

A review of recent Voice Based Applications in developing countries

A Literature study by Marie-Lou David

Motivation

- **ICT4D** projects
- **Voice Based Applications (VBA)** can be very **useful**
- **Decentralised** field of research
- Need to evaluate **impact** and **challenges**

Research questions

- RQ1: What are the **key areas of impact** of recent voice based applications in developing countries?
 - RQ1.1: To what **sectors** are voice based applications the most applied?
 - RQ1.2: What is the **observed impact** of voice based applications?
 - RQ1.3: What are the **main challenges** faced when developing a voice based application?

Method

- Snowballing approach by Wohlin, 2014.
 - Initial search on Google Scholar
 - Picking relevant articles from references and citations according to **inclusion** and **exclusion criteria**
 - Stop when no more relevant article is found

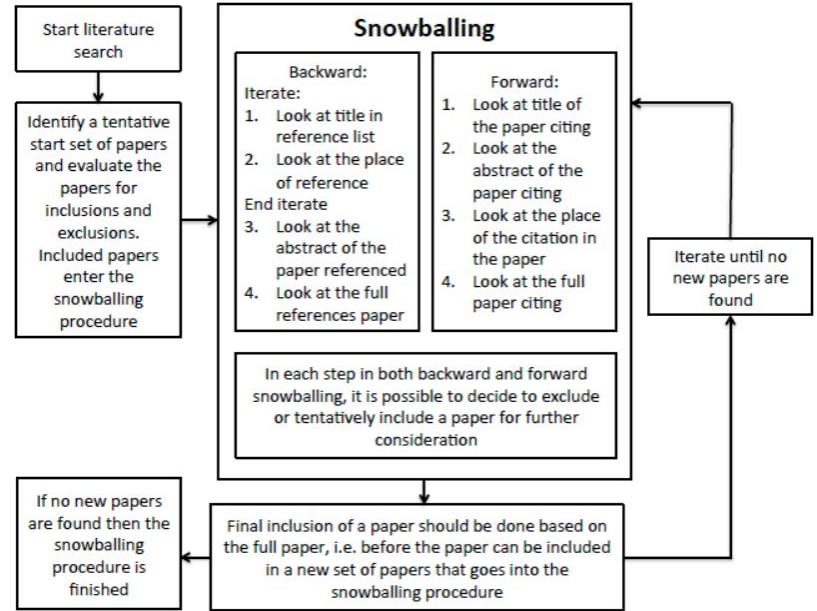


Figure 1. Snowballing procedure.

Claes Wohlin. 2014. Guidelines for snowballing in systematic literature studies and a replication in software engineering. In Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering. Association for Computing Machinery, New York, NY, USA, Article 38, 10 pages. <https://doi.org/10.1145/2601248.2601268>

Selection criteria

Inclusion criteria

- I1- Studies addressing the implementation of a voice based application.
- I2- Studies taking place in a developing country.
- I3- Studies discussing the impact of implementing a voice based application.

Exclusion criteria

- E1- Studies in the form of editorials and tutorial, and poster.
- E2- Studies that have not been published in English language.
- E3- Studies that have not been peer reviewed.
- E4- Duplicate papers or extensions of already included papers.
- E5- Papers that are not available.
- E6- Papers that are published before 2007.

Data extraction and synthesis

- Year of publication
- Country of action
- Sector of action
 - Following the International Standard Industrial Classification of All Economic Activities
- Origin of funds
 - Classified by International or local, government or NGO
- Method of evaluation
 - Classified into quantitative or qualitative
- Main goal of application
 - Classified by method of knowledge sharing (horizontal or top down)
- Evaluation results
- Challenges encountered

