E-QLT

MEASURING VULNERABILITY TO IMPROVE SOCIAL PROTECTION.

FIELDS of VIEW

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Acknowledgement

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Executive Summary

Schemes for social protection tackle different aspects such as food security, healthcare, livelihood, education, social security, etc. in order to provide a holistic protection. It helps reduce vulnerability of households by reducing exposure to risks and building household's capacity to mitigate impact of the shock. There is a need to understand and quantify household vulnerability better and understand the contribution of various social protection programmes. This will enable understanding the gaps in social protection and to design better social protection schemes.

In this study, we demonstrate a simulation based approach toward quantifying household vulnerability and the contribution of social protection schemes towards reduction of those vulnerabilities using E-QLT. E-QLT measures household vulnerability through Social Protection Score (SPS). Through a case study using primary data of 155 households across Panvel, Kagal and Chikhaldara in Maharashtra following application of E-QLT is demonstrated:
Household Level:

- Quantification of household vulnerability across health, education and financial dimension through SPS.
- Quantification of contribution of individual social protection schemes towards reduction of household vulnerabilities.
- Quantification of compound effect of 2 or more social protection schemes acting together towards reduction of household vulnerabilities

Macro Level:
- Comparison of vulnerabilities at an aggregate level across different regions and different caste groups
- Ranking schemes based on their contribution towards reduction of vulnerabilities.

Further a scenario-based analysis is demonstrated to understand the increase in vulnerability of household in face of an income shock, and the contribution of all social protection schemes towards providing shock resilience.

The report ends with the comparison of SPS with indicators of SDG 1, 2 and 4.

1.Introduction

Social Protection is viewed as a cushion against vulnerabilities and deprivation, and as a critical step to increase equality and inclusion. There are different definitions of Social Protection used across the world. According to Asian development bank, social protection can be defined "as a set of policies and programmes designed to reduce poverty and vulnerability by promoting efficient labour markets, diminishing people's exposure to risks and enhancing their capacity to protect themselves from hazards and interruption/loss of income" (Asian Development Bank, 2001). In the study by Thimmappa et al., (2021), Social Protection is described as programmes that offer basic requirements for humans such as food security, healthcare, livelihood, education, and social security. According to Cook & Pincus, (2014), Social Protection began to tackle poverty and low income where policies were introduced to increase standard of living of the disadvantaged sections, improve employment opportunities, and to provide for continued income and safe workspaces.

Based on the above definitions, a social protection system has the following important elements:

The programmes for social protection tackle different aspects such as food security, healthcare, livelihood, education, social security, etc. in order to provide a holistic protection.

It helps reduce a household's vulnerability by

Reducing household's exposure to risk[1]

Building household's capacity to mitigate the impacts of shocks.

It helps reduce poverty and inequality among the marginalized communities

The links between vulnerability, poverty and social protection and dynamic are interwoven (Fayazi & Bornstein, 2021). According to them,

On the one hand, poverty is a critical factor that pushes communities closer to the edge of vulnerability to famine, food insecurity, and natural hazards. On the other hand, poverty is an adverse outcome of vulnerability to undesirable events that decrease access to commodities and resources. However, the poor may not be necessarily vulnerable if they live in a relatively safe context with a strong, stable, social support system. Likewise, nonpoor people might be extremely vulnerable if exposed to threats to which they cannot easily adapt and for which their assets are ill-equipped to handle.

Given its interconnected nature, social protection plays a crucial role in efforts towards reducing both poverty and vulnerability. The need to prioritize social protection becomes even more crucial as the world faces unprecedented challenges from climate change related hazards, along with existing natural hazards and man-made hazards (World Meteorological Organization, 2021). The impacts of climate change affect vulnerable populations in a disparate manner, which further worsens the inequality that exists in society (Islam & Winkel, 2017).

This was apparent during the COVID-19 pandemic which once again sharpened the focus on vulnerability and illustrated the temporal and dynamic nature of vulnerability (Irudaya Rajan et al., 2020; Pathak et al., 2022; Sengupta & Jha, 2020; ten Have & Gordijn, 2021). A family can become vulnerable when faced with sudden shocks that are beyond the family's control such as an accident or disease, or loss of livelihood due to lay-offs or death of a family member. In addition, vulnerability stems from a combination of different

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[1] The risk here refers to risk both stemming from natural and man-made shocks/disasters.

dimensions such as caste, class, and gender (among others).

Schemes, policies, and other such offerings are designed to help households tackle vulnerabilities. And yet, increasingly, policies, schemes, and offerings have become targeted and uni dimensional (Irudaya Rajan et al., 2020; Sengupta & Jha, 2020). The question then is, how can we ensure different efforts come together to provide adequate social protection for households that face different kinds of vulnerabilities?

What we then need is a way to comprehend the vulnerability of different kinds of households and understand what social protection they need, and how different measures contribute to stitching together that social protection net. In this report we attempt to do this through a social security simulation tool E-QLT. E-QLT is designed to bridge the gaps in the current approaches in vulnerability assessment and measuring the role of different social protection measures towards reducing vulnerability. E-QLT, allows us to view the vulnerability of different types of households, evaluate various social protection measures, and plan for pathways to improve social protection for these vulnerable households. E-QLT enables one to simulate the conditions of the household and understand their coping strategies in face of lockdown and measure their vulnerability. Further it allows us to evaluate how various schemes helped in the reduction of vulnerability and improvement of social protection for the household, thus allowing for planning for resilience.

E-QLT models the household, and measures social protection of the household across three dimensions currently:
● Education: To look at whether the household could ensure adequate education for the children.
● Health: To look at both physiological health and nutritional adequacy of each of the members.
● Finance: To look at the financial situation of the household.

In this report we analyse the social protection measure in Maharashtra using the simulation tool E-QLT. We measure the social protection score of 155 households across Panvel, Kagal, and Chikhaldara districts to understand the different vulnerabilities that exist. We also test the contribution of various schemes and the protection provided by the scheme during a shock.

The report is structured in the following manner, in section 2, we look at the current social protection policies in Maharashtra and the challenges therein. In section 3 this will be followed by a review of literature to understand the current state of the art in defining and measuring vulnerability and social protection, to guide the development of the tool like E-QLT. In section 4, we discuss the methodology adopted in developing E-QLT and discuss the various aspects related to modelling, data collection and scenarios and limitations. This will be followed by section 5, where we present and discuss the results from the simulation runs of E-QLT for various scenario which helps in understanding the vulnerability better and the role various social protection measures play in providing a safety net for the households in Panvel, Kagal and Chikhaldara. We then in section 6, compare the results from E-QLT with indicators from SDG 1, 3 and 4 to discuss to novelty and value addition of the approach. We then conclude with outlook for the tool and the approach.

2.Social protection policy processes within Maharashtra

Maharashtra is India's second largest state in terms of population and third largest in terms of area (Office of Registrar General and Census Commissioner, 2011). Over the last decades, the state has consistently done well in terms of economic growth, having the highest State GDP (Current) across all territories of India (Reserve Bank of India, 2022). Being home to India's financial centre, Mumbai, Maharashtra has witnessed a rise in its overall economic productivity and an increase in median incomes. In terms of sectors, a majority of the State GDP is contributed by the services sector, followed by manufacturing and then agriculture and allied activities. At the same time, this growth has not meant a corresponding reduction in economic inequality. In terms of PPP, the State GDP has remained outside the top 10 states in India, even though it is home to the largest number of billionaires in India (Reserve Bank of India, 2022).

Further, like other parts of India, economic inequality is compounded by other social inequalities faced by vulnerable communities. Identities of caste, religion, ethnicity, gender, etc. all contribute to the worsening of vulnerability in terms of social protection (Pellissery, 2008a, 2008b). Parts of the state are also semi-arid, leading to periodic droughts across districts. As per the Maharashtra Human Development Report 2012, while the state's Human Development Index (HDI) increased since the 1990s, the state was unable to report high levels of HDI corresponding to its economic growth (Jayachandran, 2012). The HDI accounts for fundamental factors of social protection such as education and health, and therefore, reflects the macro-level changes to the state's social protection ecosystem. The need for social protection is immensely exacerbated by the fact that Maharashtra has the highest percentage of in-migrants amongst all states in India (Office of Registrar General and Census Commissioner, 2011).

In Maharashtra, there is no formal department or institution for social protection. Several schemes, both social and economic, have been framed as part of the Social Justice and Special Assistance Department. The stated focus of this department is to assist in the upliftment of Scheduled Castes (SCs) and Scheduled Tribes (STs), categories of persons deemed to historically deprived and needing special protection by the Constitution of India. Yet, there is no explicit, overarching framework of social protection policies in the state. As a result, not all relevant policies or programmes may be under the umbrella of the Social Justice Department. This is critical to understand the complex nature of institutional delivery of public services and its arising challenges (Pellissery, 2008a, 2008b).

Based on the geographical, demographic, and economic context discussed above, the need for social protection is clear. Below, we discuss measures that the state has sought to adopt for addressing such vulnerabilities and to improve social protection, including the processes that impact present evaluation processes.

India's social protection landscape is complex and consists of varying initiatives managed by the Central, State and Local governments. Initiatives such as Integrated Child Development Scheme (ICDS) and PM-POSHAN (erstwhile Mid-Day Meal Scheme) are majorly sponsored by the Centre though implemented at the state level in Maharashtra. Other schemes such as the Maharashtra Employment Guarantee Scheme or the Swasthya Bima Yojana are entirely state-funded schemes.

Regarding education, the primary Central scheme is the Right of Children to Free and Compulsory Education Act, 2009 (RTE Act), which provides free and compulsory education to all children between the ages of 6 and 14. In terms of tracking the process of such schemes, the Maharashtra state government sought to use a Digital Education Guarantee Card, which was an online platform designed to assess the dropping out, enrolment, and continuity in education of children across the state. It was introduced in 2015 with an aim to keep track of migrant children in the state education system.

