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RESEARCH ARTICLE

THE APPLICATION OF RECOMMENDER SYSTEM IN MICRO AND SMALL ENTERPRISES FOR THE SELECTION OF NEW SECTORS IN BENISHANGUL GUMUZ REGION, ASSOSA, ETHIOPIA

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ABSTRACT

The main objective of this study is to apply recommender system in Benishangul Gumuz Micro and small enterprise sectors (BGMSEs). As a methodology, interview and document analysis methods were employed and the necessary data cleaning, filtering and modelling as well as representations were performed. Finally the recommender system was developed and tested on BGMSEs, 80% of experts and members are satisfied with the developed system.

Key words:

Benishangul Gumuz Micro and small enterprise sectors, Micro and Small Enterprises, Recommender system.

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INTRODUCTION

Recommendation process is a sequential process. It is not simply a sequential prediction problem rather a sequential decision problem. At each point, the recommender system makes a decision about the item/items. This decision should take into account the sequential process involved and the optimization criteria suitable for the recommender system. They suggest items to the user who can then accept one of the recommendations. At the next stage a new list of recommended items is calculated and presented to the user. This sequential nature of the recommendation process, where at each stage a new list is calculated based on the user's past ratings, will lead us naturally to our reformulation of the recommendation process as a sequential optimization process (Julie Main, 2001). The MSEs (Micro and Small Enterprises) in Benishangul Gumuz region are described as the national home of entrepreneurship. It provides the ideal environment enabling entrepreneurs to exercise their talents, to experiment, to innovate and transform their ideas into goods and services. In all the successful economies, MSEs are seen as an essential springboard for growth, job creation and social progress at large. The small business sector is also seen as an important force to generate employment and more equitable income

distribution, to activate competition, exploit niche markets, and enhance productivity and technical change. The sector is characterized by low enterprise requirement, operational flexibility, and location wise mobility (Dereje Workie, 2012) According to, Federal Micro and Small Enterprises Development Agency, Manual on the Micro and Small Enterprise in Ethiopia, 2013. Before going to Benishangul Gumuz Region Micro and Small Enterprises (BGMSEs) to begin the MSEs procedure, it is advisable to consider the following points: decide on the MSEs sector of interest, calculate the MSEs capital required, have an idea of member's requirement and have an idea of environmental situation. That is, getting MSEs advice is a critical issue for members' since knowing the right area is a key factor and also knowing the right enterprise to implement in is another factor to consider for new members. Because, members tend to lose money by making the wrong choice MSEs sector and choosing the wrong enterprises (Ashok Kumar, 2012).

Statement of the problem

According to BGMSEs sector experts, members have a few factors to consider when looking for the right place to put their money such as safety of capital, current income and capital appreciation. MSEs Decision will also depend on a member's age, capital, gender, educational level, location (region, zone and woreda) affecting the success of members in the activities

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of MSEs. The BGMSEs sector experts further comments that, members are confused about where to start the enterprise sector, what fund to use and which MSE sector is best to them to be successful due to lack of understanding the businesses.

In the BGMSEs sectors experts faced problems like, lack of appropriate, relevant and understandable information system that they need to provide advice and guidance to their members. Advice is one of the most important issues of small enterprises, in particular MSEs. Lack of access to appropriate information is encountered by BGMSEs due to the fact that information system is not developed to enable proper collection, organization and dissemination in the sector. Even if, there are federal and regional micro and small enterprises agencies in Ethiopia, there is no integration or collaboration between different experts that are found in different MSEs to develop an organized guidance to new members. Because, collection of ideas from different members is important to develop well defined and organized guidelines to new members. So this study aims to identify all the factors that should be considered at the time of enterprise selection in BGMSEs and design a prototype for the selection of enterprises in the region.

Accordingly, this study attempts to explore and answer the following research questions:

- What are the major attributes that have more influence in MSE sectors and activities selection in the BGMSEs?
- What are the potential areas in BGMSEs?

Objectives of the study

- To identify main attributes that influence MSE sectors selection to new members. To identify the potential areas for MSEs in the region
- To identify and collect the previous cases, facts and rules that new members need to know in order to select MSE sectors.
- To collect different expert ideas and develop guidelines or advice systems to new members.

Scope of the study

This study is restricted only on assessing the application of recommender system for BGMSEs. The study were not include other activities of the BGMSEs lack of access to market, finance, lack of business premises, low ability to acquire skills and managerial expertise, low access to appropriate technology and poor access to quality business infrastructure.

Method of data collection

Both primary and secondary data sources were employed, to acquire the needed knowledge.

