questionnaire containing 26 signs (used in the game) with the option to select between 2-3 different terms describing the sign was administered. On average the older children performed better by a factor of 1.5, as well as the girls performed better by a factor of 2. On average each child recognized 15 out of 26 signs, and for each sign an average of 9 children could name the sign correctly.

We tested the usability of the game with all the 17 users. On average, each child spent 30 minutes playing the game. After playing the game each child filled in a usability evaluation survey comprising of 15 questions related to the quality of the game’s background graphics, music, game story and difficulty level in each stage.

The results of the usability testing show that all the users found the game interesting and they expressed the desire to play it a second time. They found the music and background of the game satisfactory. While they understood the story of the game they suggested changing it to a voice/video format rather than just text. The learning process embedded in the game was interesting for them while they suggested making the graphics more local and relevant to the indigenous environment.

A post-game questionnaire test, identical to the pre-game questionnaire, was filled in by every child individually. On average each child now recognized 17 out of 26 signs, and for each sign an average of 11 children could name the signs correctly.

Although playing the game once did not yield in significant learning of signs, it did however draw the children’s attention to their own cultural heritage in digital forms.
Oroo’ Tangibles

Three rounds of evaluation were carried out. The first 2 were conducted on our first visit to the village. The third was on a subsequent visit a month later. Each round assessed different aspects of the research question. The first evaluation focused on whether the community elders felt that the tangible system could meet the basic requirement of aiding the preservation of Oroo’. In the second evaluation, we had people of various ages interact with the system. Thus, we were able to assess whether it was engaging to different user groups and informally observed knowledge transfer. The final evaluation concentrated on the efficacy of the system as an intergenerational collaborative environment. All community participants in the 3 rounds were Penans from the village. We refer to people involved in each group as Gn[Father|Mother|Child] e.g. G1F is Group 1’s Father; G5C is Child in Group 5. The goal of intergenerational knowledge transfer was accomplished as the children all learnt a number of symbols during the session (see below Table). Recall that the prototype includes the 10 most common symbols. In the pre-test, one child knew 2 symbols, the others knew none. In the post-test the mean was 8 correctly identified symbols. Our first group (G1) included father, mother and son. During the post-test G1C correctly remembered 9 symbols out of 10. G1F retaught the forgotten symbol. The 4th group, the teachers were G1F & G1C while the student G4C was the nephew and cousin of G1. G4C, born and raised in the city was visiting Long Lamai with his parents. During this session we asked G1C to teach the Oroo’ symbols to G4C. After introducing all the symbols, G1C asked G4C to repeat the names by looking at the tangibles; he correctly remembered 6 symbols. We observed how the children worked together well and noted that G1C had retained knowledge of the symbols he had learnt 2 days earlier, and how to put them together to make an Oroo’ story.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Age</th>
<th>Symbols identified</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pre-test</td>
</tr>
<tr>
<td>G1C</td>
<td>M</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>G2C</td>
<td>M</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>G3C</td>
<td>F</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>G4C</td>
<td>M</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>G5C</td>
<td>M</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>G6C</td>
<td>F</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td>0.33</td>
</tr>
</tbody>
</table>
Users and uses

**Tips:** Discuss with your project team who would be the future users and how they would use the findings throughout the project lifecycle. The uses identified should relate to the theory of change that you have discussed with your project team. The discussion about theory of change, users and uses, will be a very important input to your communication strategy: depending on who the user is and of what use will be the findings, a communication strategy can be developed. For example, if the users of the findings are policy makers and the use is to influence a change in the regulatory framework, which communication approach will work the best?

**Who will be the user of these findings?**

**What are the more relevant things the project team wants to learn about or evaluate through the lifecycle of this project?**

There are few main outcomes of the project i.e. the research methodology, publications and the software systems.