To tackle economic and health vulnerabilities, the Government of Maharashtra implements two social protection schemes: *Employment Guarantee Scheme* (EGS) and *Rashtriya Swasthya Bima Yojana* (RSBY) respectively. EGS is implemented in the rural areas for the poorest sections to provide some form of stable employment which can result in creation of assets (Pellissery, 2008a, 2008b). RSBY offers health insurance for in-patient services for the poorest sections (Sabharwal et al., 2014). These social protection schemes offer opportunities, access and funds to employment and healthcare. Schemes such as PM-POSHAN and ICDS further help to ensure food security and healthcare for women. In terms of tracking implementation, these programmes use hand-filled cards to track the health of the beneficiaries and have now been converted into standardised templates which can be used across states and languages (Gurnani et al., 2018).

However, challenges remain with regards both the coverage as well as accessibility of these schemes. In terms of coverage, many schemes are unable to account for vulnerable groups such as migrants or young mothers, as a one-size-fits-all approach is unable to account for their unique circumstances. For instance, many migrating mothers are unable to seek benefit under the Pradhan Mantri Matru Vandana Yojana (PMMVY), which provides financial support only at the time of having a first-born child, as they may be moving during their pregnancy. Similarly, in terms of accessibility, the state's main health insurance scheme, Mahatma Jyotiba Phule Jan Arogya Yojana (MJPJAY), lacks adequate empanelment of hospitals across all districts in the state. Further, it was found that there was also a significant lack of awareness regarding financial support for healthcare amongst many communities, hindering access to such schemes (Lone et al., 2022).

Given the substantive challenges which exist in social protection measures, it is important to understand the best methods of designing and delivering such schemes. It has been observed that the use of even one such scheme can improve social protection in other aspects of vulnerable communities. A study by Sabharwal et al., (2014) observed that EGS leads to

continuous house income, healthcare and food security. They further analysed how RSBY aided other dimensions of income, employment/job security, social networks and relationship between state and societies. The study found that due to the insurance, people didn't have to pay for in-patient medical expenses which resulted in more savings, investments in employment and participation in communities.

Finally, it is critical that processes of determining vulnerability and tracking changes in social protection must account for not just the myriad schemes, their benefits and eligibility criteria, but also often overlooked data such as the influence of institutional arrangements, informal identity networks, etc. It has been argued, based on primary research, that tracking only outcomes may not be able to reflect the journey of a scheme's implementation (Pellissery, 2005). Policy processes play an equally important role in determining the effectiveness of any social protection programme. Existing power structures, such as caste networks in a village, can prevent access to schemes for certain communities, thereby furthering their vulnerability (Pellissery, 2005).

We need a method of assessment that helps determine context-specific needs and constraints of households, while also accounting for both their requirements as well as preferences and aspirations. In the next section, we discuss the idea of a 'Social Protection Score', which attempts to evaluate household-specific vulnerabilities and determine how best the impact of different schemes may be coalesced.

3.Literature Review on vulnerability and its assessment

As discussed previously, social protection systems play a crucial role towards reduction of vulnerability and poverty. To improve upon the current approaches in understanding the role of social protection measures in reduction of vulnerability through the method of E-QLT, we first review how vulnerability is defined across different approaches and disciplines, and the various assessment approaches. This will be followed by exploring how the vulnerability assessment could be carried out using the Sustainable Livelihood Approach, which is the theoretical underpinning for the E-QLT in this study and look at ways in which E-QLT helps address the various gaps highlighted.

3.1 Vulnerability and various methods of vulnerability assessment

The term vulnerability in common parlance is defined as, 'The quality or state of being exposed to the possibility of being attacked or harmed, either physically or emotionally.' Alwang et al., (2001) have reviewed the concept of vulnerability across different disciplines such as food security, sustainable development, sociology, anthropology, disaster management, natural hazards and health and nutrition. They conclude,

...practitioners from different disciplines [and even from different perspectives within the same discipline] use different meanings and concepts of vulnerability, which, in turn, have led to diverse methods of measuring vulnerability.

Additionally, their study concluded that vulnerability indicators chosen for one context might not be suitable to use in assessing vulnerabilities in other contexts. Hence, it is necessary to understand how the vulnerability differs from one discipline to another in order to ensure accurate measures of vulnerabilities.

In literature, the vulnerability is often understood from the following three broad disciplines[2]:

1. Climate Change
2. Food Security and nutrition
3. Multi-dimensional poverty

We attempt to unravel the vulnerabilities faced in the context of these three disciplines and see how we can synthesize the understanding for the purpose of this study.

Climate Change:
Intergovernmental Panel on Climate Change (IPCC, 2007) defined vulnerabilities as,

"the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity".

Climate change researchers have described vulnerabilities & the factors affecting it in different ways in order to ensure clarity & avoid misunderstandings around vulnerability. A report by UNDP (Pelling et al., 2004) has differentiated between four groups of vulnerability factors in the context of reduction in disasters induced by climate change such as *physical factors*, which describe the exposure of vulnerabilities within a region; *economic factors*, which consider economic resources of individuals populations groups, and communities; *social factors*, which account for non-economic factors that determine the well-being of individuals, population groups, and communities, such as level of education, security, access to basic human rights, and good governance; and *environmental factors*, which characterize the environmental status of a region.

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[2] The term disciplines are used here broadly to denote different streams of research, which may include overlaps as well.

Food Security and Nutrition:
Food security is attained when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life (National Research Council, 1986). In the context of food security, the term vulnerability has been defined as the combined effects of *"risk and of the ability of an individual or household to cope with those risks and to recover from a shock or deterioration of current status"* (Maxwell, 2000). Researchers have developed comprehensive frameworks for food insecurity which accounts for the complete risk-response-outcome chain[4]. Factors such as diversity of income sources, cattle and land ownership, etc. have been used as proxies for food insecurity (Maxwell, 2000). Consumption of famine foods, frequency of use of coping strategies, migration, asset sales, to name a few, have also been used as proxy variables and their use serves as an implicit recognition of the role of household responses as signals of vulnerability (Barrett, 2002).

In the case of nutrition, vulnerability is classified as nutritional vulnerability, defined as the probability of inadequate nutritional intake needed to live a normal and active life (National Research Council, 1986), or the probability of suffering nutrition-related morbidity or mortality (Davis, 1996).

Multi-dimensional Poverty:
Pritchett et al., (2000) define vulnerability as the probability that a household will experience at least one episode of poverty in the near future and calculate a headcount rate to arrive at the proportion of households vulnerable to poverty. Multi-dimensional Poverty Index (MPI) includes a set of dimensions (Education, Health, Living Standard), indicators to these dimensions (Years of Schooling, Child School Attendance, Mortality, Nutrition, Electricity, Sanitation, Drinking Water, Flooring, Cooking Fuel, Asset Ownership) and weights and deprivation cut-offs for the same. This approach is performed on an individual level and classifies a person as deprived[3] or non-deprived based on their score on each indicator. A poverty cutoff of 33.33% identifies people as poor over multiple dimensions when their deprivation score meets or exceeds this mark (Alkire et al., 2014). However, people who experience deprivation in some indicators yet whose weighted sum of deprivations is less than 33.33% are not considered poor (Alkire & Santos, 2014). In fact, Alkire & Kumar, (2012) found that out of the 40–47% of households identified as multidimensionally poor or monetary poor, only 14% of them are considered poor by both measures at the same point in time. Thus, room is left for individuals' deprivations to appear unaccounted for and not included in the MPI.

While we have presented the varied definitions of vulnerabilities across different disciplines thus far, in the next section, we attempt to dissect the common methods of vulnerability assessments used to estimate the quantitative representations of these vulnerabilities.

3.2 Vulnerability assessment across approaches

Vulnerabilities can be defined and measured using different indicators or time horizons with respect to exposure to shocks, household responses to negative events and the link between transitory and permanent consequences. These vulnerabilities can be assessed with either quantitative or qualitative methodologies or a mixture.

At the individual or household level, vulnerabilities are commonly assessed via qualitative assessment which aims at understanding community perceptions with the result of effective program targeting. An example of such a technique is the Participatory Rapid Appraisal (PRA) which includes these community perceptions and their own assessments of vulnerabilities faced (Banerjee et al., 2009; Moret, 2014). A further extension of this method can be found in the Participatory Vulnerability Analysis (PVA) framework which also motivates individuals to take appropriate actions in addition to self-

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[3] In multidimensional poverty analysis, however, the terms 'deprived' and 'poor' have a clear distinction. A person is considered deprived in an indicator if the person fails to meet the threshold in that indicator. By

being deprived a person may not necessarily be considered poor. (Seth & Villar 2017)

examinations of their own vulnerabilities. Although, a major drawback of this framework is the lack of external validity to other contexts. However, it has been emphasized that assessment of vulnerabilities should be easily transferable from households to regional levels (Frankenberger et al., 2005; Moret, 2014). As a result, in this report we will focus primarily on common quantitative assessments of vulnerabilities.

Methods of quantitative assessment are necessary to aid in: ascertaining household characteristics which are correlated with vulnerabilities, examining sources of vulnerabilities vis-a-vis characterization of shocks and risks faced by the household & determining gaps between risk and risk-management mechanisms[4]. These measurement approaches are recommended when measured poverty is low but household consumption is just above the poverty line, indicating that an adverse shock could tip many households back into poverty (Hoddinott & Quisumbing, 2010).

Vulnerability as Expected Poverty (VEP)
Chaudhuri et al., (2002) and Christiaensen & Subbarao, (2005) consider vulnerability to be defined as the probability that a household will fall into poverty in the future. Such a measure has the advantage that if expected poor turn out to be poor in a consequent time period, they can be identified as chronically poor. In this approach, expected consumption is considered as a proxy variable for well-being. One can also explore the linkage between chronic poverty and vulnerability using this approach. A study in rural India found that higher share of more educated members, larger size of land and more irrigated land tend to reduce household probability of poverty (measured as expected per capita consumption) while more female members, and younger or older members would increase the probability of poverty. It was also found that although chronic poverty is relatively small, the high incidence of transient poverty highlights

the significance of covariate[5] and idiosyncratic shocks[6] (R. Jha et al., 2011).