Primary data sources: 25(twenty five) and 20(twenty) members and domain experts were interviewed respectively with related to enterprise sectors in the region.

Secondary data sources: for this study previously recorded MSEs members' cases (72 cases) were reviewed and used for recommender system development from the Benishangul Gumuz region micro and small enterprise sector in Ethiopia.

The researcher selects enterprise sectors that are at growth and maturity stages for the recommender system development. These successful enterprise activities were selected from each enterprise sectors. There were totally 500 growth and matured enterprise sectors from the total of 1000 start up, growth and maturity levels of enterprise sectors. But since the data set having different problems such as missing value of majority attributes, redundancy, etc the researcher selects seventy two (72) growth and matured cases from the total of 500 cases. Finally these 72 cases represented as case base in a CSV (Comma Separated Values) format that are used as previously solved cases. From 72 cases used for this research 17 were from manufacturing, 11 were from trade sector, 17 from service sector, 14 from construction sector, and 24 from urban agriculture sectors. So the researcher selects the case from each sector proportionally.

Sample MSES areas in Benishangul gumuz region

BGMSEs, is one of the Regional Micro and Small Enterprises Development Agency (ReMSEDA): which has several enterprise sectors in different woredas.

Table 1. Enterprise sectors in the region

No.	Region	Enterprise sector	Total number
1	Benishangul Gumuz	Manufacturing	17
		Trade	11
		Service	17
		Construction	6
		Urban Agriculture	21
		Total	72

Literature review

Architecture of recommender system

The recommendation seeker (members) asks recommendation with the help of recommender system from preference provider and universe of alternatives by entering the required queries by them. Based on the items listed in the preference provider, the system provides solution or recommendation by measuring similarity between new cases which is provided by the members and existing case stored in the case base. Finally, the system will provide best similar cases to the members from the existing cases (Agnar Aamodt and Enric Plaza, 1994).

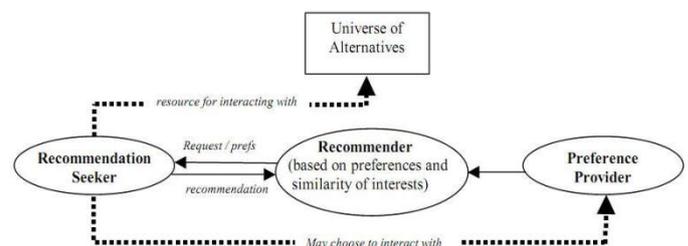


Figure 1. Architecture of recommender system

Types of recommender system

Based on how recommendations are made, Recommender systems can be classified into the following categories.

- **Content-based recommender systems:** in which the user is recommended items similar to those the user preferred in the past.

- **Knowledge based recommender system:** in which it depends either on explicit domain knowledge about the items or knowledge about the users to derive relevant recommendation.
- **Collaborative filtering systems:** in which the user is recommended items that people with similar tastes and preferences liked in the past.
- **Hybrid recommender system:** Due to the shortcomings proper of each of these strategies alone, combinations of content based and collaborative filtering have been investigated in the so called hybrid recommender systems (Azeb Bekele Eshete, 2009).

Knowledge modeling

Knowledge modelling is the representation of information in the form of logic for the purpose of processing knowledge to simulate intelligence. After the knowledge is acquired from different sources, the next step is organizing and structuring of knowledge. To make the acquired knowledge reasonable for knowledge representation, there are different conceptual modelling techniques. For this study hierarchical structure was used to model how enterprise sector and activity selection is performed by using jCOLIBRI programming tool (Tagel Aboneh, 2013). After identifying necessary information from BGMSEs office experts and members, the application of recommender system to the selection of enterprise sector and activity is done by taking consideration of the attributes such as: age, gender, educational level, amount of capital, form of ownership (trade association, cooperation and private), number of members, address (zone and woreda), and enterprise type (micro and small).

Knowledge representation

Knowledge representation is the systematic means of encoding knowledge of the human expert in an appropriate medium like predicate calculus and logic, rules, semantic networks, frames and structured objects (Christiane Gresse von Wangenheim, 2000). For this study, feature-value case base representation method is used. Because, representing cases using feature-value case based representation is that this approach uses old experiences to understand and solve new problems. It also reuses its solutions and lessons learned in the past for future use and it represents cases in an easy way by using attribute and value pair representation. The algorithms used to calculate the similarity of cases in a case base representation is nearest neighbour retrieval algorithm. The similarity function of nearest neighbour retrieval algorithm involves in computing the similarity between the stored cases in the case base and the new query. After that, selects the most similar stored cases to the query (Henok Bekele, 2011).