1): **Research Publications and Community based co-design methodology;**

Our initial literature background research has revealed that information about Oroo’ and other sign languages of Borneo is extremely limited. The sign languages of Borneo Island as documented and published by only a small number of anthropologists differ between the tribes yet have a common pattern. The literature references to the rainforest sign language hardly exceeded one paragraph and a number of examples of messages illustrated by drawings. Hence, we produced a database of signs and literature related to Borneo Sign languages. Based on user interaction we adopted a community-based approach to design ICT tools where we met the community demands for greater empowerment with regard to technology. At the same time the signs documentation and systems testing was done within the community and forest, which we call “contextual documentation and testing”. The design approach and publication will attracts the following users;

1) Researchers and linguists can refer to research publications in their future studies
2) Development practitioners can refer to the community based co-design research methodology as adopted in the project

2): **Software Systems**

As mentioned earlier, we developed two software systems in the project Oroo’ Adventure game and Oro” tangibles which is in use of the community members for intergenerational knowledge transfer.
Indicators

**Tips: Indicators help to measure project's progress.**

Indicators help the objectives that were set by the project team to be affordable, tangible, and measurable. They help to verify the success and rewrite the course in case we are not achieving it. An indicator could be quantitative (percentage, amount) or qualitative (perception, opinion).

The ISIF Asia secretariat suggests the SMART approach to indicators:

- **S** Specific
- **M** Measurable
- **A** Achievable (acceptable, applicable, appropriate, attainable or agreed upon)
- **R** Relevant (reliable, realistic)
- **T** Time-bound

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Indicators</th>
<th>Progress</th>
<th>Assessment</th>
<th>Course of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No database of the signs existed</td>
<td>Database of the signs</td>
<td>A digital database of 54 signs</td>
<td>The database contains high resolution; a) Photos b) Drawings c) Video annotations</td>
<td>The next course of action is to extend the project partner communities and enhance the number of signs in database</td>
</tr>
<tr>
<td>Limited Scholarly Literature No. of scholarly publications produced</td>
<td>5 research publications produced during the project duration</td>
<td>All the publications are published and presented in high impact conferences and journals. a) 1 publication is the winner of SIGCHI Best of CHI Honorable Mention Award and among the top 5% of all submission to CHI 2015 conference which is the highest reputable conference in Human Computer Interaction 2) another publication is the winner of UNESCO's IFIP Brian Shackel Award 2015 and IFIP Interaction Design for International Development (IDID) Award 2015 The UNESCO IFIP Brian Shackel Award recognises the most outstanding contribution with international impact, which draws attention to the need for a comprehensive human-centred approach in the design and use of information technology in which the human and social implications have been taken into account. The Interaction Design for International Development Award recognizes the most outstanding contribution to the application of interactive systems for social and economic development of people in developing countries. This is the first time that a paper has won two awards handed out at an INTERACT 2015 conference.</td>
<td>More in-depth analysis of research findings will be published</td>
<td></td>
</tr>
<tr>
<td>No digital learning tools of Oroo’ language existed</td>
<td>No. of software developed</td>
<td>2 software application developed</td>
<td>The software tools were evaluated in different sessions with the users and in cultural context. The results of the testing is presented in above sections</td>
<td>The software will updated based on the feedback of users</td>
</tr>
</tbody>
</table>
Project implementation: understanding the chain that leads to results

**Tips:** This is the most important section of the report. Here, the reader will understand the processes and operational issues of your project and how they contribute to the achievement of the objectives and the theory of change behind the project implementation.

Is possible that the project team’s understanding of the development problems to be addressed with this project will have evolved or changed from those described when the project was originally submitted and approved. If that is the case, please share what motivated the change and what course of action has the project team identified.

<table>
<thead>
<tr>
<th>Results chain</th>
<th>Implementation</th>
<th>Development Results</th>
<th>Development Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT</td>
<td>Financial, human and material resources</td>
<td>WHAT it is needed</td>
<td>WHAT should be produced/delivered</td>
</tr>
<tr>
<td>ACTIVITY</td>
<td>Actions taken, work performed</td>
<td>WHAT is being done</td>
<td>WHAT it is produced/delivered</td>
</tr>
<tr>
<td>OUTPUT</td>
<td>Results from the development intervention like products, capital goods and service</td>
<td>WHAT it is delivered</td>
<td>WHAT it is expected</td>
</tr>
<tr>
<td>OUTCOME</td>
<td>Likely or achieved short and medium term effects</td>
<td>WHAT it is achieved</td>
<td>WHAT it is expected</td>
</tr>
<tr>
<td>IMPACT</td>
<td>Long term effects</td>
<td>WHAT it is achieved</td>
<td>WHY it's done</td>
</tr>
</tbody>
</table>