Vulnerability as Low Expected Utility (VEU)
Ligon & Schechter, (2003) propose a measure of vulnerability that defines vulnerability as the difference between the utility derived from some level of certainty-equivalent consumption - at and above which the household would not be considered vulnerable - and expected utility of consumption. This method was introduced in Bulgaria and the study found that poverty and risk played almost identical roles in reducing welfare (Ligon & Schechter, 2003). In the context of rural India, a food security study used expected utility measures to identify risk-prone households. Significant findings from the study included: idiosyncratic risk being the largest driver (a utility loss of almost 51%) as compared to the covariate shocks and poverty (M. Das, 2021).

Vulnerability as Uninsured Exposure to Risk (VER)
In the absence of risk management tools, shocks impose a welfare loss to the extent that they lead to a reduction in consumption. This is a dimension of vulnerability that a third approach, vulnerability as uninsured exposure to risk, explores. It differs from VEP measures in that it is backward-looking, that is, it is an assessment based on the past occurrence of a negative shock which caused welfare loss rather than an analysis of future poverty based on the occurrence of a potential shock (Hoddinott & Quisumbing, 2010). This approach analyses how households manage to smooth their consumptions over time with the amount of loss incurred due to shocks being measured as equivalent to the amount paid as insurance to keep a household as well off as it had been before any shock (Deressa et al., 2009). The VER method of vulnerability assessment has also been implemented in Russia wherein support from relatives/friends and home production were found to act as important insurance mechanisms for the most vulnerable (Gerry & Li, 2010).

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[4] Holding assets such as physical, financial, human, natural & social is a key ante-risk management mechanism (Hoddinott, & Quisumbing ,2010)

[5] Covariate events directly affect large numbers of people in a given geographic area e.g., climate disasters, disease outbreak, etc.

[6] Idiosyncratic events affect specific individuals or households within a community e.g., illness, job loss, social exclusion, etc.

The three econometric approaches mentioned above bear similarities as well as differences between them. For instance, while the VEP approach looks at poverty to be expected in the future due to vulnerabilities faced from a potential shock, the VEU approach analyses poverty as expected utility lost as a result of vulnerabilities and the VER approach measures poverty from a past shock which caused the welfare loss. Ultimately, these approaches still possess the aim of assessing vulnerabilities faced by low-income communities from shocks/stresses.

Methods of Vulnerability Measurement	Variables Used		Methodology	References
	Internal	External		
VEP	Per capita consumption expenditure, household characteristics (location, characteristics of head, assets)	Prices, shocks	Expected log per capita consumption expenditure less than the poverty line conditional on household characteristics used to find probability of being poor in the future	(Chhinh & Poch, 2012; Mahanta & Das, 2017; Vo, 2018)
VEU	Utility derived from certainty equivalent (1), expected utility derived from consumption (2), idiosyncratic shocks	Covariate shocks	Poverty (Difference between (1) & (2)) + Covariate & idiosyncratic risks	(E. Jha et al., 2010; R. Jha et al., 2011; Ligon & Schechter, 2003)
VER	Per capita consumption expenditure, fixed household characteristics, idiosyncratic shocks	Predicted consumption (households unaffected by any shocks), covariate shocks	Difference between households affected by shocks and predicted consumption = impact of shocks on the household Note: Some variants of this method use pre-shock household characteristics as a baseline (Hoddinott, J., & Kinsey, B., 2001).	(Hoddinott & Quisumbing, 2010; Senapati, 2019; Tesliuc & Lindert, 2002)

Table 1. Measures of Vulnerability

The degree to which a household is vulnerable is a function of both internal and external risk components, and their capability - determined by their asset portfolio - to respond to these risks (Adger & Winkels, 2014).

Hence, we proceed to investigate with the Sustainable Livelihoods Approach which incorporates this phenomenon.

The consensus which is commonly observed across most disciplines and approaches is that vulnerabilities occur on account of internal or external shocks experienced by households who lack the ability to cope and adapt with existing resources or assets.

3.3 Analysis of Vulnerabilities through the Sustainable Livelihoods Approach (SLA)

According to Serrat (2017) the sustainable livelihoods approach is a way of thinking about the objectives, scope, and priorities for development activities. It is based on evolving thinking about the way the poor and vulnerable live their lives and the importance of policies and institutions. It helps formulate development activities that are

- People-centered
- Responsive and participatory
- Multilevel
- Conducted in partnership with the public and private sectors
- Dynamic
- Sustainable

This makes it suitable as the theoretical backbone for the E-QLT, as it allows understanding of vulnerability at different level, the role played by various policies and institution and helps in formulating new policies. While drawbacks of using the SLA approach include evaluation of livelihoods on the basis of "sustainability" of resource use & resultant livelihoods and focus on non-income aspects of livelihoods, such as reduced vulnerability, makes the outcomes difficult to measure (Ashley et al., 1999; Small, 2007). We are primarily using the SLA approach as a framework to better understand the different kinds of vulnerabilities present across different fields and seek to use common indicators from different studies (explained further in next section) in conjunction with the SLA to come up with Social Protection Scores to enable measurement of vulnerabilities and worsened livelihoods as a result. Although, we do account for other disadvantages of this framework while conducting this analysis: Inadequate attention to inequalities of power, downplay of elements such as macroeconomic trends & conflict and underrating of the fact that enhancing one group's livelihood can weaken those of another (Serrat, 2017).

As discussed in the previous section, people are constantly found to move in and out of poverty depending on their vulnerability status and the concept of vulnerability is seen to capture the processes of change better than poverty line measurements (Serrat, 2017).

Thorat et al., (2017) found that 65% of Indian households who were poor in 2005 had escaped poverty by 2012 and 14% non-poor slipped back into poverty with increased human and physical capital contributing towards avoiding falling into poverty. Vulnerabilities classified under the SLA possesses two aspects: an external side which deals with shocks, seasonality, and critical trends; and an internal side of helplessness and endangerment caused by lack of ability and means to cope with the same.

It has been observed that the disparity between design and implementation often presents itself in implementation studies. For instance, in the case of Self-Help Groups (SHGs), members who avail benefits have suffered from elite capture with the poor and marginalized left ostracized. The haste that goes into the establishments of institutions for the poor without an adequate framework has led to many groups being defunct in nature. The choice of livelihoods often has been predetermined by the government with the poor not being involved with programmes being implemented in a top-down approach, ignoring the participatory approach as envisaged in the livelihoods design (Patnaik & Prasad, 2014). Therefore, SLA frameworks have been recommended as strategies for widening choices, reducing powerlessness, promoting innate self-respect, emphasizing cultural and moral values of the poor and focusing on the way poor people live their lives (Ashley et al., 1999; Chambers & Conway, 1992).

From Table 2, we can observe that the asset capitals classified under the SLA approach can be drawn from existing literature which investigates the relationship between different shocks faced by households and vulnerabilities as a result of a lack of livelihood assets. Studies on climate change, food insecurity, malnutrition and multi-dimensional poverty were broadly found to measure similar physical and financial asset capitals such as cattle & land ownership and income levels & sources with common vulnerabilities observed across the human capital domain such as loss of education, reduced employment & deteriorating health outcomes.

Common coping strategies used by people in the face of a climate disaster are found to be using up past savings, selling livelihood assets, borrowing from money lenders, borrowing from friends/relatives & income diversification (Bhattacharjee & Behera, 2018a; Brouwer et al., 2007; Sultana & Rayhan, 2012). From the perspective of food insecurity and malnutrition, studies have found that households suffering from moderate to severe food insecurity are more likely to compromise on quantity and/or quality of food and borrow money and food from relatives & friends with these strategies even being adopted during the recent COVID-19 pandemic (S. Das et al., 2020; Farzana et al., 2017; Shariff & Khor, 2008). Also, large & literate social networks among mothers are found to be positively associated with better child nutrition (Moestue et al., 2007). Lastly, coping mechanisms for multi-dimensional poverty include limiting food vis a vis meal size reduction & skipping meal, borrowing food from neighbours and working on other farms to make up for insufficient farm income (Joshua et al., 2017). Strong social networks in terms of religion, family & community bonds are also found to be an effective coping mechanism for multi-dimensionally poor individuals (Trani et al., 2016).

Shocks/Disasters	Livelihood Asset Capitals	Vulnerabilities
Climate Disasters (Floods, Droughts, Earthquakes, Hurricanes)	Physical: Ownership of livestock, access to irrigation facility, housing infrastructure (kucha/semi-kucha)	Destruction of infrastructure (roads, bridges, clinics, water systems, etc.)
	Natural: Ownership of farmland, household having more than 66.9 sqm of land	Reduced soil moisture for plant growth, reduced ground water for drinking.
	Human: Age, Gender, Education	Disruption of education, loss of employment
	Social: Household membership in local club Social Institutions	Breakdown of social cohesion if recovery is not rapid, weak social norms leading to reduced aid and support
	Financial: Total income of household, household with more than one earning member, source of income	Loss of income/savings to meet increased prices of goods
Food Insecurity & Malnutrition	Human: Mother's education, BMI status	Deteriorating health outcomes, reduced employment opportunities for the mother, reduced access to education for the child
	Physical: Cattle & land ownership	Lower standard of living
	Financial: Wealth status, income sources	Reduction in present and/or future incomes
	Social: Community groups & mutual trust	Decreased access to social networks due to poor health conditions
Multi-dimensional Poverty	Human: Years of Schooling Child School Attendance Mortality Nutrition	Reduction in quantity and/or quality of meals Withdrawal of children from schools Engaging in informal employment
	Physical: Electricity Sanitation Flooring	Reduced access to housing, electricity and sanitation facilities
	Social: Networks with external and internal stakeholders	Security from elites/patrons in exchange for trading autonomy and potential for economic improvement

Table 2. Vulnerabilities across livelihood asset capitals with respect to shocks/disasters Prepared from (Alwang et al., 2001; Barrientos, 2011; Bhattacharjee & Behera, 2018b; Hoddinott & Quisumbing, 2010; Khan & Mohanty, 2018)

While assets can be measured across different shocks, it can also be classified across different time horizons: rapid, slow, prolonged. Table 3 provides an analysis of the duration/speed at which vulnerabilities present themselves in the form of reduction in quantity and/or quality of livelihood assets as a result of shocks or stresses experienced by individuals. For instance, a study conducted in Zimbabwe during the 2001-08 crisis found that some dimensions of wellbeing such as livestock asset depletion & removal of children from school require immediate support whereas measures like infrastructure maintenance and investment require long-term support since household dimensions such as access to health & drinking water were found to decline even post-crisis (Stoeffler et al., 2015).