Selected papers

ID	Iteration	Title	Publication Year	Citations	References	Selected Papers
P1		Developing voice-based information sharing services to bridge the information divide in marginalized communities: A study of farmers using IBM's spoken web in rural India [6]	2021	6	71	1
P2	Start set	An alternative information web for visually impaired users in developing countries [27]	2008	9	9	1
P3		Spoken web: using voice as an accessibility tool for disadvantaged people in developing regions [19]	2012	8	12	2
P4		Voice-Based Marketing for Agriculture in Northern Ghana [9]	2013	11	14	3
P5		Power to the peers: authority of source effects for a voice-based agricultural information service in rural India [24]	2012	39	27	1
P6		VOISERV: Creation and Delivery of Converged Services through Voice for Emerging Economies [20]	2007	16	17	0
P7		Designing a voice-based employment exchange for rural India [32]	2012	21	21	3
P8	Iteration 1	Avsaj Otalo: a field study of an interactive voice forum for small farmers in rural India [23]	2010	217	24	5
P9		RadioMarché: Distributed Voice- and Web-Interfaced Market Information Systems under Rural Conditions [7]	2012	9	23	0
P10		Tibaqsim: Information Access for Low-Resource Environments [8]	2021	0	21	0
P11		E-Service Innovation in Rural Africa Through Value Co-Creation [4]	2020	4	27	1
P12		Supporting treatment of people living with HIV / AIDS in resource limited settings with IVRs [17]	2014	32	37	0
P13		Personalized weather information for low-literate farmers using multimodal dialog systems [26]	2021	3	50	1
P14		Learnings from deploying a voice-based social platform for people with disability [10]	2019	7	27	0
P15		A Real-Time IVR Platform for Community Radio [18]	2016	38	35	0
P16	Iteration 2	User-centred design of a digital advisory service: enhancing public agricultural extension for sustainable intensification in Tanzania [3]	2020	32	56	0
P17		A Hybrid Multi-Modal System for Conducting Virtual Workshops Using Interactive Voice Response and the WhatsApp Business API [25]	2021	1	31	0
P18		Collective Support and Independent Learning with a Voice-Based Literacy Technology in Rural Communities [21]	2020	14	88	1
P19		Revisiting CGNet Swara and its impact in rural India [22]	2015	33	34	1
P20		Ila Dhageyso: an interactive voice forum to foster transparent governance in Somaliland [11]	2013	14	12	0
P21		Voice-based Web access in rural Africa [12]	2013	15	30	0
P22	Iteration 3	Baang: A Viral Speech-based Social Platform for Under-Connected Populations [30]	2018	23	33	0
P23		Use of interactive voice response for professional development in Kenya [16]	2017	2	17	0
P24		Kamrad: A Voice-based Crowdsourcing Platform for Underserved Populations [29]	2021	8	67	0

Results RQ1.1

To what **sectors** are voice based applications the most applied?

- Agriculture
- Social well being

Section - Division	Corresponding articles
Agriculture	P1, P3, P4, P5, P8, P13, P16, P17
Professional activities - advertising	P4, P6, P9, P11
Information and communication	P2, P19, P20, P21
Arts, entertainment and recreation	P10, P14, P22
Administrative and support service activities - employment	P7, P23, P24
Human health	P12, P15
Education	P18

Table 2: Papers categorized by sector of activity

Results RQ1.2

What is the **observed impact** of voice based applications?

Method	Corresponding articles
Quantitative usage data	P1, P2, P3, P5, P7, P8, P11, P12, P13, P14, P15, P16, P17, P18, P19, P20, P22, P23, P24
Qualitative interviews	P1, P2, P5, P8, P9, P11, P12, P13, P14, P15, P16, P17, P18, P19, P20, P21, P22, P24
Quantitative form	P4, P10, P15, P16, P21, P22, P23, P24

Table 3: Methods used for impact assessment of a voice based application

Results RQ1.2

Crowd sourced knowledge sharing applications: 46% of papers

- Facilitate **knowledge sharing** inside a community
- **Social connections** inside and outside their circles
- **Professional networking**, especially in disabled communities

Top down knowledge sharing applications: 54% of papers

- Information given by an **authority**: expert from NGO or government
- Not always judged trustworthy (healthcare VS agriculture)
- Bridge gap between government and citizens
- Improved sense of **autonomy**

Results RQ1.3

What are the **main challenges** faced when developing a voice based application?

- Make a **usable** VBA for people with low digital literacy skills
- Properly **train** the users
- Systems experience a lot of **down time**
- **Local** languages
- **Cultural awareness**
- **Marketing**

Discussion

- Different implementation period
 - Can be from 3 months to multiple years
 - Need for **longer** projects and **more publications**
- **Long term** evaluation process
 - Identify **factors of success and failures** in retrospective
 - Need for **standard** and **objective** evaluation process
- **Funding**
 - Two thirds comes from **international aid**
 - Need for **sustainable projects** which can go on without extra funding

Conclusion

- Voice based applications are helpful for remote communities with low digital skills
- The target **user** and **domain** is central to developing VBAs
- Need for **standardised evaluation**
- **Long term sustainability** of projects is essential for success

Questions