

Review of Multidimensional Poverty Identification and Welfare Targeting for InvisibleAid

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Abstract— This review paper is prepared from the literature survey conducted for the project “InvisibleAid: A Rule-Based Hidden Poverty Identification and Welfare Recommendation.” Two closely related topics are selected from the surveyed literature: (1) multidimensional poverty identification and (2) welfare targeting and intervention. The first topic examines how poverty can be identified using multiple deprivation dimensions rather than income alone. The second examines how identified vulnerable households can be connected with appropriate welfare interventions and how targeting errors can affect the delivery of support. Existing studies show the importance of multidimensional indicators, household characteristics, and evidence-based targeting. However, much of the literature focuses on measurement, statistical prediction, or policy analysis rather than a transparent software workflow that performs household-level screening and connects the result to welfare recommendations. Based on these observations, InvisibleAid is positioned as a rule-based decision-support application. The review summarizes the selected literature, compares the approaches, identifies the research gap, and explains how the findings support the proposed system.

Keywords— Multidimensional poverty, poverty identification, welfare targeting, rule-based system, household vulnerability, welfare recommendation, decision support.

I. INTRODUCTION

Poverty is a complex socio-economic condition that cannot always be represented by household income alone. A household may have low income while maintaining reasonable access to education or housing, or it may have income above a monetary threshold while experiencing serious deprivation in other areas. This has led poverty research toward multidimensional approaches that examine several dimensions of well-being together [1], [2].

The literature survey conducted for the InvisibleAid project identified several research directions, including multidimensional poverty measurement, poverty prediction and targeting, welfare interventions, and data-driven approaches. From these areas, two topics are particularly connected to the proposed system: multidimensional poverty identification and welfare targeting/intervention.

The first topic provides the basis for deciding which household characteristics can be considered when identifying vulnerability. The second provides the basis for connecting identified needs with suitable welfare support. Reviewing these two topics together is useful because InvisibleAid is intended to bridge the gap between identification and recommendation.

The objective of this review is not to propose a new poverty measure. Instead, it is to synthesize existing findings and use them to establish a research foundation for a transparent, rule-based household screening and welfare recommendation system.

II. SELECTED TOPIC 1: MULTIDIMENSIONAL POVERTY IDENTIFICATION

Multidimensional poverty research extends the analysis of poverty beyond a single monetary variable. Alkire and Foster proposed a counting methodology in which deprivation is assessed within individual dimensions and then aggregated using a second cutoff across dimensions [1].

Their approach demonstrates how a person or household can be identified as poor through multiple simultaneous deprivations.

The multidimensional perspective is important for InvisibleAid because the proposed application collects several socio-economic attributes. Possible indicators include household income, family size, employment status, education, housing or living conditions, and other project-defined characteristics. These indicators can be converted into explicit rules for preliminary vulnerability screening.

A systematic review by D'Attoma and Matteucci examined research on definitions, measurement methods, and empirical applications of multidimensional poverty [2].

Their review shows the importance of dimensions such as education, health, income, and living standards. It also points to continued dependence on survey data and the need for broader and more timely data approaches.

Multidimensional poverty identification therefore provides two important lessons for InvisibleAid. First, vulnerability should not be represented only by income. Second, indicators need to be combined using an explicit identification logic. The project adopts the second idea through a rule engine rather than directly implementing a formal poverty index.

The rule-based approach can represent conditions in a simple and auditable form. For example, a rule may identify a vulnerability condition when a household falls below a configured income threshold and also has a large number of dependents. Another rule may combine employment instability with housing deprivation. The exact thresholds must be defined from the project's requirements and, where applicable, authoritative policy criteria.

III. SELECTED TOPIC 2: WELFARE TARGETING AND INTERVENTION

Identifying a vulnerable household is only one part of poverty alleviation. The next question is how limited welfare resources and support services can be directed toward households with relevant needs. Welfare targeting research therefore studies methods for identifying intended beneficiaries and assessing whether programmes reach them.

