



Towards a Multimodal Portal Framework in Support of Informal Sector Businesses

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Abstract. The potential of the informal business sector to contribute significantly to the economic development of developing nations has been widely acknowledged. By taking an instance of the informal business sector of South Africa, this paper presents the conceptual design of an ICT-based initiative that is dubbed Technology Support for the Informal Sector of South Africa (TESISSA). The central goal of TESSISA is to tackle some of the challenges of the informal sector of South Africa through ICT in a way that is beneficial to concerned stakeholders such as service providers in the informal sector, customers, and the government. To attain the aim of TESSISA, a multimodal portal framework that leverages the integration of intelligent cloud-based services and semantic technologies is proposed. The affordances, and architecture of a multimodal portal framework are presented as a plausible and potential solution to some of the core needs of informal business operators on one hand, and the challenges of the government as the main regulator of the informal sector that are so far unattended.

Keywords: Informal sector · Multimodal web portal · Ontology

1 Introduction

The informal sector (also known as the informal economy) refers to economic activities in all areas of the economy that are operated outside the purview of government regulation. The informal sector may be invisible, irregular, parallel, unstructured, backyard, underground, or survivalist [1]. The potential of the informal sector to contribute positively to the economic development of many developing nations is widely acknowledged [2–5]. In South Africa, the informal sector represents the lowest tier of the small, medium and microenterprises (SMME) [2, 5]. According to the third quarter of 2016 Quarterly Labour Force Survey statistics, about 2.6 million South Africans work in the informal sector, which represents 16.7% of total employment in the Country. Although this is relatively low compared to other developing countries, yet it constitutes between 16–18% of the total employment in the country [4]. It also contributes 5.2% to the Gross Domestic Product (GDP) of South Africa. Thus, the contribution of the informal sector to the economy of South Africa is still relatively low compared to other African countries.

Relevant documents from agencies of the South African government such as the National Informal Business Development Strategy (NIBDS) [6] and the National

Informal Business Upliftment Strategy (NIBUS) [7] revealed that the key challenges of the informal sector have to do with issues of poor financing, poor access to skills training and technology, poor organization, and poor regulatory control and coordination by agencies of government. The findings of the study by the Sustainable Life Foundation on the South African informal economy using a survey of nine townships in four regions of South Africa [5, 8] reveal that some of the extant challenges of the informal sector of South Africa can be tackled through the application of information and communication technology (ICT) [5, 8].

Therefore, an ongoing research initiative, which is dubbed Technology Support for the Informal Sector of South Africa (TESISSA) has been proposed. The goal of TESSISA is to tackle some of the identified challenges in order to foster the improved economic participation of business operators in the informal sector of South Africa [9].

This paper presents the conceptual design of the multimodal web portal - TESSISA Portal (TP) in terms of its affordances, architecture and its capacity to effectively address some of the challenges of the informal sector of South Africa. Multimodality in the context of the TP entails a portal framework that is able to support user interactions via different modes such as web, mobile, short message service (SMS), and voice user interface (VUI). Relative to previous research efforts, the conceptual design of the TP is based on the novel integration of intelligent cloud-based services and semantic technologies in order to evolve an ICT-based multimodal framework that is capable of addressing some of the core challenges of the informal sector of South Africa that are so far unattended.

The organisation of the rest of this paper is as follows. Section 2 presents the background and related work, while Sect. 3 gives an overview of the research methodology. In Sect. 4, the TP was benchmarked with some existing classified web platforms while Sect. 5 presents the results and discussion. The paper is concluded in Sect. 6 with a brief note.