Recommender system for enterprise sector and enterprise

Activity selection

In this study, the case structure has two important parts. The first one is the problem descriptions or situation and the second one is the solution.

Problem Description/Situation: It is the part of the case structure that is consisted of attributes which describes the problem to be solved.

Solution: This part of the case structure provides recommendation based on the given members information. Therefore, the researcher identifies different description and solution attributes with the help of enterprise experts and from the previous members cases recorded data set. Select 11 description and 3 solution attributes from total of 16 attribute to the development of case based recommender System. The most influential attributes that affects the selection of enterprise sector and activities decisions are listed as follows:

Table 2. The case structure for enterprise sector selection

Attribute name	Parameter
Age	Description
Gender	Description
Capital	Description
Educational Level	Description
Form of ownership	Description
No. of members	Description
Region	Description
Zone	Description
Woreda/town	Description
Enterprise type	Description
Interested Enterprise activity	Description
Recommended Enterprise sector	Solution
Recommended Enterprise activity	Solution
Explanation	Solution

The following short descriptions are used to explain the selected attributes:

Age: is the age of members. If members are engaged in a partnership or joint, the value of age is assigned plc instead of number. In enterprise sectors and enterprise activity selection decision there is significant relationship between age and the time periods of enterprise made by the members.

Gender: is the sex of members as male and female. In this case the values of this attribute are male or female or plc. If members are formed in either partnership or joint, the value of gender is plc instead of male or female.

Capital: is the total amount of capital needed to start the selected enterprise sector.

Educational Level: it indicates the grade levels as well as the experience of members before starting the enterprise selection. Additionally it has also Plc value because assigning all the members values is difficult, if they are formed in a group.

Form of ownership: this attribute contains: the members form of ownership like private, cooperation (It is also an enterprise owned by a group of persons who take full part in the activity of the enterprise by coordinating their knowledge and assets) and trade association (Provide representatives and other collective products and services to businesses with a common interest).

Number of members: it contains the number of members initially and currently as well as it contains the temporary and permanent employees.

Region: is the regional place where members are planned to put their enterprises. The value of this attribute is, Benishangul Gumuz.

Zone: is the zonal location of the enterprise. Since each region

has its own zone, members selects specific zones based on the selected region.

Woreda/town: is the woreda or town location of enterprise that specifically facilitates service to members.

Enterprise type: contains values small and micro enterprises, which is categorized based on the amount of capital required.

Member’s interested enterprise activity: is the process of member’s interested activity that wants to start. So members fill their query as interested sector.

Recommended enterprise sector: it is the solution and provides a recommended enterprise sector based on the similarity of cases.