**Narrative - project implementation**

Please write a narrative description about the project implementation, starting from the problem statement you develop on your approved proposal. Please use this section of the report to provide context to the work conducted. For example:

1. Describe any **partnerships** with other organizations, researchers and community leaders that have been developed during the project cycle and the usefulness of these in achieving the project's objectives.
2. Describe the **involvement** of project beneficiaries, during all phases of project implementation.
3. Describe any **gender, ethnic and generation gap** issues that have impacted positively or negatively your project implementation.
4. Please take the time to reflect about activities that you struggle to implement during the period reported, along with processes and methods originally planned that might need **adjustment** to achieve your project objectives.

The following section describes briefly the research process:

A. **Need assessment:** We assessed the need of the documentation process and henceforth the social, economic, cultural and scientific implications of the project.
B. **Problems exploration:** In this stage of the research, we mainly probed the issues leading to the imminent loss of Oroo’.
C. **Documentation of Oroo’ signs:** In this stage we commenced written, photo and video documentation and analysis process of Oroo’.
D. **Designing digital technologies for preservation of Oroo’ language:** After documentation and analysis, we formulated our strategies and designed digital tools for preservation of Oroo’ sign language.
### Project Implementation Activities Plan

#### Users in Oroo’ Tangibles Evaluation Session

<table>
<thead>
<tr>
<th>Input</th>
<th>Project Activities</th>
<th>Outputs</th>
<th>Outcomes</th>
<th>Timeline</th>
<th>Status</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two intern hired for 6 months</td>
<td>Hypothesis formation</td>
<td>1. Need Assessment</td>
<td>The community now better understand the current situation and the problems related to the rapid loss of Oroo’ language</td>
<td>April-September 2014</td>
<td>Completed</td>
<td>The results are reconfirmed in the wider community meeting</td>
</tr>
<tr>
<td></td>
<td>2. Problems Identification</td>
<td>2. Problems Identification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tow intern are hired for 3 months</td>
<td>Documentation</td>
<td>A repository of 54 signs; 1. Photos 2. Videos 3. Drawings</td>
<td>High quality data set is available for research and development purposes</td>
<td>June-August 2014</td>
<td>Completed</td>
<td>Local elders and Oroo’ Masters are active members of the documentation activities and reconfirmation sessions</td>
</tr>
<tr>
<td></td>
<td>2. Demonstration</td>
<td>2. Demonstration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Confirmation Analysis</td>
<td>3. Confirmation Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A collaborative network developed with National University of Singapore and University of Auckland, New Zealand</td>
<td>Digitalisation and Preservation</td>
<td>Oroo’ Tangibles</td>
<td>The local community has a software tool to use for teaching and learning Oroo’ language</td>
<td>July-November 2014</td>
<td>Completed</td>
<td>Cycle of evaluation process is done</td>
</tr>
<tr>
<td></td>
<td>• Oroo’ Tangibles software</td>
<td>• Oroo’ Tangibles software</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Project outputs, communication and dissemination activities

**Tips:** Take into account that the reader of your report has not being involved in project implementation, so readers do not have any further knowledge besides the information you are providing here.

This section of the report will allow you document the communication and dissemination efforts that the project team has conducted, which might be part of a specific communication strategy design as part of the project, or in place for the organization as a whole. When possible, please provide information about strategies in place and the rationale behind them.

Lessons can be learned from many aspects of project implementation, covering a wide variety of aspects such as technical, social, cultural and economical. Taking the rationale behind the project and its objectives can serve as a framework to draw your conclusions. Lessons can be identified by project partners, beneficiaries and general staff from the organization. A project diary and other activity records can serve as a tool to reflect during project team meetings and immediately after project activities are conducted.