2 Background and Related Work

The key challenges of the informal sector of South Africa, according to [6–8, 10] include the following: (1) lack of access to finance; (2) poor access to skills training and technology; (3) the weakness of informal business associations and their lack of ‘voice’; (4) problems in the legal and regulatory environment and issues of intergovernmental coordination; (5) lack of organisation; (6) poor quality of service; (7) lack of service standards; and (8) lack of documentation and inability to bring operators into the tax net of government. The specific agenda of TESSISA is to address some of these challenges (specifically 4, 6, 7, and 8) which are considered to be susceptible to an ICT-based solution approach. To do this, the notion of a multimodal portal framework – TESSISA Portal (TP) – has been conceived. The aim of the TP is to create a platform for active real-time interactions between informal sector service providers, customers, and relevant agencies of government that have regulatory and coordination oversight on activities of the informal business sector. It will also provide opportunities for

private organisations that want to contribute to the informal economy value chain to engage with actors in the informal sector. The TESISSA agenda is not expected to solve all the problems of the informal sector, but it is aimed at addressing the challenges that pertain to the organization of the informal sector, quality of service, promotion of service standards, business documentation, progression towards quasi-formalisation, and integration with the formal sector of the economy.

Before now, most of the ICT-based initiatives on Small, Micro and Medium Enterprises (SMMEs) in South Africa have largely considered two issues, which are (i) the assessment of technology adoption and e-readiness of SMMEs [11–13] and (ii) enablement of SMMEs using ICT particularly in terms of providing shareable but scarce ICT infrastructure for SMMEs [14–16]. But, these efforts have not focused primarily on the informal sector, which constitutes the lowest base of the SMMEs in order to tackle its core challenges, hence many of the problems confronting the informal sector of South Africa still persists [2, 6].

3 Research Methodology

The Design Science Research (DSR) approach has been selected for the execution of the TESISSA project. This entails understanding the problem, defining requirements, design and development, demonstration, and evaluation. We are currently in the design phase of the project. The requirements, affordances, and high-level conceptual design of the TESISSA Portal (TP) are presented next.

3.1 Requirements and Affordances of the TESISSA Portal (TP)

Some of the functional requirements that the TP must satisfy include: listing of available services, search and browsing, handling of textual requests, service rating and reviews, profile update and documentation, location-based and context-aware services, integration with the social media, semantic-aware information retrieval, multilingual information retrieval, intelligent recommendations, multimodal interface, pricing and negotiation, financial transactions (optional), and processing of voice-based requests. The critical non-functional requirements (NFR) that must be satisfied by the TP include security, interoperability, performance, reliability, and availability. Security is particularly critical in order to mitigate security threats such as fake identity, impersonation, identity theft, fraud, and denial of service attacks in order to increase trust, while the other NFRs are also vital for the effectiveness of the TP.

Based on the identified requirements, the affordances of the proposed TP in terms of the action possibilities are listed in Table 1. In the table, U denotes the affordances of the TP when the actor is a user/customer actor; P when the actor is a service provider; A represents generic affordances that pertain to any type of user, while G represents affordances of the TP for government agencies.

Table 1. Affordances of the TESSISA portal.

s/no	Affordance	Type of actor	Affordance code
1	View profile of service providers	Customer	U1
2	Search and query service providers' profiles	Customer	U2
3	Make a service request	Customer	U3
4	Get notification of acceptance of service request	Customer	U4
6	Obtain context-aware service recommendations	Customer	U5
7	Obtain constrained-based recommendation	Customer	U6
8	Obtain semantic-aware recommendation	Customer	U7
9	Rate the quality of service by operators and write reviews	Customer	U8
10	Make voice-based request	Customer	U9
11	Upload Operator's resume	Provider	P1
12	Upload Operator's business profile documents	Provider	P2
13	Receive request for services	Provider	P3
14	Rate customers	Provider	P4
15	Declare availability for pending services	Provider	P5
16	Bid for pending services	Provider	P6
17	Make voice-based response for services	Provider	P7
18	Send text messages in multiple languages	Generic	A1
19	Pricing and negotiation	Generic	A2
20	View personal transaction history	Generic	A3
21	Search for service standards and expectations	Generic	A4
22	Integrate with social media	Generic	A5
23	Search for relevant service regulations	Generic	A6
24	View and generate provider's service profile	Generic	A7
25	Generate summaries based on demography	Government	G1
26	Extract data for planning purposes	Government	G2
27	Extract business profile for archiving	Government	G3
28	Provide feedback on provider's profile	Government	G4
29	Update service standards and regulations	Government	G5

3.2 The Architecture of the TESSISA Portal

The conceptual design of the TESSISA Portal (TP) is based on a layered architecture comprising five layers (See Fig. 1). The layers of the TP are described next.