Shocks/Disasters	Speed of onset / Duration of Vulnerabilities		
	Rapid	Slow	Prolonged
Climate Disasters	<u>Physical:</u> Destruction of infrastructure (roads, bridges, clinics, water systems, etc.) <u>Natural:</u> Reduced soil moisture for plant growth, reduced ground water for drinking.	<u>Human:</u> Disruption of education, reduced access to healthcare	<u>Social:</u> Breakdown of social cohesion if recovery is not rapid
Food Insecurity & Malnutrition		<u>Social:</u> Decreased access to social networks due to poor health conditions	<u>Human:</u> Deteriorating health outcomes, Reduced employment opportunities for the mother, reduced access to education for the child <u>Financial:</u> Reduction in present and/or future incomes
Multi-Dimensional Poverty	<u>Human:</u> Reduction in quantity and/or quality of meals Withdrawal of children from schools Engaging in informal employment	<u>Physical:</u> Reduced access to housing, electricity and sanitation facilities	<u>Social:</u> Security from elites/patrons in exchange for trading autonomy and potential for economic improvement

Table 3. Duration / Speed of onset of vulnerabilities resulting from shocks and/or disasters analyzed across asset capitals
Prepared from: (Barrientos, 2011; Hoddinott & Quisumbing, 2010; Khan & Mohanty, 2018)

Understanding the speed and/or duration of shocks and the vulnerabilities faced as a result is crucial in determining the rate of transient poverty experienced by low-income households. The process of households falling in and out of poverty occurs when households are unable, or unwilling, to smooth consumption due to income shocks. During the Zimbabwe 1994-95 droughts, households who did not wish to sell physical assets like livestock experienced a temporary reduction in women's health but a likely permanent reduction in children's human capital (Hoddinott, 2006). A study in Andhra Pradesh found that during the period 1978-2004, 14% of surveyed households escaped poverty but 12% of households fell into poverty at the same time. Reasons for falling into poverty were attributed towards droughts, ill health & high healthcare costs, high-interest private debt and social & customary expenses (Krishna, 2006).

Although the table gives us an understanding of the speed or duration at which vulnerabilities are in effect due to the disasters or shocks faced by exposed households, there seems to be a gap in literature with respect to temporal references. Few available data sources take into account the fact that risks are sometimes interlinked (e.g., floods resulting in disease outbreaks) or dependent across time i.e., when shocks lead to nutritional deficiencies which further result in reduction in quality of health outcomes. However, the cumulative consequences for these events and mechanisms are not clearly understood (Hoddinott & Quisumbing, 2010). Füssel, (2007) provided a conceptual framework of vulnerabilities for climate change which included four dimensions: characteristics of the vulnerable system, type and number of stresses and root causes, effects on the system, and time horizon of the assessment. However, when examples were considered, he found that the temporal references were not specified. Also, the term 'dynamic' is often used for vulnerability concepts which refer to present in addition to future thereby providing ambiguous results during assessment.

On a positive note, studies have shown the successful implementation of the SLA within the context of vulnerable populations like India. In Odisha, the Western Odisha Rural

Livelihoods Project (WORLP) saw the partnership between communities and government staff, engaged in participatory processes with the full engagement of low-income residents. This helped to build trust and positive relationships, identifying the needs and grievances of those most vulnerable to negative events. The approach had created an enabling environment, empowering and informing people, allowing them to make informed choices for their long-term well-being. As a result, in areas where WORLP was implemented, the incidence of poverty reduced by 30% i.e., approximately 15,000 households or 72,000 people have moved above the government's defined poverty line. Much of this was found to be attributed towards higher levels of financial, human, natural, and social assets brought in under the project, which had built resilience, and improved adaptability to climate change (Patnaik & Prasad, 2014). After having looked through the various approaches in understanding vulnerability and ways to measure them and the state of the art in the literature, we next summarize the gaps and learnings highlighted here, and discuss briefly how E-QLT aims to incorporate the same.

3.4 Why do we need a Social Protection Score?

From the discussion in the previous section the drawback to the current approaches and learnings are listed below. These needs to be improved to enable policymakers and CSOs to understand and measure vulnerability better. This will enable to take stock of how the current social protection measures fare and could lead to design of responsive and adaptive social protection measures.

- Vulnerabilities are dynamic, while the current approaches are not responsive enough.
    - The approach needs to address both temporal and contextual nature of vulnerabilities while accounting for both endogenous and exogenous factors that affect households.
- Current social protection measures and approaches are inadequate
    - Shocks are often non-uniform, with different intensity (low, high), frequency and effects (long-term and short-term).

- o Responses range from avoiding, building resilience, mitigating effects to post-shock rebuilding.
- Approaches that measure multi-dimensional poverty , doesn't look at interconnectedness of various dimensions.
- The role of various processes and institutions are not contextualised in terms of resilience for the community despite their influence on directionality and rate of change.
  - o Effects of schemes and programs as a measure of the improvement of wellbeing or reduction of vulnerability of a household is not currently measured.
- Indicators like poverty line, MDPI, etc. are often used at the aggregated level, even when used at micro level, it provides limited scope to help with actions at the micro-level.

To address the above challenges and to make social protection measure actionable we propose a simulation based approach using the tool E-QLT which computes Social Protection Score at the household level. The simulation tool allows for understanding how social protection measures by different stakeholder contribute towards reduction of vulnerability. The methodology employed is discussed in the next section.

4.Methodology

In this section we describe the methodology employed in the E-QLT simulation model. To overcome the drawbacks of current approaches of vulnerability assessment highlighted in the previous sections, we adopt a micro modelling approach where we build the simulation of the household to better understand how the households manage their expenses and how various choices made in terms of managing the expense and it effect on different aspects like health, education, living standard, etc and how it impacts household's vulnerability. To better understand the results from this simulation and to quantify vulnerability we have developed an index called the Social Protection Score. The SPS ranges from 0-300; 300 points denoting the point where households start becoming vulnerable, and 0 point denoting critical vulnerability. The score is computed by taking the output from the simulation runs for each of the households. For modelling, as previously discussed the Sustainable Livelihood Approach provides insights into how we can model different capitals at the household level, and how the household uses it to come with coping strategies to mitigate their vulnerability. The

capitals modelled in the simulation presently are Physical, Financial and Human capital The E-QLT simulation uses a system dynamic simulation model that simulates at the household level on how the household manages their income and expenditure and computes its short-term and long-term impact on finance, education and health aspects.
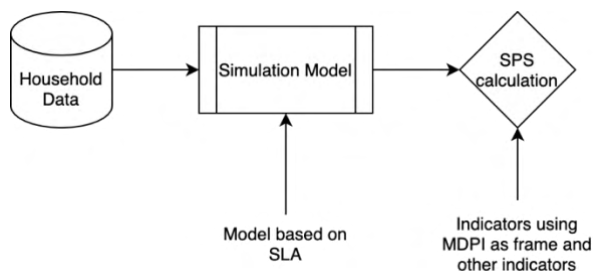
Figure 1. Conceptual Model of E-QLT

For the Social Protection Score, in the present study we build upon the three categories of deprivations which are part of the Multi-Dimensional Poverty Index, namely Health, Education and Living standards. This link to the Human, Physical and Financial capitals described before. We also refer to other indices within each of the broader category that make up the dimensions of the SPS. The model, the SPS calculation methodology and the process for selection of household is described in subsequent sections.

Figure 2. The Sustainable Livelihood Approach (Serrat, 2017)

Figure 3. Global Multidimensional Poverty Index (OPHI, 2022)

4.1 Model development

E-QLT uses a system dynamic modelling approach to model the dynamics of a household. In the present study we have run E-QLT at a monthly time step owing to available granularity of data. E-QLT allows us to model daily transactions and different copi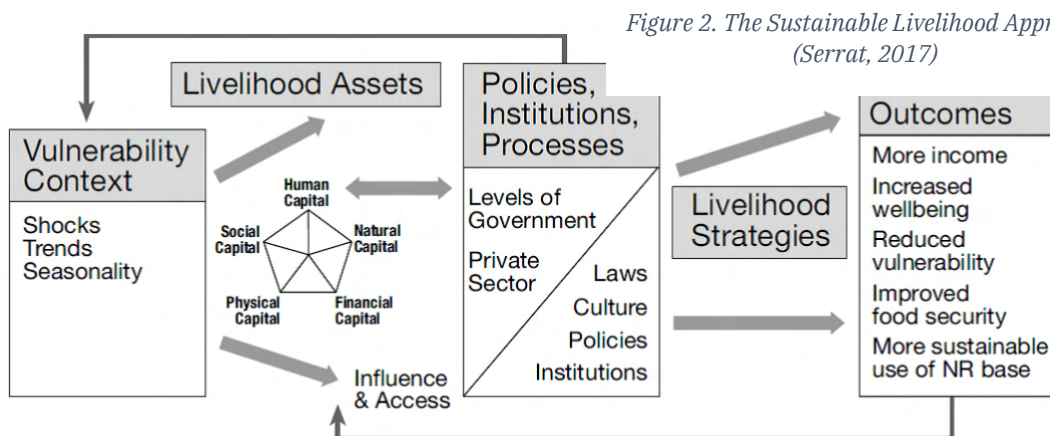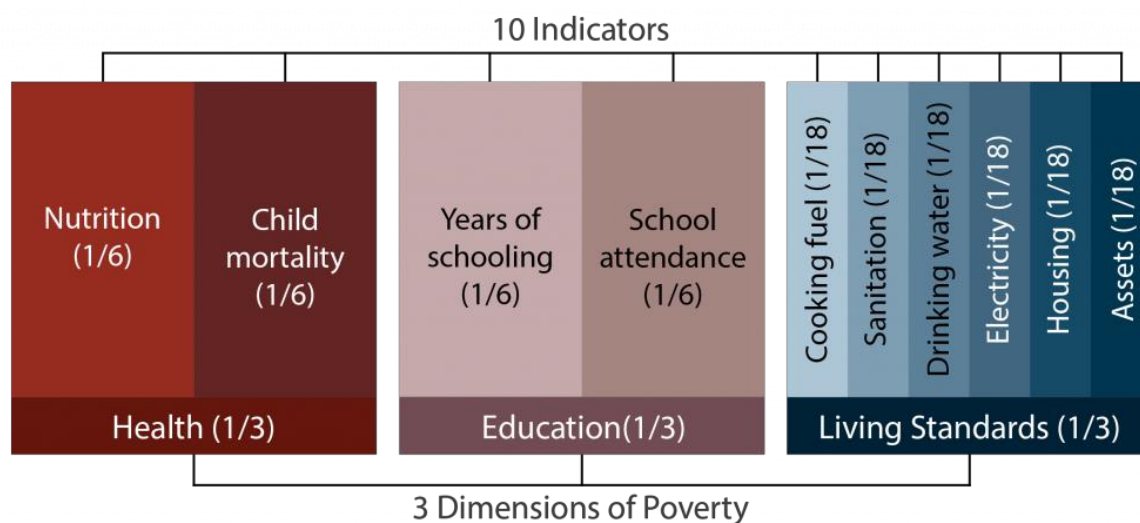ng strategies the household adopts. The household utilizes one of the three categories of assets namely physical, financial and human towards devising different coping strategies. This allows us to understand both the short-term and long-term effect through dimensions of finance, education and health. Based on the current date, in case of a shock or during inability to meet the various expenses, the households could take one of the four strategies, or a combination of them.