**Outputs are immediate, visible, concrete developmental change that is the tangible consequence of project activities, under direct control of the project team.**

Example of possible outputs to report are:
- New products and Services (software, online platforms, applications);
- Information sharing and dissemination (publications, conferences, multimedia, social media);
- Knowledge creation (new knowledge embodied in forms other than publications or reports, such as new technologies, new methodologies, new curricula, new policies);
- Training (short-term training, internships or fellowships, training seminars and workshops) and
- Research Capacity (research skills; research management capacity and capacity to link research to utilization of research results).

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<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Start Date</th>
<th>End Date</th>
<th>Status</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oroo’ Adventure Game software</td>
<td>The local community has an education software game for learning Oroo’ language</td>
<td>July-November 2014</td>
<td>Completed</td>
<td>Software tested and evaluated with end-users</td>
<td></td>
</tr>
<tr>
<td>Handicraft</td>
<td>The local designs and products has developed interest of local artisans and cultural models</td>
<td>November 2014-January 2015</td>
<td>Completed</td>
<td>Demonstrated and evaluated by experts</td>
<td></td>
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<tr>
<td>Feedback session with the experts and external evaluators</td>
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<tr>
<td>Participation in UNIMAs Research and Development Expo</td>
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<tr>
<td>Dissemination of Knowledge</td>
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<tr>
<td>Data collection and writing</td>
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<tr>
<td>Project outputs</td>
<td>Status</td>
<td>Assessment</td>
<td>Dissemination efforts</td>
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<tr>
<td>Need Assessment</td>
<td>Completed</td>
<td>The finding are reported in the research publication and reviewed by the local</td>
<td>The findings part of the publications and videos.</td>
<td></td>
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<tr>
<td>Problems Identification</td>
<td></td>
<td>community elders and Oroo’ experts</td>
<td></td>
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<tr>
<td>A repository of 50 signs;</td>
<td>Completed</td>
<td>Number of re-confirmation sessions has been performed with local community elders</td>
<td>The findings part of the publications and videos</td>
<td></td>
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<tr>
<td>• Photos</td>
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<td>and Oroo’ experts</td>
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<tr>
<td>• Videos</td>
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<tr>
<td>• Drawings</td>
<td></td>
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<tr>
<td>Oroo’ Tangibles</td>
<td>Completed</td>
<td>The results are presented in a peer reviewed publication;</td>
<td>The paper is presented in 33rd Annual ACM conference on Human factors in Computing Systems (CHI) ACM, Korea.</td>
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<td></td>
<td></td>
<td>Plimmer, B., He, L., Zaman, T., Karunanayaka, K., Yeo, A.W., Jengan, G.,</td>
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<td>an Old Language. In: Conference 33rd Annual ACM conference on Human factors</td>
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<td>in Computing Systems (CHI) ACM, Korea. (SIGCHI Best of CHI Honorable Mention</td>
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<tr>
<td></td>
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<td>Award: among the top 5% of all submission to CHI 2015) [Key conference on</td>
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<td></td>
<td></td>
<td>Human-Computer Interaction: Acceptance rate: 23%: CORE Conference Ranking: A*</td>
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<td></td>
<td></td>
<td>(Indexed in ACM Digital Library)</td>
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<tr>
<td>Oroo’ Adventure Game</td>
<td>Completed</td>
<td>The results are presented in a peer reviewed publication;</td>
<td>The paper is presented in the International Conference on Information and Communication Technologies and Development, 15-18 May, 2015, Nanyang Technological University, Singapore</td>
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<td></td>
<td></td>
<td>Zaman, T., Winschier-Theophilus, H., Yeo, A.W., Ting, L. C., Jengan, G.</td>
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<tr>
<td></td>
<td></td>
<td>Adventure Game. Paper presented at Proceedings of the International Conference</td>
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<td>on Information and Communication Technologies and Development, 15-18 May,</td>
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<td>2015, Nanyang Technological University, Singapore (Indexed in ACM Digital</td>
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<td></td>
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<td>Library)</td>
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<tr>
<td>Oroo’ hand carved wood model</td>
<td>Completed</td>
<td>Evaluated by artist experts</td>
<td>The product is demonstrated in the Faculty of Applied and Creative Arts UNIMAS</td>
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<tr>
<td>Internship training – 4 undergraduate</td>
<td>Completed</td>
<td>The outcomes of the internship evaluated by concerned faculties and</td>
<td>The outcomes of the internship reports are part of the paper presented in the</td>
<td></td>
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<tr>
<td>students</td>
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<td>international visitors</td>
<td>International Conference on Information and Communication Technologies and Development, 15-18 May, 2015, Nanyang Technological University, Singapore</td>
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<tr>
<td>Awards</td>
<td>On-going</td>
<td>The publications and project is selected for awards after an intensive</td>
<td>The project is presented and demonstrated in UNIMAS Research and Development Expo, 2015</td>
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<tr>
<td>International</td>
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<td>selection process</td>
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<tr>
<td>• The UNESCO IFIP Brian Shackel</td>
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<td>Award 2015 for the paper Penan’s</td>
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<td>Oroo Short Message Signs (PO-SMS)</td>
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<tr>
<td>• Co-design of A Digital Jungle</td>
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<td>Sign Language</td>
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</table>