Client Layer: This layer will enable users to interact with the services provided by the TP. Clients requests can come from web browsers, mobile apps, web services, and mash-up applications.

Protocol Selection Layer: This layer will enable the selection of the most appropriate communication protocol to be used to execute a client's initiated request based on the type of client. The TP will utilise standard communication protocols such as HTTP,

WML, VoiceXML, JSON-RPC and its variants in order to handle requests depending on the type of client, be it web, mobile, a web service, or a mash-up application.

Semantic Support and Middleware Layer: This layer contains the pool of semantic components and necessary middleware tools that will enable the TP with semantic processing capabilities. It will also provide support for intelligent algorithmic procedures such as context-aware recommendations, constrained-based recommendation, cross-domain recommendations, semantic information retrieval, and query processing, and pricing and negotiation. The semantic middleware artefacts in this layer are typically APIs that are embedded in the TP architecture. These artefacts can be classified into three categories, which are:

- *Processing of natural language:* this entails performing semantic-based operations on natural language texts using tools like Jena, *DKPro*, *Stanford NLP*, *Apache Lucene*, and *DBPedia*.
- *Processing of multilingual texts:* this entails processing of texts in multiple languages, these include *BabelNet*, *WordNet*, *SentiWordNet*, *Google Translate*. *BabelNet* supports the analysis of African languages such as Xhosa, Zulu, Northern Sotho, Sesotho, Tswana, Yoruba, Hausa, Igbo, Afrikaans, and Swahili; while *SentiWordNet* supports opinion mining and sentiments analysis of service ratings and reviews by users.
- *Processing of slangs and urban texts:* this involves the semantic analysis of informal words, such as abbreviations, slangs, urban words, and social media terms. The tools for this include *ConceptNet*, *Slang to Text*, *Internet Slang to Text*, and *Urban Dictionary*. The other components of this layer are:
- *Recommendation Engine:* this implements algorithms that enable the TP to provide context-aware recommendations and constrained-based recommendations.
- *Speech Processing Engine:* this enables voice-based user queries to be processed. This is to cater for the needs of visually impaired persons.
- *Semantic Information Retrieval Engine:* this supports semantic-based analysis of queries in order to ensure accurate information retrieval.

Data Resources Layer: This layer contains the backend data resources in form of databases and suite of ontologies that support the TP. The key components of this layer are the following:

- *Informal Business Database:* which stores data of informal business operators, and transactions by customers, this includes profile documentation and update, submission of a resume, submission of reviews, and many more.
- *Third Party Databases:* These are other databases that the TP will need to regularly interact with in order to deliver its services.
- *South African Informal Business Regulatory Ontology (SAIBRO):* SAIBRO is a suite of interlinked ontologies that relate to integral aspects of the informal sector. The SAIBRO is a knowledge infrastructure that defines an extensive vocabulary that pertains to several aspects of the informal business sector by using formal

semantics. It will embrace dimensions such as informal sector regulations and by-laws, informal business model, and informal business services amongst others. SAIBRO is required in order to provide ready access to the range of regulations that govern the informal sector and to foster an understanding of rules and services of the informal sector. The SAIBRO has to be created as an upfront investment in order to ensure an efficient operation of the TP. The SAIBRO will amongst others:

- i. create a suitable vocabulary of the informal sector that is based on formal semantics in order to eliminate ambiguity;
- ii. create a searchable platform to readily access regulatory rules on the informal sector for both humans and machines; and
- iii. make it simpler for informal sector enterprises to map dynamic government policies onto regulations and make changes whenever it is necessary.