- Utilization of savings
- Borrow from formal/informal lenders
- Cut back on different expenditures
- Liquidate certain physical assets (e.g. sell house, or motor vehicle)

The tool allows us to explore the outcomes of employing these different strategies for different households. In case of utilization of savings, the household's ability to deal with future expense related uncertainty or shocks diminishes. In cases where the household borrows, based on the type of debt (formal/informal), there would be additional expenditure and debt burden on the household, and whether the debt gets repaid would depend on the available income. In the case where the household decides to cut back on certain expenditures, the household allocates expenditure towards different expenditure heads based on the priorities of the household. These priorities could be either static or dynamic (linked to disaster, or drop in a certain level of income). The impact of different allocations is measured both for short term and long term across the three dimensions of social protection. In the final case of liquidation of assets, the overall financial capital of the household decreases, and there could be secondary effects, for. e.g. in case of selling of a house owned by the family, there would be an increase in monthly expenditure in the form of rent being paid.

The model has different sub-models namely finance, nutrition, education and health. The sub-model of finance relates to the physical and financial capital under the SLA, while the nutrition, education and health sub-models relate to the human capital. Each of the sub-model are described next.

Finance sub-model

The finance sub-model is shown in Figure.4. In this sub-model, we model how the household manages their income and expenditure. Based on the number of members in the household, each member's income is added to the income

quantum variable, which gets aggregated at the income inflow. The expenditure outflow is aggregation of 15 expenditure heads which the household makes based on the priorities collected. The expenditure demand is based on the collected data for the households. The expenditure is split into expenditure demand and expenditure met. The demand is based on the actual household needs. The expenditure met is allocated based on the priority budget, which captures household priority towards different expenditure heads.

Expenditure Demand and Expenditure Met
The various expenditure demand of the household are listed under the financial parameters later in this section. For food expenditure demand, the model computes the daily nutritional requirement for each member of the household based on their age, gender and the pregnancy and lactation status based on the dietary recommendation by National Institute of Nutrition, (2011). The nutritional requirement for each member is computed along the following food groups:

- Cereals and millets
- Pulses/meat
- Milk
- Roots
- Leafy vegetables
- Other vegetables
- Fruits
- Sugar
- Oils

The food expenditure demand for the household is computed using the following formula:

$$Food\ Expenditure\ Demand = \sum_{m=1}^{n} Nutritional\ Requirement_{fg} * Cost\ of Food_{fg}$$

fg=food group
m=member

In the situation where the expenditure is not able to be met from the income alone, following four pathways are possible.

- Utilization of savings
- Borrow from formal/informal lenders
- Cut back on different expenditures
- Liquidate certain physical assets (e.g. sell house, or motor vehicle)

For pathway 1, 2 and 4 above, the expenditure is met through either use of savings, borrowing or liquidating of physical assets. In case of pathway 2, additional expenditure demand of loan repayment is added from the next month. For pathway 3, the expenditure met is calculated using the priority that each household has for various expenditures, such that the expenditures with higher priority gets fulfilled first, followed by the next highest priority expenditure, till all of available savings and income is allocated. The allocation is implemented using Wood algorithm (Ventana Systems, n.d.).
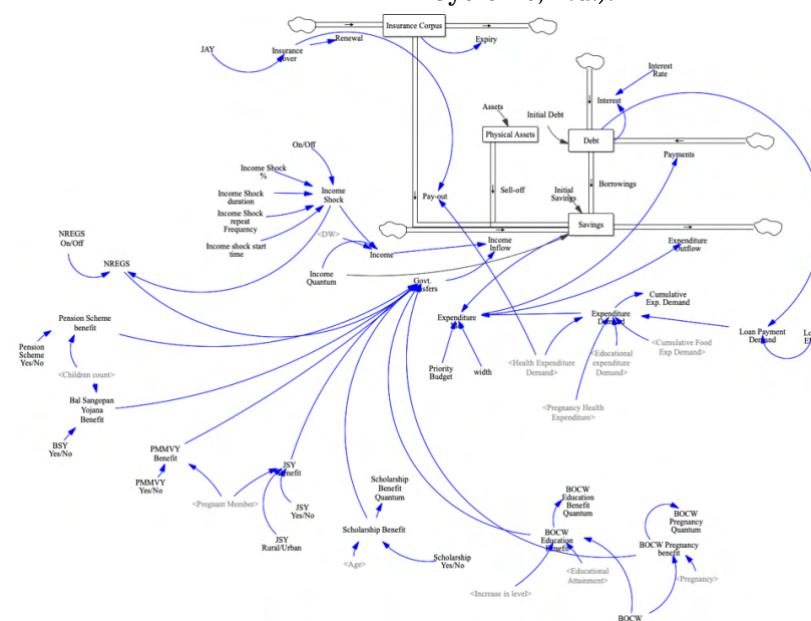

Figure 4. Finance Sub-model of E-QLT

Nutritional sub-model

The nutritional sub-model of E-QLT is shown in Figure 5 below. In this sub-model we look at nutritional (food groups) and calorie balance for each member of the household. Based on the age of each member and gender, the Nutritional Requirement (NRS) is calculated based on the guidelines of National Institute of Nutrition. The cost of food is average unit cost for various food groups, in the previous section, we have shown how the food expenditure demand is calculated based on the nutritional requirement and cost of food.

Nutritional and Calorie deficit

Once the various expenditures are allocated based on available income and savings, the food expenditure met, is then distributed towards different members nutritional needs. The distribution follows priority-based allocation similar to the expenditure. Here priority for members and priority for food groups determine the allocation. The priority for members allows for possibility for households to prioritize different members either based on gender, age or other aspects.

Similarly, the priority for food groups allow for prioritization of different food groups either based on cost, or food preference. In the present study the priority for both member and food group is kept constant, i.e. all members

and all food groups are equally prioritized. Based on the allocation, in case food expenditure met is lower than food expenditure demand, there will be cutting back on each of the food groups for each member, leading to deficit in intake. In the model we measure both the nutritional deficit and the calorie deficit. The nutritional need and nutritional intake is converted to calorie need and calorie intake by using the average calorie content of each of the food group. The deficit is calculated as a difference between need and intake.

Education and Health sub-model

The educational sub-model is shown in Figure 6.

Educational Attainment

For educational expenditure demand the school fees for each of the school going members (ward) is derived from the primary survey. Based on Educational expenditure met, each of the ward is able to continue education while the education expenditure met is equal to education expenditure demand. In case the educational expenditure met is lower, the education attainment get proportionally affected to the ratio of educational expenditure met and educational expenditure demand.
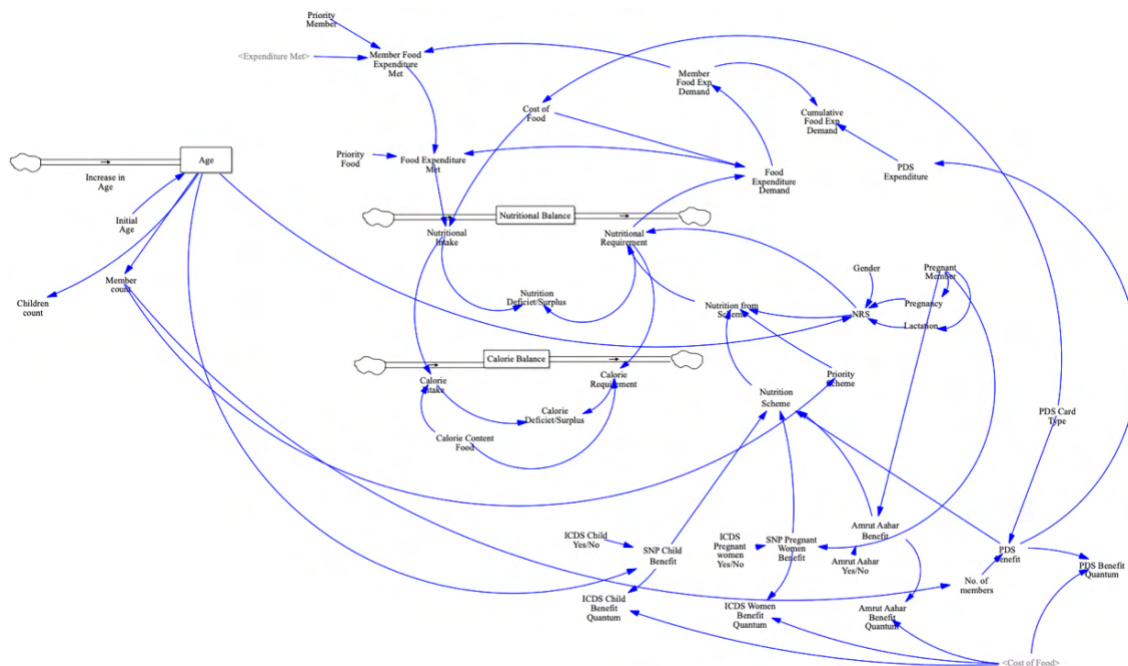