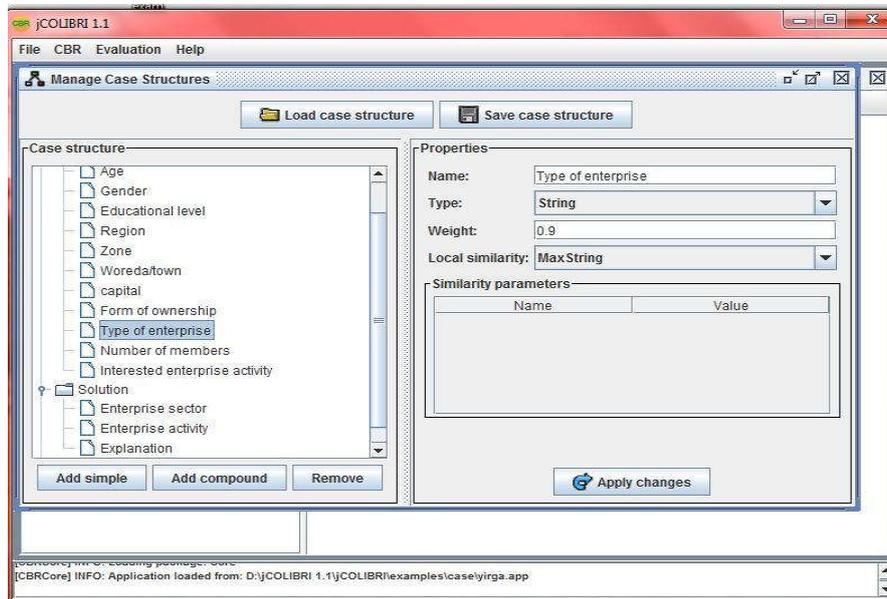


Figure 2. Defining case structure

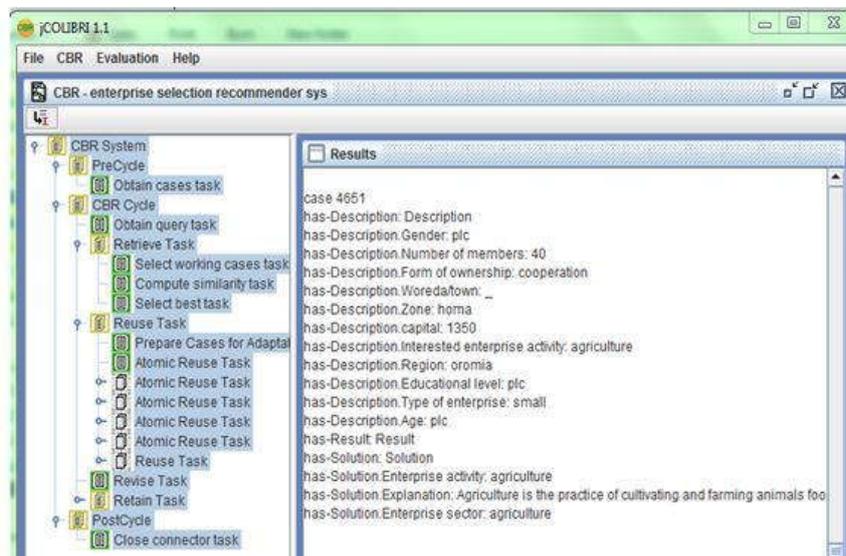


Figure 3. Explanation facility for enterprise activity

Table 2. The system performance evaluation by the domain expert

No.	Evaluation criteria	Performance value					Average	Percentage
		1	2	3	4	5		
1	The efficiency of the system				12	13	3.7	74
2	The use of the system			6	10	9	4	80
3	The layout of the system					2	5	100
4	The clearness of the system for decision or explanation				12	1	4	80
5	The relevance of the selected attributes			2	10	1	4.19	83
6	The advantage of the system in the domain area				15	1	4.1	82
						0		
					Total average		4.12	80%

Recommended enterprise activity: it is put under a solution and provides a recommendation enterprise activity.

Explanation: is used to give explanation and description about the recommended enterprise activities.

The explanation facility of recommender system for the

System

The explanation facility in this study is used to give explanation about the recommended enterprise activity given by the system. Once the system reaches final decision on the recommendation, it gives explanation about the selected enterprise activity.

System testing

After developing the recommender system, user's acceptance for applicability of the prototype was evaluated by potential users. 25 (twenty five) and 20 (twenty) members and domain experts were evaluated. During testing experts are requested to rank each parameter from poor to excellent by assigning value for poor=1, fair=2, good=3, very good=4, excellent=5. As shown in the above, regarding to the efficiency of the system 74% of the respondents said as very good and excellent, 80% respondents responded as good, very good and excellent for the case of system usage. According to the system layout 100% of the respondents said that excellent, with the clarity and explanation of the system 80% of the respondents said as good, very good and excellent. 83% of the respondents said the selected attributes are relevant. The developed system is important for the domain area as 82% responded that.

Findings

- The attributes used for this research were collected from the previous members' cases from BGMSEs. These attributes are not enough for the selection of enterprise sector and enterprise activity decision. So further research can be conducted by adding other important attributes such as land size required, marital status and level of risk taker for the enterprise sector and activity selection.
- The major attribute that have more influence in enterprise sector and activity selection are age, gender, capital required, educational level, enterprise location (such as region, zone, woreda), form of ownership, enterprise type, interested area of enterprise activity. The result of system performance indicated that users are satisfied with proposed system and the performance of the system validation result showed the system recommends highly acceptable enterprise sector and activities for members.
- The developed system does not have any controlling mechanisms to control the dynamic nature of the environment. Environments change may affect the success and implementation of enterprise activities. So, future researches can be done on managing the dynamic nature of the environment to start enterprise activity.

Conclusion

The main goal of this research was to develop a prototype recommender system for enterprises selection system in BGMSEs. Mainly, the system aims to help all experts, members and the region to select enterprises. In order to, acquire knowledge domain Experts, members and documents were used. Mainly previous member's cases were collected from BGMSEs. The acquired knowledge was conceptually modelled using hierarchical structure conceptual modelling method. The case representation method that is used in this study is feature value case representation method. The prototype was developed by using jCOLIBRI 1.1 Programming.

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