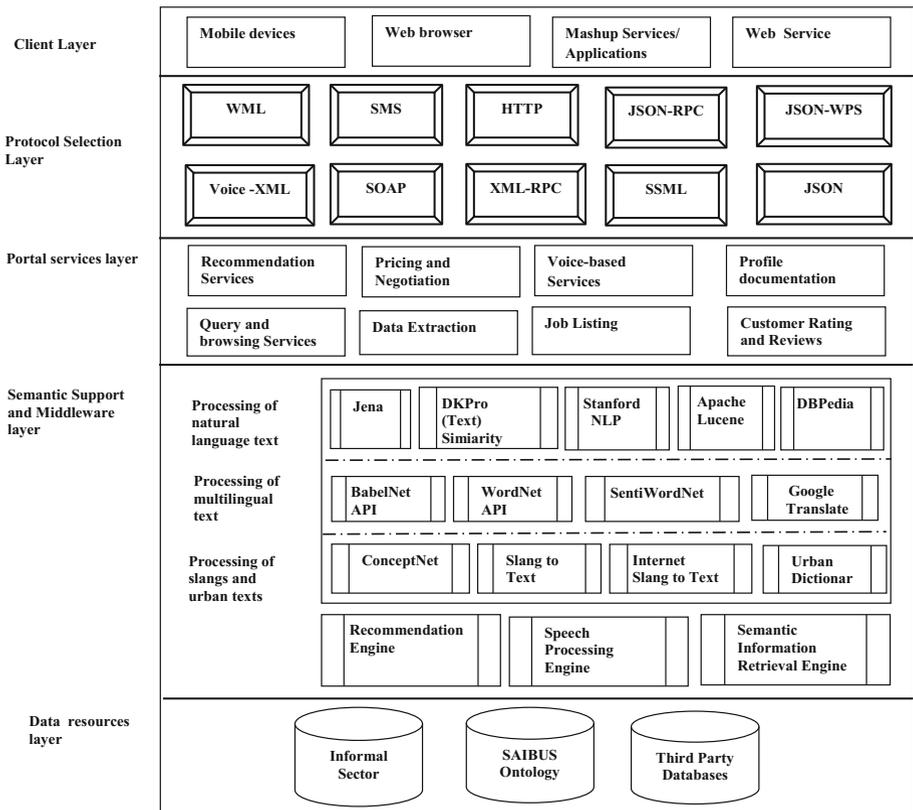


Fig. 1. The layered architecture of the TESSISA portal

4 Analytical Comparison of the TESSISA Portal and Other Classified Websites

It was discovered that there are some classified websites in South Africa that have significant conceptual similarities with the proposed TP. Therefore, an analytical comparison of TP and these classified websites is crucial. The four prominent classified websites that were selected are *Locanto.co.za*, *gumtree.co.za*, *olx.co.za*, and *bidorBuy.co.za*. The four classified websites specialise in facilitating formal and informal business interactions between customers (buyer) and provider services (seller) in an online environment. They provide a low entry point for buyers and sellers to meet and interact without the strictures of government regulations. Although, these websites have gained good acceptance within the populace, problems such as the risks of fake goods and scamming still exist. In order to perform the analytical comparison, we selected five parameters that were relevant to all the platforms. The parameters are the security measure, ethics code, feature categories, integration with social media, and support for intelligent services.

5 Result and Discussion

5.1 Results

The result of the comparative analysis reveals that although the four websites share some similarities with the TP in terms of utility (purpose) and some affordances, yet significant differences exist in the following areas:

- The purpose of the TP is not just on facilitation of informal business activities, but also regulation of service delivery to ensure credibility, and compliance with regulatory and quality standards;
- The TP is designed to give more attention to the issue of security compared to the other classified websites;
- The TP is more focussed on the aspect of services in the informal sector compared to other sites that cover several areas ranging from sales promotion, marketing and many more; and
- The TP is designed to provide more advanced and elaborate support for intelligent services and multimodality when compared to the others platforms.

Therefore, although the TP shares some conceptual similarities with certain existing classified websites, it is very different in terms of its purpose, design and expected outcomes, which are emphasised by its unique set of affordances. Also, there is a specific niche market that the TP will serve in contrast to the classified websites (CW). In addition, while the CW are solely driven by private enterprise objectives, the TP is motivated by developmental objectives that target the interests of informal sector operators, government, and other stakeholders.

5.2 Discussion

TESSISA was conceived to provide a solution to some of the problems of the informal sector, particularly the problems listed as 4–8 (see Sect. 2). The extents to which the conceptual design of the TP can address specific challenges of the informal sector of South Africa are discussed below in terms of components of the TP and the specific affordances of the TP (see Table 1).