Peng et al. studied patterns and determinants of multidimensional poverty together with welfare interventions in Hong Kong [3]. Their study illustrates how different poverty profiles can be related to different types of welfare support. This is relevant to InvisibleAid because a household may need a particular category of support depending on its combination of deprivations.

Poverty targeting can also involve statistical and machine-learning methods. Mariyah and Wobcke investigated Selective Guided Domain Adaptation for improving Proxy Means Test targeting [4]. Their 2025 study addresses estimation, inclusion, and exclusion errors and evaluates the method using household data from Indonesian districts. The work demonstrates the technical challenge of accurately targeting households when data distributions change.

These studies show that targeting is not simply a matter of labeling a household as poor or non-poor. The quality of input information, choice of indicators, eligibility thresholds, and characteristics of the target population can influence the resulting classification. For a practical application, the recommendation layer should therefore remain transparent and should support human verification.

InvisibleAid approaches welfare recommendation as a decision-support function. After the rule engine identifies relevant vulnerability conditions, the application can match those conditions with stored scheme categories and eligibility rules. The recommendation is preliminary and should not replace the official eligibility decision made by the responsible authority or programme.

IV. REVIEW OF SELECTED LITERATURE

The selected literature can be organized around the two review topics.

Alkire and Foster [1] provide a methodological foundation for multidimensional identification through multiple deprivation cutoffs. The major contribution is the explicit treatment of poverty as a condition involving deprivation across dimensions rather than relying only on one measure.

D'Attoma and Matteucci [2] synthesize a large body of multidimensional poverty research and show the diversity of definitions, dimensions, measurement techniques, and applications. Their review is useful for selecting candidate indicators for a system such as InvisibleAid.

Peng et al. [3] connect multidimensional poverty patterns with welfare interventions. Their work is particularly relevant to the second topic because it demonstrates the policy value of understanding which dimensions contribute to different poverty profiles.

Mariyah and Wobcke [4] focus on poverty targeting through Proxy Means Tests and domain adaptation. Their work highlights practical targeting problems such as estimation error and inclusion/exclusion error and demonstrates the value of using current information to improve targeting.

Together, these studies establish a progression: identify relevant dimensions, assess household deprivation or vulnerability, understand targeting limitations, and connect identified needs with appropriate intervention. InvisibleAid follows this conceptual progression in a simplified software form.

V. COMPARATIVE DISCUSSION

The first selected topic, multidimensional poverty identification, primarily answers the question “How can poverty or vulnerability be characterized?” The second topic, welfare targeting and intervention, addresses “How can support be directed toward households with relevant needs?” Both are necessary for the conceptual foundation of InvisibleAid.

Multidimensional measurement frameworks are theoretically strong but may require carefully selected dimensions, thresholds, weights, and data.

Statistical or machine-learning targeting methods can provide predictive capabilities but may require representative training data, validation, and periodic updating. Policy studies can reveal intervention patterns but are not necessarily implemented as end-user software.

A rule-based application occupies a different position. It does not claim to produce an official poverty statistic or compete with advanced predictive models. Instead, it converts documented project rules into a transparent decision-support workflow. Its practical advantage is explainability: the system can display which input conditions triggered an assessment or recommendation.

The literature also indicates an important limitation. No rule set can capture every dimension of poverty, and a household's circumstances may change over time. Therefore, the proposed system should be viewed as a preliminary screening and recommendation tool. Human review and official scheme verification remain important.

VI. RESEARCH GAP

The literature survey reveals several gaps relevant to the project.

- 1) Identification and recommendation are often treated as separate problems. Research may measure poverty or evaluate welfare interventions without implementing a single household-level workflow that connects both stages.
- 2) Many studies operate at survey, regional, or population levels. There is an opportunity for a simple application that processes an individual household profile and provides an understandable preliminary result.
- 3) Advanced targeting approaches may require historical datasets and model training. A lightweight rule-based system can operate without a machine-learning training phase and can make its decision logic explicit.