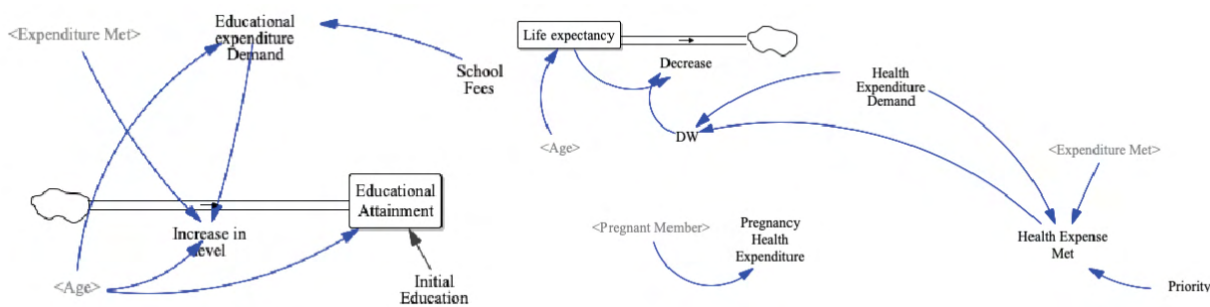*Figure 5. Nutrition sub-model of E-QLT*

Figure 6. Education and Heath sub-model of E-QLT

Life Expectancy

Each household member's age is derived from the primary survey. The life expectancy of 82 years at birth is considered standard in this study for both genders. The remaining life expectancy is then calculated by subtracting the standard with the age. The model makes use of disability weights to account for loss of healthy life due to various diseases and death (Global Burden of Disease Collaborative Network, 2020). For this study no disease-based disability weight is added. We instead look at whether the household is able to adequately spend on the various health expenditures. In case the health expenditure demand met is lesser than health expenditure demand, then a disability weight is added proportional to the ratio of health expenditure demand met and health expenditure demand.

4.2 Scenarios

For the scenarios as part of the study we look at the scheme contribution towards social protection and the effect of income shock, the logic used in the model for it is explained below.

Scheme contribution

The various schemes by the government at different levels can be categorized to providing benefits in the following three categories:

- Cash Transfer to the households: Here a sum of money is transferred to the households at different time intervals.
- Transfer of food items and cooked food: Here either food items like rice, wheat, sugar, etc. are provided for free or at a concessional rate to households, or the household members can access cooked

food for free at different centres designated by the government.

- Insurance based support: Here the households are insured for health up to a certain limit, and can claim it during the health shock they face.

The cash transfer schemes are modelled as government transfers towards income inflow. For the transfer of food items and cooked food, the inputs are added to nutritional support from schemes, which is used to calculate the remaining nutritional requirement for each person after the inputs from the schemes. For insurance, there is an insurance corpus modelled, the pay-out from which happens in case of an health shock (high health expenditure). Following schemes are modelled in the current version of E-QLT. Brief description of each of the schemes is provided below:

Cash Transfer to the household

- Income support
  - National Pension Scheme
  - National Rural Employment Guarantee Scheme[7]

- Pregnancy related
  - Pradhan Mantri Matru Vandana Yojana
  - Jnani Suraksha Yojana

- Support towards education
  - Scholarship

- For specific vulnerable groups
  - Building and Construction Worker schemes (Education

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[7] The employment guarantee scheme in this report is considered only during a shock as a way to tide over unemployment

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and Pregnancy related schemes)
- o Bal Sangopan Yojana

- ▪ For Child
- ▪ For Pregnant women
- ▪ Amrut Aahar Program

Transfer of food item or cooked food
- Nutritional support
  - o National Food Security Program
  - o Supplementary Nutrition Program

Insurance based support
- Support towards healthcare
  - o Pradhan Mantri Jan Arogya Yojana
  - o Mahatma Phule Jan Arogya Yojana

Scheme Name	Description
Pension Scheme	5 different schemes are part of it each targeting a different vulnerable group, for. e.g., widow, poor, etc. The eligible houses get a monthly pension of INR 1000-1200, depending on the number of children in the household.
National Rural Employment Guarantee Scheme	This scheme provides up to 100 days of work in rural areas. In the present model, the household who avail NREGS, make use of the scheme during the income shock period and can avail up to 30 days of work at wage rate of INR 250/day (average wage rate under NREGS in Maharashtra)
Pradhan Mantri Matru Vandana Yojana	A one-time conditional cash transfer of INR 5000 in three installments for pregnant women
Jnani Suraksha Yojana	For promotion of institutional delivery, a sum of INR 600 and INR 700 for urban and rural areas respectively.
Scholarship	There are different kinds of scholarships that the households are eligible for. Based on the primary survey, on average eligible houses get INR 300/month towards educational expenses, and the same has been used as input to the model.
Building and Construction Worker schemes (Education and Pregnancy related schemes)	• Two schemes under the BOCW list of schemes are considered at the moment. • Education: Under education the households get INR 2500-10000/year/student based on the educational attainment. • Pregnancy: For pregnant women, the eligible household gets an INR 15000 for expenses towards delivery.
Bal Sangopan Yojana	A grant of INR 1100 per month for orphaned children is provided.
National Food Security Program	• In case of Pradhanya Orange card, the households are eligible for 3kg/person wheat and 2kg/person rice at INR 2/kg and INR 3/kg respectively. • In case of Antyodaya card, the households are eligible for 20kg and 15kg of wheat and rice respectively at INR 2/kg and INR 3/kg. The household can also avail sugar at INR 20/kg.
Supplementary Nutrition Program (Part of ICDS) For Child For Pregnant women	These schemes provide one-time cooked meals for children up to 6years of age and for pregnant and lactating mothers. The average nutritional content provided in the meals are used in the model.
Amrut Aahar Program	This scheme is designed specifically for tribal areas to provide one-time cooked meals for pregnant and lactating women. The average nutritional content provided in the meals are used in the model.
Pradhan Mantri Jan Arogya Yojana	This scheme provides eligible households a health insurance cover of INR 5 lakhs/year.
Mahatma Phule Jan Arogya Yojana	This scheme provides eligible households a health insurance cover of INR 1.5 lakhs/year.

Table 4. Description of Central and State government schemes designed for social protection

4.3 Income Shock

To understand the effects of shock, income shocks are presently modelled for E-QLT. Income shock has three parameters:
- Intensity of income shock
- Duration of income shock
- Repeat frequency of income shock

For the scenario of income shock, we look at proneness to climate induced disasters and its impact on income. Among the regions in this study

Kagal and Chikhaldara are more prone to droughts while Panvel is more prone to flooding. The range of impact on income varies based on the intensity of these hazards. For comparability across the regions, in this study we assume the impact of the respective hazard to be 50% drop in income starting at 5th month, and having a duration of 2 months, and a repeat frequency of 2 years.

The various parameters in the E-QLT model are categorized as below.

- **Demographic parameters:**
  - Age of members of household
  - Gender of members of household
  - Caste (used for grouping of households for analysis)
  - Religion (used for grouping of households for analysis)
- Financial Parameters
  - Type of work of members of household
- Income of members
- Various Expenditures
  - Nutrition
    - Groceries
    - Cooked food
  - Health
  - Education
  - Housing
  - Transport
  - Utilities
    - Electricity
    - Water
    - Sanitation
    - Waste Collection
    - Cooking fuel
  - Communication
    - Internet
  - Towards debt
  - Others
  - Savings
  - Physical Assets
  - Debts
  - Household priorities for different budget heads
- Nutritional Parameters
  - Daily nutritional requirement based on age, gender, activity
  - Daily nutritional intake
  - Cost of various food items
  - Calorie requirement and Intake
  - Household priorities for different food groups
- Eductional Parameters
  - Type of school
  - Access to school
  - Cost of education based on type of school, access and standard.
- Health related parameters
  - Diseases and/or disabilities affecting members of household
  - Duration of disease/disability
  - Cost for treatment
  - Disability weights
- Policy related parameters (Household scheme access and benefits)
  - Income support
  - National Pension Scheme
  - National Rural Employment Guarantee Scheme
- Pregnancy related
  - Pradhan Mantri Matru Vandana Yojana
  - Janani Suraksha Yojana
- Nutritional support
  - National Food Security Program
  - Supplementary Nutrition Program
    - For Child
    - For Pregnant women
    - Amrut Aahar Program
- Support towards education
  - Scholarship
- Support towards healthcare

- o Pradhan Mantri Jan Arogya
  Yojana
- o Mahatma Phule Jan Arogya
  Yojana
- For specific vulnerable groups
  - o Building and Construction
    Worker schemes
  - o Bal Sangopan Yojana
- Income Shock
  - o Intensity of income shock
  - o Duration of income shock
  - o Frequency of income shock

4.4 Development of the SPS scorecard

To understand household vulnerability and social protection cover of the households, we develop a concept of Social Protection Score (SPS). The SPS is a number ranging between 0-300. The 300 point is defined as a vulnerability point and a score of 0 is defined as critical vulnerability, i.e. at SPS of 300 the households are not vulnerable, below it they start becoming vulnerable, and at a score of 0 they are critically vulnerable. The SPS has three dimensions:

- Finance
- Education
- Health

These dimensions roughly correspond to the Living standards, Education and Health indicators respectively which are part of MDPI, while the sub indicators under each of the dimensions are derived from different sources which are described in coming sections. Each of the dimension is equally weighted, and contributes 100 points towards the overall score. The scores for each of the dimensions are derived by running the model for the period of 10 years, and SPS being calculated at each month. The results from the finance sub-model is used to compute the Finance SPS, while the results from education sub-model is used to compute Education SPS, and finally the results from the nutrition and health sub-model is used to compute the Health SPS. This helps understand the temporality of vulnerability along with its intensity. The vulnerability point and critical vulnerability point for each of the dimensions is 100 and 0. The SPS values are computed for each month, and currently the simulation runs for 10 years. The final SPS number is average of the SPS values for each month over the period of 10 years. The average SPS allows for a quick overview of vulnerability of the household, while the monthly SPS helps

better understand the temporal changes in the vulnerability.

$$SPS = SPS_{Finance} + SPS_{Education} + SPS_{Health}$$

The three dimensions of SPS are defined as follows:

Finance

To understand the financial situation of the household, SPS finance looks into whether the household has a debt or not, and in case there is debt, how long does it take to repay the debt. The SPS Finance is calculated for each month using the following formula:

$$SPS_{Finance} = \frac{(\text{Debt Duration(Std)}) + (\text{Debt Duration (Std.)} - \text{Debt Duration(Current)})}{(\text{Debt Duration (Std.)})}$$

The Debt duration (Standard) is defined as 20 years presently, as anything beyond 20 years could lead to intergenerational debt. The SPS finance arrived is multiplied by 100. A value of zero or lower indicates more than 20 years to repay the debt, while value of 100 implies no debt on the household. The Debt duration(Current) is calculated by calculating the slope of the debt curve in the model.

Education

To understand the vulnerability stemming from educational dimension, we developed SPS education, which looks at the educational attainment of the children. The SPS Education is calculated for each month based on following formula.

$$SPS_{Finance} = \frac{(\text{Edu. Attainment (Expected)}) + (\text{Edu. Attainment (Expected)} - \text{Edu. Attainment(Current)})}{(\text{Edu. Attainment (Expected)})}$$

Based on the age of the child, the educational attainment expected looks at the age specific educational attainment, for e.g. by 18 years of age the child should have completed 12 years of schooling. In case the household is not able to spend on education, the educational attainment gets affected, and leads to reduction of SPS education score.

Health

In the current version two aspects of health are covered, Nutritional and Physiological. For nutritional aspect, each person in the household is assumed to have BMI in normal

ranges, for children age specific height and weight are used to compute expected BMI. It is assumed that a deficit of 500 calories per day for a week would lead to a weight loss of 1 kg. The calorie deficit computed in the model for each person is then used to compute the changes in SPS Health (Nutritional) as per the formula below:

$$SPS_{Health-N} = \frac{(\text{BMI(Expected)} + (\text{BMI (Expected)} - \text{BMI(Current)})}{\text{BMI (Expected)}}$$

For the physiological aspect of health, each person is assumed to have a life expectancy of 82 years at birth. Based on the age of the household members, this is used to compute the Life Expectancy values expected at each age. If a person is suffering from sickness, the disability weights corresponding to the disease is used to deduct from the life expectancy of the person for the duration of the disease and is computed as Life Expectancy (Current) in the model. The SPS Health (Physiological) is then calculated using the following formula:

$$SPS_{Health-P} = \frac{(\text{LE(Expected)} + (\text{LE (Expected)} - \text{LE(Current)})}{\text{LE (Expected)}}$$

Both component of health are weighed equally in the present version of the model. The SPS$_{Health}$ is computed using the formula below.

$$SPS_{Health} = \frac{1}{2}SPS_{Health-P} + \frac{1}{2}SPS_{Health-N}$$

SPS measurement during scenarios:
To understand the household vulnerability the SPS for each household is calculated first by switching off the contribution of various schemes. This provides us with the base SPS for the household. To measure the contribution of individual schemes towards increase in SPS, each scheme is switched on individually, and the difference in SPS score is attributed to the contribution of scheme. Finally, to understand the compound impact of different schemes acting together, all the eligible schemes are switched on for the household, and the difference in SPS is attributed towards the compound effect of the scheme. The same procedure is followed when understanding the drop in SPS due to income shock, and to measure the contribution of schemes during income shock.

4.5 Data needs

The model is designed to run at the household level at a monthly time step. The model primarily looks at:
- How much income does the household get and how it manages various expenses.
- The priorities the household have over different expenditure heads.
- The assets and liabilities the household has the increases and decreases their vulnerability
- The access to various government schemes that help in reduction of their vulnerability

In order to understand the above as part of the project primary survey was conducted with the support of Youth for Unity and Voluntary Action team. Total of 155 households were surveyed across three places, Kagal, Chikhaldara and Panvel. The regions were chosen based on composition of the place, Kagal being a representative of primarily rural households, Chikhaldara being a representative of primarily Tribal households and Panvel being a representative of primarily Urban households. The surveys were undertaken in the month of April 2022. The households were selected based on vulnerability based typology among those who accessed the Social Protection Facilitation Centres setup by YUVA. The various parameters for the primary survey is described in the next section.

While for this study we conducted a primary survey, E-QLT can link to existing databases like NSSO, CMIE, Census and others to utilize the existing data. In case the data doesn't exist, for e.g. income related data, proxies can be used to estimate the quantum. This provides ability to use and scale the use of the tool for much broader context.

Primary survey
The household primary survey was conducted using Kobo Toolbox online forms. The survey form consisted of four sections:
- Demographic details: To capture details of each household member in terms of Name, Age, Gender, Marital status, Educational attainment, Type of occupation.

- Income and Expenditure: For each member the income details with respect to quantum and periodicity of income and the variability in the same was captured. For expenditure details on expenditure towards food, health, education, travel, housing, amenities, loan repayment, etc. was captured. The household priority with respect to various expenditure heads was also captured.
- Assets and Liabilities: In this section information of assets (Physical and financial) and Liabilities (Formal and Informal) was captured.
- Government Schemes: Eligibility and access related information for various schemes (described in previous section) were asked in the form.

The form can be accessed here: https://ee.kobotoolbox.org/x/NXadUQCk.

Survey statistics

Some key statistics from the household primary survey is presented below. The household split across the three places is shown in Figure 7 below.
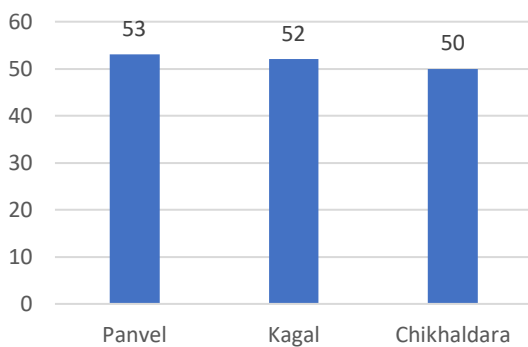

Figure 7. Household split across places

Among the 155 households, 88% identified as belonging to Hindu religion, followed by Buddhist (11%) and Muslim (4%) and Christian(1%) as can be seen in Figure 8
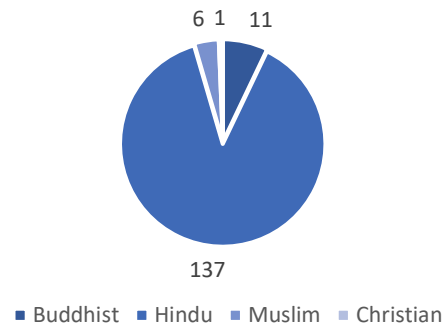

Figure 8. Religion split of the households

In terms of caste, 41% of the households were belonging to SC caste, followed by Open (19%), ST (17%), OBC (14%), NT (8%) and minority (1%), as seen in Figure 9.
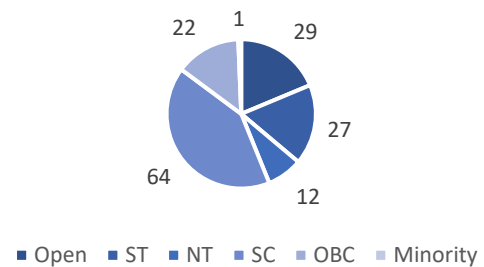

Figure 9. Caste split of Households

4.6   Limitations

For the purpose of this study certain assumptions were made in the modelling which limits the results obtained:

- Given the purpose was to demonstrate the use of the methodology, we have not assumed any inflation or changes in income over the period of 10 years.
- We collected data of household's for one time step, and then used it to extrapolate for other time steps, assuming them to be similar for each month.
- The link between the nutritional aspects and health has not been included in the model owing to lack of data to validate the link.

After having gone through the methodology and limitations, we now proceed towards going through the results of the simulation runs of E-QLT, to demonstrate a novel approach towards understanding and measuring vulnerability and to measure the contribution of various schemes.

5.Results and Discussions

In this section, we will look at the various results as part of the study. We will start by looking at the summary of income and expenditure and the household priority derived from the primary survey. This helps in setting context for the households in the three districts and the variation that exists. We will then look at the macro level trends with respect to Social Protection Score for households. This will be followed by digging deeper in terms of the SPS dimensions for each of the district, Figure 10. On average the household in Panvel, Kagal and Chikhaldara earns around INR 23506, INR 14976 and INR 10656 respectively,

followed by looking at specific impacts of different government schemes on SPS for the households. We then close this section with a scenario-based analysis where we look at compounding effect of schemes, effect of income shock on household SPS and the role of various government schemes towards mitigating the effect of income shock.