- i. ***Lack of legal and regulatory environment and intergovernmental coordination:*** The provision of the SAIBRO infrastructure, which provides a detailed vocabulary for informal business activities and regulations, will enable a user to be able to see the relationship between different regulations that pertain to their own line of business. The specific affordances of the TP that were aimed at solving this problem are A2, A4, and A6. Therefore, the TP can facilitate coherent regulatory information and improved coordination.
- ii. ***Lack of organisation:*** The provision of an extensive database server for the TP will allow storage of profile information, business documentation, and history of service transactions. With this, the government or any other interested social agency/NGO will have enough information to properly organise the informal sector based on authentic data. The specific affordances of the TP that support this objective are A7, U1, U2, G1, G2, G3, P1, and P2. Therefore, the TP is a tool that can help to engender quasi-formalization and improved organisation of the informal sector.
- iii. ***Poor quality of service:*** The TP will allow individual service profile, recommendations, ratings of services, and customer reviews on the quality of service to be generated. With this, all operators and customers will know that they have to give their best at all times since a very low rating will have adverse consequences on their market value. Also, government agencies will have access to the profile of specific operators in order to identify those that may have a criminal record. Customers will have enough information before deciding to engage a service provider. The affordances of the TP that supports this objective are: A3, A7, U2, U5, U6, U7, U8, P1, P2, P4, and G4. Thus, the TP will promote quality service delivery in the informal sector.
- iv. ***Lack of service standards:*** The provision of the SAIBRO will enable ready access to standards and regulations that pertain to the rendering of specific types of services in the informal sector. In addition, the TP also has the capacity to provide top-N recommendations to a customer, when requested. Recommendations will be based on previous service records, the capacity to render such services and effective matching between the context of the customer and that of the provider, such that the most qualified persons after all necessary constraints have been applied are placed at the top of the list. Thus, the customer will be helped to make an informed decision. The provision of a template for pricing and negotiation ensures that certain minimum standards are associated with the costs of different types of services. Also, relevant government agencies shall be able to communicate the changes in regulations to informal sector operators through the TP. The affordances of the TP that supports this objective are A4, A6, A7, P4, U4, U5, U6, U7, and G5. Therefore, the TP will promote awareness of service standards, and its enforcement.

- v. ***Lack of documentation and inability to bring the operators to tax net of Government:*** The TP makes provision for the personal profile, business profile, and transaction history of all service operators to be stored. Data can also be extracted for planning purposes and formulation of relevant interventions that target specific sub-sectors of the informal business sector and demographics. The affordances of the TP that will cater for this objective are U2, A7, P1, P2, G1, G2, G3, and G4. Hence, the TP will enable the documentation of informal businesses and provides sufficient data that the government can use for planning and development.

Apart from directly addressing some of the problems of the informal sector, the TESISSA initiative brings some benefits to relevant stakeholders. These include:

- i. ***Increased Economic Participation and Wealth Creation:*** The TP will connect informal operators with more economic opportunities based on their performance profile and expertise as documented on the TP. This will lead to improved income through access to a more extensive market. The affordances of the TP that makes this possible are: A2, P1, P2, P3, P4, and P6.
- ii. ***Increased Accessibility:*** The TP will enable voice-based requests and response for services, processing of multilingual texts and informal English terms, which will make it accessible to more people. The affordances of the TP that caters for increased accessibility are A1, P7, and U9.
- iii. ***Collaboration for Development:*** TP provides a platform for relevant government agencies like the Department of Trade of South Africa, the Office of Statistics, private organisations, and academic institutions who are interested in developing the informal sector to collaborate. The affordances of the TP that caters for increased collaboration for development are G1, G2, G3, and G4.
- iv. ***Improved Revenue for the Government:*** The TP will bring more informal sector operators within the purview of governments control by enabling access to their documentation, which can bring them ultimately into government's tax net. It is expected that the TESISSA initiative if successful would increase the contribution of the informal sector to the GDP to be between 8–10% from the current 5.2%, and also increase overall employment by an additional 5% [4]. It will also create increased business opportunities for informal sector operators in an enlarged market, which will lead to more tax revenues for the government.