4) Existing research demonstrates the importance of multiple dimensions, but translating those dimensions into an accessible NGO-oriented decision-support interface remains an implementation challenge.

5) Welfare eligibility can change with policy updates. A practical system therefore needs a maintainable rule and scheme database rather than hard-coded assumptions.

These gaps motivate the InvisibleAid design: a configurable rule engine that uses multiple socio-economic inputs and connects the resulting vulnerability conditions to welfare recommendation categories.

VII. PROPOSED INVISIBLEAID FRAMEWORK

Based on the reviewed literature, InvisibleAid can be represented as a sequence of five stages.

- **Stage 1** — Household data collection: the authorized user enters relevant socio-economic information such as income, family size, employment status, education, housing conditions, and other selected indicators.
- **Stage 2** — Validation: the application checks whether required values are complete, valid, and within acceptable ranges.
- **Stage 3** — Rule-based identification: predefined rules evaluate the household profile. The system records which vulnerability conditions are satisfied.
- **Stage 4** — Welfare matching: the system compares the identified conditions with stored scheme categories and configured eligibility criteria.
- **Stage 5** — Recommendation and review: relevant schemes or support categories are displayed with an explanation of the matched conditions. The user can then verify the information and consult the appropriate official source.

The proposed technology stack for the academic prototype is Python/Django for the backend, React for the frontend, and MySQL for data management. The rule engine is implemented as application logic rather than a machine-learning model.

A key design principle is explainability. For example, instead of returning only “Vulnerable,” the system may show that the result was triggered by a combination of low household income, high family dependency, and employment instability according to configured project rules. Similarly, a recommendation should indicate the conditions that caused the scheme to be considered relevant.

VIII. LIMITATIONS AND ETHICAL CONSIDERATIONS

The proposed review and system concept have important limitations. First, the project-defined rules are not equivalent to an official national poverty line or government eligibility determination. Second, incomplete or inaccurate user information can affect the assessment. Third, welfare schemes may change over time, so the recommendation database requires maintenance.

Privacy is also important because socio-economic household information can be sensitive. The system should collect only necessary information, restrict access to authorized users, protect stored data, and avoid unnecessary disclosure. Results should be presented as screening or recommendation information rather than stigmatizing labels.

The recommendation layer should also direct users toward official sources for final eligibility verification. The system is intended to reduce information barriers and organize available information, not to make binding decisions about access to public benefits.

IX. FUTURE SCOPE

Future work can evaluate InvisibleAid using real or carefully constructed household cases and measure consistency, recommendation coverage, false inclusion, and false exclusion. The rule database can be made configurable so authorized administrators can update conditions without changing source code.

The application can also be extended with multilingual support, mobile-friendly interfaces, field-worker dashboards, and secure integration with verified external data sources. After sufficient quality data are collected, machine-learning methods could be evaluated as an optional future module. Such methods should be compared against the transparent rule-based baseline rather than replacing it without validation.

A further research direction is to study how different combinations of deprivation indicators influence recommendation coverage. This can help determine whether the selected rules are sufficiently representative of the households that the system is intended to support.

X. CONCLUSION

This review paper examined two related topics from the literature survey conducted for InvisibleAid: multidimensional poverty identification and welfare targeting/intervention. The first topic establishes that poverty can involve multiple forms of deprivation and provides a foundation for selecting household indicators. The second demonstrates the importance and difficulty of accurately targeting welfare interventions.

The literature also reveals a practical gap between research-based poverty measurement or targeting and a transparent household-level software workflow that connects identification with welfare recommendation. InvisibleAid addresses this gap through a rule-based decision-support architecture.

The proposed system collects socio-economic information, evaluates predefined vulnerability rules, and matches the resulting conditions with relevant welfare support categories.

The review therefore provides the conceptual foundation for developing and evaluating InvisibleAid while recognizing that the system should complement official poverty assessment and human verification rather than replace them.

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