This work has been developed with the support provided by the Information Society Innovation Fund (ISIF Asia) – 2013, licensed under the Creative Commons Attribution-ShareAlike 3.0 Unported.
Application, 16 September 2015 Bamberg, Germany
- The UNESCO IFIP Interaction Design for International Development (IDID) Award 2015, for the paper Penan’s Oroo Short Message Signs (PO-SMS): Co-design of A Digital Jungle Sign Language Application, 16 September 2015 Bamberg, Germany
- SIGCHI Best of CHI Honorable Mention Award: among the top 5% of all submission to CHI 2015: for the paper New Interaction Tools For Preserving an Old Language

**University Level**
Gold Medal in UNIMAS R&D Expo 2015 for the Project Digitalising and Preserving Oroo, a secret signage language of the nomadic Penans in the rainforest

<table>
<thead>
<tr>
<th>2 journal papers and 2 conference proceedings</th>
<th>Completed</th>
<th>Peer reviewed referred publications</th>
<th>Published and accessible from Springer and ACM digital repositories</th>
</tr>
</thead>
</table>

**UNESCO IFIP Brain Shackel Award**

**IFIP IDID Award (Certificate)**
Project outcomes

**Tips:** This section should be completed ONLY for the final report.

ISIF Asia expects you to report about the outcomes of the project as defined in the table below, based on the project implementation section of this report. Project team is encouraged to discuss the questions provided below to guide the reflection:

Can you identify and describe the relationships between the activities implemented and the social, economical, cultural and/or political benefits of your project implementation?

<table>
<thead>
<tr>
<th>Outcomes can be defined as:</th>
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<tbody>
<tr>
<td>• Medium-term effects</td>
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<tr>
<td>• Effect of a series of achieved outputs</td>
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<tr>
<td>• Should capture the changes for the beneficiaries</td>
</tr>
<tr>
<td>• Take place during the life of project/strategy</td>
</tr>
<tr>
<td>• Influence but not direct control</td>
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</tbody>
</table>

**Anticipated Outcomes**

The anticipated outcomes include;

• High impact publication
• Awards
• Software tools
• Database of Oroo’ signs
• Increase in knowledge about Oroo’ sign
• Enhanced interest of local youth in Oroo’ language
• Partnership with NUS and University of Auckland

However there are many unanticipated outcomes of the project. These outcomes initially targeted however later on requested by the partners and based on need of the project the activities became part of the project.

**At community level;**

• We found that the project produced a community of practice that emerged in collaboration within villages as well as between two villages (Long Lamai and Long Kerong, a sister village of Long Lamai). Initially we have five members of the community as part of the project team and they identified 32 signs for documentation. In second stage, the local champion engaged more and experienced community members from Long Lamai and the number of signs increased to 50. In third stage, few community members from Long Kerong have been engaged and they added five more signs to the list as well as shared more comprehensive knowledge rules and combinations of the signs.