6 Conclusion

In this paper, the conceptual design of the multimodal TESISSA Portal (TP), which is capable of tackling five of the core challenges of the informal sector of South Africa has been presented. The layered architecture of the TP has been presented as a novel integration of relevant components that will guarantee the delivery of the envisioned affordances of the TP as a viable tool that can facilitate significant improvement to the economic status of informal sector operators, enhance the capability of the government to assist the informal sector, and bring benefits to all stakeholders. In our further work, the prototype implementation of the TP shall be undertaken, with an objective to

having a minimum viable product (MVP) model of the TP by mid-year 2019. This will involve the design and development of key infrastructures of the TP such as the South African Informal Business Regulatory Ontology (SAIBRO), and variant models of software artefacts including the web portal, mobile app, SMS-based portal, and voice user interface. All of these shall be undertaken by leveraging the concepts of lean product development, recommender systems, and multimodal user interface design.

References

1. Williams, C., Horodnic, I.: An institutional theory of the informal economy: some lessons from the United Kingdom. *Int. J. Soc. Econ.* **43**(7), 722–738 (2016)
2. Rogerson, C.: South Africa's informal economy: reframing debates in national policy. *Local Econ.* **31**(1–2), 172–186 (2016)
3. Valodia, I., Devey, R.: The informal economy in South Africa: debates, issues, and policies. *Margin: J. Appl. Econ. Res.* **6**(2), 133–157 (2012)
4. Skinner, C.: Informal Sector Employment: Policy Reflectors (2016). <https://www.africancentreforcities.net/5205-2/>
5. Charman, A., Petersen, L., Piper, L., Liedeman, R., Legg, T.: Small area census approach to measure the township informal economy in South Africa. *J. Mixed Methods Res.* **11**(1), 36–58 (2017)
6. Department of Trade and Industry (DTI): The National Informal Business Development Strategy (NIBDS). DTI Broadening Participation Division, Pretoria (2013)
7. Department of Trade and Industry (DTI): The National Informal Business Upliftment Strategy (NIBUS). DTI, Pretoria (2014)
8. Sustainable Livelihoods Foundation (SLF): South Africa's Informal Sector – Research Findings from Nine Townships (2016). livelihoods.org.za/wp-content/uploads/2016/06/SLF_Booklet_Lowres_Web.pdf
9. Daramola, O., Ayo, C.: Enabling socio-economic development of the masses through e-government in developing countries. In: European Conference on e-Government, pp. 508–513 (2015)
10. Fatoki, O.: The obstacles to the use of information and communication technologies by female informal traders in South Africa. *J. Soc. Sci.* **49**(3–2), 303–306 (2016)
11. Chiliya, N., Chikandiwa, C., Afolabi, B.: Factors affecting small micro medium enterprises' (SMMEs) adoption of e-commerce in the Eastern Cape Province of South Africa. *Int. J. Bus. Manage.* **6**(10), 28 (2011)
12. Ruxwana, N., Herselman, M., Conradie, D.: ICT applications as e-health solutions in rural healthcare in the Eastern Cape Province of South Africa. *Health inf. Manage. J.* **39**(1), 17–29 (2010)
13. Modimogale, L., Kroeze, J.: The role of ICT within small and medium enterprises in gauteng. *Commun. IBIMA*, 1–13 (2011)
14. Mvelase, P., Dlodlo, N., Williams, Q., Adigun, M.: Custom-made cloud enterprise architecture for small medium and micro enterprises. *Int. J. Cloud Appl. Comput. (IJCAC)* **1**(3), 52–63 (2011)
15. Dalvit, L., Thinyane, M., Muyingi, H., Terzoli, A.: The deployment of an e-commerce platform and related projects in a rural area in South Africa. *Int. J. Comput. ICT Res.* **1**(1), 9–18 (2007)
16. Ismail, R., Jeffrey, R., Belle, J.: Using ICT as a value adding tool in South African SMEs. *J. Afr. Res. Bus. Technol.* **2011**, 1–12 (2011)