• The local artisans and community elders are part of the project activities. They are developing handicrafts model based of Oroo’. The model is demonstrated by the local artist in the meeting with experts from the Faculty of Applied and Creative Arts UNIMAS and received feedback for improvements.

• Oroo’ is a living cultural heritage of the Penan. Penans are losing the “contents” of Oroo’ because the “context” in which Oroo’ is alive is dying. It is a language of the forest. Deforestation and changing lifestyle of the Penan youth have adverse effects on Oroo’. We realized that mere documentation process or digitization cannot sustain the Oroo’ language healthy unless that we revive the socio-cultural context in which the language can survive. Hence, we reframed and enhanced the goals of our project.
In addition to documentation of the contents, we are promoting a cultural event Oroo’ trail hunt, as a tourism activity that would yield a product of Oroo’.

At university level

Four undergraduate interns, two from the Faculty of Computer Sciences and IT and two from the Faculty of Applied and Creative Arts, UNIMAS are hired under the project. The interns experienced field work under the supervision of experts, attended workshops and seminars conducted in ISITI, UNIMAS, presented their research findings in the community, Institute, Faculty meetings and their performance is evaluated by the national and international experts.

Project management and sustainability

**Tips:** Please comment on the general project administration, staffing, procurement, etc. specially those aspects contributing to the fulfilment of the project objectives as well as those that have delay project implementation.

Indicate how the project team has strengthened its capacity and work towards sustainability with the support provided by ISIF Asia? (new equipment, training, improved administrative skills, lessons learned from the project). Has the organization increased its research or administrative skills of the team involved? Has the project allowed for a particular contribution to capacity building of women or marginalized social groups? Special attention should be paid to the expected or unexpected impact on marginalized social groups.

Have you done anything different to provide administrative support for this project besides your “business as usual” processes and procedures? Has the project inspired change inside your organization?

Sustainability is to be examined not only in terms of staff retention and financial stability of the organization supporting the project but about the communities’ appropriation of benefits.
perceived from project implementation.

The ISIF Asia Secretariat is very interest to learn if this project has generated opportunities for future development (new funding from partnerships, sponsorships, investment or other funding mechanisms), please provide details.

Please explain if the ISIF Asia grant has helped to consolidate your organization and how. If any of the project activities will continue after the end of the ISIF Asia grant, please describe how your organization is planning to support future developments.

At community level

Long Lamai community selected Garen Jengan, a local community member as a contact person/coordinator for this project. His main responsibilities include coordination between research team and community’s council for elders and management of project activities, documentation and providing support for research team visits to community. Garen Jengan is also working as reviewer of the research findings and a co-author in research publications. The contents included in publication such as photos, findings etc. are reconfirmed by the community’s selected individuals.

At university level

The project is supervised by Professor Dr Alvin Yeo Wee and Prof. Heike Winschiers-Theophilus and the research teams are led by Dr Tariq Zaman. All the interns are directly reporting to the Team leader. In addition, the technical team for developing Oro’ tangible software is led by Associate Professor Beryl Plimmer.

Administration by the research organisation

Although little administration was required and that which was needed was generally adequate, managing “intangible” aspects of the project is very challenging. The condition of the project is highly experimental. Managing varied expectations from the community members in Long Lamai and of the collaborators remain challenging. At the same time the team has to remain focus to the intentions of the funding organisation and sensitive to the community. The research team is therefore responsible to answer questions, to write reports, to deliver effectively to meet expectations of the beneficiaries in Long Lamai and research community. The team is still experimenting with ways and means to balance these different and sometimes contradicting intentions and desires. An organisational structure to manage the project at 2 levels (community and university) was initiated by the research team. Financial records were adequate and logistical support was sufficient.

Scientific management of the project

The early stages of community studies were adequately supported by the members of the research team who had experience of such research. Project collaborators facilitated later stages of technology development, testing and deployment.

Technical and other support

ISIF and APNIC support was crucial for team and institutional capacity building. In particular, participation by team members in the APRICOT 2014 (24-28 February 2014), ICTD 2015 and INTERACT 2015 made additional contributions to team and project development.

Sustainability

UNIMAS has made RM 18958.00 as a cash contribution to the project. In addition, the project is nominated to be presented in iENA 2015 - International Trade Fair Ideas-Inventions-New Products, Nuremberg, Germany. The
travel and registration cost will be supported from UNIMAS internal grant. We also received two applications from applicants to join the project as Postgraduate students.

Impact

**Tips:** This section of the report does not refer to the project activities, but about the “bigger picture”. It will be desirable if the project team can reflect on the impact that the project has contributed to as part of other actions implemented by your organization and/or your partners.

**Impact** refers to the influence the project may had on the way people does things through the use or adoption of the project outputs; changes in the context the project was implemented; changes in the community the project has been working with; and/or changes inside the organizations that have participated in the implementation or the relationships established through the project’s implementation.

Impact is often impossible to measure in the short term and is rarely attributable to a single activity. Impact can be linked to a vision or long-term development goal that your organization might be working towards. It can be identified as a logical consequence of achieving a combination of outputs and outcomes. Impact is usually measurable after the project life and is outside the direct control of the project team and the organization.

**Impact at community Level**

Through the engagement of the community throughout the whole project, it has ensured that there is continued participation and support from the community, and in turn sustainability of the project. There is an increase of awareness and interest of youth for learning Oroo’ signs in target community. The findings of the project demonstrates that the developed software and technology helped the elders of the community in teaching Oroo’.

**Impacts at University/researchers Level**

In addition to developing the skills of researchers, the project is generating opportunities of networking and visibility for ISITI and UNIMAS. The project was initiated by the researchers from two universities based in two continents (Asia and Africa) and recently the collaborators team is joined by the researchers from two other prestigious universities National University of Singapore (QS World University Rankings (2014/15) ranked NUS 22nd within the world and 1st within Asia) and University of Auckland (68th within the world). The research papers and software tools are helping in achieving the target Key Performance indicators of the researchers and partner universities.

**Impact in wider research community**

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The SIGCHI Best of CHI Honorable Mention Award, UNESCO IFIP Brian Shackel Award and IDID Award 2015 recognises the project impact as as the most outstanding contribution with international impact, which draws attention to the need for a comprehensive human-centred approach in the design and use of information technology in which the human and social implications have been taken into account.

Overall Assessment

**Tips:** This section of the report is extremely valuable for the ISIF Asia secretariat as it provides evidence about the role and relevance of ISIF Asia contributions in the Asia Pacific region.

**Tips:** Briefly provide your own views on the value and importance of the project relative to the proposed innovation, investment of time, effort and funding involved. Include the strengths and weaknesses of the project and the steps taken to strengthen the credibility and reliability.

This is your opportunity to conduct a team reflection about the value of the project for the organization. The following questions might help you to prepare a substantive overall assessment.

- To what extent does the project meet its objectives?
- What were the most important findings and outputs of the project? What will be done with them?
- What contribution to development did the project make?
- Were certain aspects of project design, management and implementation particularly important to the degree of success of the project?
- To what extent did the project help build up the research capacity of your institution or of the individuals involved?
- What lessons can be derived that would be useful in improving future performance?

To a greater extent we have achieved the goal of the project which was to develop and design appropriate ICT tools for preservation and digitalisation of sign language of the community. The most important outcome and finding of the project is to highlight and catch the attention of research and development community towards the unique way of communication which in this case is Oroo’. We have successfully achieved the three objectives 1,3 and 4 however the objective No. 2 still need more intensive work and we are still working on it. The objective No. 2 is “to gain insights into this intricate informal message composition and asynchronous communication approach”. In the absence of a documented grammar of Oroo’ we have engaged the community in a systematic exercise to explicate the tacit rules of combining the signs forming a valid message, as well as categorizing the signs. In this exercise we have limited success.

During the process of project management and implementation, we have developed a new partnership with researchers from National University of Singapore and University of Auckland. Here in below section, we are presenting quick reflections of our partners;

1): Associate Professor Beryl Elizabeth Plimmer

Science Centre, The University of Auckland

Auckland 1010 New Zealand

“We have recently completed the first round of a sub-project of the Oroo’ language project. The goal of this sub-project was to develop a computer software tool that supports ‘Tangible’ interaction. In this case the Tangibles are Oroo’ symbols augmented with a base-plate so that they could be sensed on a capacitive display (such as iPad). The tangible Oroo’ symbols can then be used as stamps to make an Oroo’ story on the computer.

The project included 3 prototype rounds of, requirements specification, development and evaluation. The evaluations show that the final prototype provides an excellent environment for playful intergenerational knowledge exchange. During this process we advanced the research in Tangible interaction. A report on the project is currently under review for a major computer science conference.
There are also possibilities to extend the prototype. Two different applications are commercialization and language preservation. Properly packaged it could be sold to tourists. The physical nature of the Tangibles makes the system particularly appealing as a tourist gift. And as an aside, my own grandchildren thoroughly enjoyed playing with it. Also it could be further developed to supplement other software tools as a part of the language repository.

Finally, it was a pleasure to be involved in this project. The Oroo’ language is very interesting and it is important that it is recorded while there are still people who are competent in it.”

2): Dr. Kasun Karunanayaka,
Research Engineer @ Keio NUS Cute Center,
National University of Singapore, Singapore

“I have had the pleasure of working with the Oroo’ project with researchers from Institute of Social Informatics and Technological Innovations (ISITI), University Malaysia Sarawak since May 2014. Keio-NUS Cute Center, National University of Singapore has mainly provided the technological skills to develop the Oroo’ language learning tool using Tangibles. I have involved with development of the software prototype, making Tangibles and in the third user evaluation that conducted in the Long Lamai village. Within three months we have developed three prototypes and evaluated them with the Penan community to further improvements. With the final evaluation round we have observed that the Tangibles application has the potential to become the learning tool of the Oroo’ language for the younger generation. So in future we planned to add the complete set of Oroo’ signs and define the rules of the language.

Personally, I didn’t believe that the iPad based application can be successfully introduced to the community. Once we get into the village, it was surprising to see that both the adults and kids love to use the system and learning the technology behind it. I think most of the children who play with the Tangibles & with the app, feel it as a game.

I felt very happy by seeing the success of this project so far, because I believe we manipulate our knowledge, skills and resources to develop a tool that can be practically used by the community in Long Lamai to preserve the Oroo’ sing language. I would like to thank ISITI for getting me involved to this wonderful research!”

Dr Kasun and a family from Long Lamai in Oroo’ tangibles evaluation session
Recommendations

**Tips:** Include any recommendations in this section that you and your project team, the organizations supporting the project and the community you worked with, would like to make to other practitioners or researchers on the field facing similar problems or implementing similar solutions.

**Please take a minute to share recommendations with the ISIF Asia secretariat that might help to improve the support provided.**

The project was unique in nature, as the technologists need to work very closely with the local community and different groups in the community such as elders and youth. Hence, the technologist needed to adopt multi-disciplinary approaches and breaks their comfort zone to go to the ground and work in *in-situ* situation. The process itself has shown to be very rewarding for community members and technologist, engaging the youth and the elders in a creative development.

We would like to submit the following specific recommendations to other researchers and development practitioners;

1. Community as centre of the development project is the most important lesson learned from this project.
2. The community based c-design approach need a long term engagement process which may be time consuming however, it ensures the active participation of end-users. The long term engagement process warrants project sustainability.
3. Community based co-design approach also myth bursting. In traditional research and development paradigms, indigenous and rural communities are considered as "consumers of technologies"; however we found that the community based co-design approach empowers them to be a part of "producers" and this enhance their confidence level.

We also found that our partner community considered technology as a "connector" between the generations. Hence it is important that the researchers and development practitioners work in a local context to address the wider issues such as inter-generational knowledge gap, socio-economic development.

Bibliography

**Tips:** Include complete bibliographic references to all sources (printed, on-line, quotes, etc) used to prepare the different sections of this report. The APA style guide offers examples about how to reference a variety of sources. [http://www.apastyle.org/learn/quick-guide-on-references.aspx](http://www.apastyle.org/learn/quick-guide-on-references.aspx) (as accessed on 3/7/2013).