5.1 Survey Summary

The average income and expenditure of households in the three region is shown below in the

while their total expenditure is around INR 23446, INR 13679 and INR 11761 respectively.
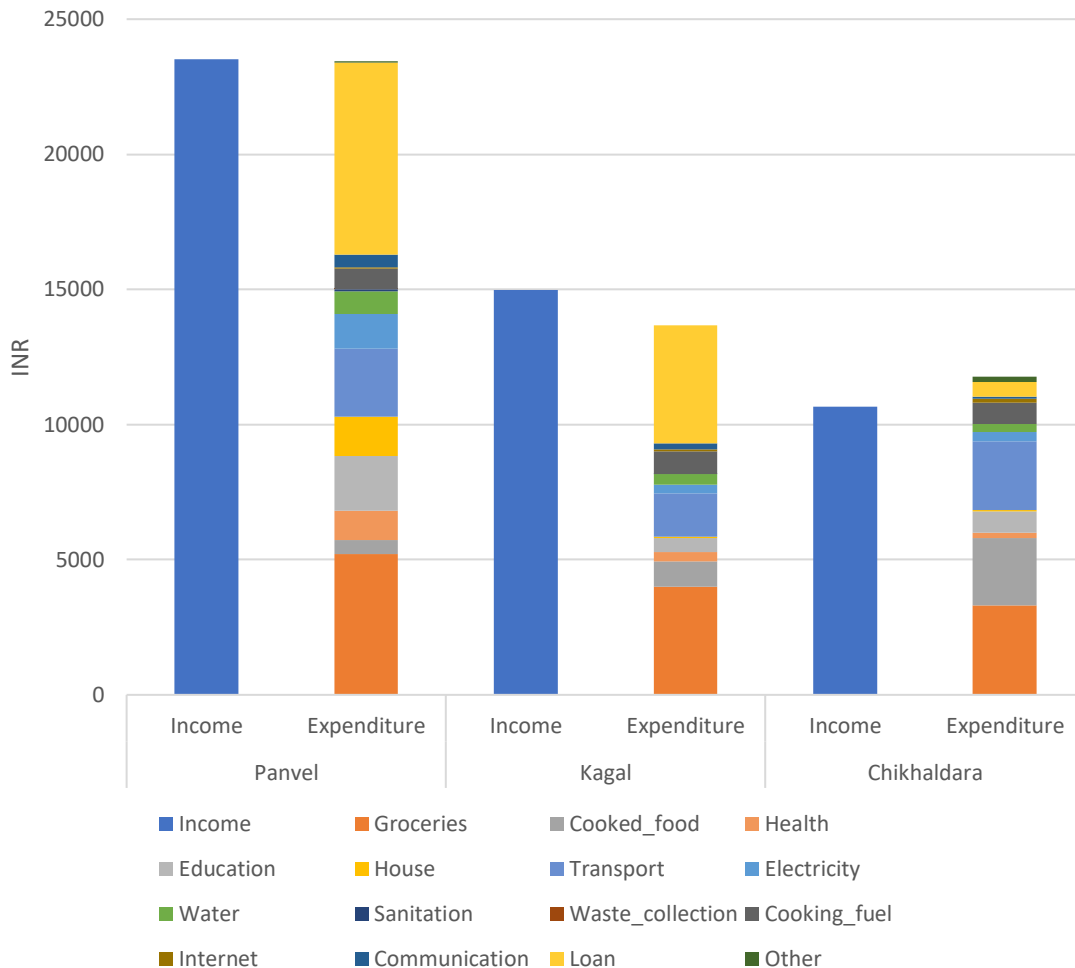

Figure 10. Income and Expenditure distribution for different households

(Unit: Percentage of Households)	Priority							
Expenditure Heads	1st	2nd	3rd	4th	5th	6th	7th	8th
Food expense	43%	34%	15%	2%	2%	0%	2%	2%
Household amenities (Electricity, water, etc.)	6%	28%	30%	25%	6%	2%	4%	0%
Housing Expenses	23%	13%	9%	17%	19%	8%	6%	6%
Healthcare expense	13%	11%	26%	23%	13%	9%	4%	0%
Travel Expense	0%	2%	4%	13%	25%	28%	25%	4%
Other expense	0%	0%	2%	0%	4%	11%	17%	66%
Loan Repayments	4%	2%	2%	8%	15%	34%	26%	9%
Education Expenses	11%	9%	11%	13%	17%	8%	17%	13%

Table 5. Household Priorities towards expenditure in Panvel

(Unit: Percentage of Households)	Priority							
Expenditure Heads	1st	2nd	3rd	4th	5th	6th	7th	8th
Food expense	25%	23%	13%	19%	6%	10%	4%	0%
Household amenities (Electricity, water, etc.)	33%	17%	15%	6%	19%	8%	2%	0%
Housing Expenses	27%	21%	10%	17%	12%	8%	6%	0%
Healthcare expense	4%	8%	21%	10%	17%	21%	19%	0%
Travel Expense	2%	0%	15%	17%	17%	15%	27%	6%
Other expense	0%	0%	0%	0%	0%	2%	4%	94%
Loan Repayments	0%	10%	4%	12%	10%	31%	35%	0%
Education Expenses	10%	21%	21%	19%	19%	6%	4%	0%

Table 6. Household Priorities towards expenditure in Kagal

(Unit: Percentage of Households)	Priority							
Expenditure Heads	1st	2nd	3rd	4th	5th	6th	7th	8th
Food expense	74%	8%	4%	2%	8%	4%	0%	0%
Household amenities (Electricity, water, etc.)	4%	30%	46%	12%	4%	4%	0%	0%
Housing Expenses	0%	8%	8%	22%	22%	12%	28%	0%
Healthcare expense	4%	40%	20%	4%	4%	10%	18%	0%
Travel Expense	4%	4%	8%	32%	20%	14%	14%	4%
Other expense	0%	0%	0%	0%	0%	2%	18%	80%

Loan Repayments	4%	2%	6%	10%	30%	26%	10%	12%
Education Expenses	10%	8%	8%	18%	12%	28%	12%	4%

Table 7. Household Priorities towards expenditure in Chikhaldara

Loan repayment occupies major share of household expenditure in Panvel and Kagal followed by the expenditure on groceries. For Chikhaldara, groceries followed by travel expenditure accounts for the major expenditure.

In terms of Household priority for various expenditure heads, the results from the surveyis shown above for Panvel, Kagal and Chikhaldara in Table 5, Table 6 and Table 7 respectively. The household priority gives indication on what expense are most likely to be reduced in case the income and savings of the household is not enough to meet the expense, i.e. the last priority expense is more like to be cut back on and the 1st priority is least likely to be cut back on. For Panvel the highest priority is towards food, housing and healthcare expense, while 35% and 30% of households prioritize last the loan repayment and education expenditure respectively. Household amenities and travel expense come somewhere in the middle in terms of priority. For Kagal, the households prioritize Household amenities most followed by housing, food and education. Healthcare, travel and loan expense and prioritized last. For Households in Chikhaldara food expense becomes the 1st priority with respect to expenditures. This is followed by healthcare, household amenities and housing. Macro level trends In this section we look at the macro level trends on how the SPS score for household change with quintile classes across the three district and across caste. This helps in comparison among districts to identify which districts has a higher share of vulnerability and how the distribution of vulnerability changes with the population.

5.2   Quintile class comparison across districts

The SPS of households for different quintile classes in Panvel, Kagal and Chikhaldara is shown below in Table 8 The households with SPS between 250-300 are categorized as marginally vulnerable, Those with SPS between 200-250 are considered moderately vulnerable and those with SPS below 200 are considered extremely vulnerable. When comparing Q1, we can see that household in Kagal is the most vulnerable, while those in Panvel and Chikhaldara have similar vulnerabilities but are still extremely vulnerable. In Q5, both in Panvel and Chikhaldara, we see the top percentile having a SPS of near 300 which makes them least vulnerable. Across quintile classes except Q2, the vulnerability of households in Kagal is more than that of Panvel of Chikhaldara. The average household SPS and the components of SPS is shown in Figure 11. The Finance SPS is least for Panvel followed by Kagal showing the vulnerability of the households in financial dimensions. In terms of Health SPS the most vulnerable are the households in Kagal and Chikhaldara. The Education SPS is comparable across the three districts. The variation of household SPS dimensions is a result of income, expenditure, demography and households priorities.

Quintiles	Panvel	Kagal	Chikhaldara
Q5	300.0	299.8	300.0
Q4	274.7	250.9	298.4
Q3	244.4	235.6	250.3
Q2	207.7	215.8	210.5
Q1	154.3	135.3	151.4

Table 8. SPS Quintiles across district
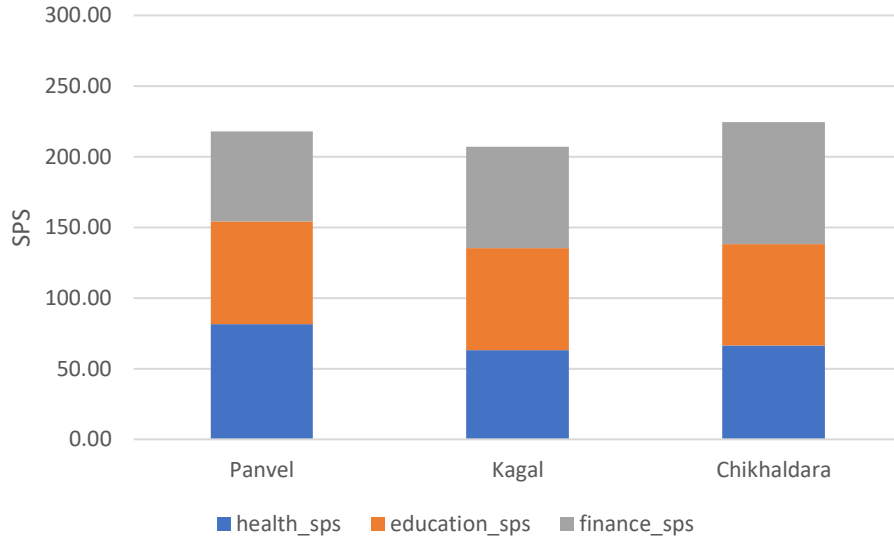
Figure 11. Average Household SPS across district

Quintiles	NT	OBC	Open	SC	ST
Q5	300.00	286.79	300.00	300.00	300.00
Q4	300.00	248.74	272.35	251.23	298.52
Q3	267.38	230.40	239.15	246.90	250.51
Q2	217.86	200.83	212.80	216.22	206.14
Q1	198.35	157.92	144.75	152.60	155.48

Table 8. SPS quintiles across caste grouping
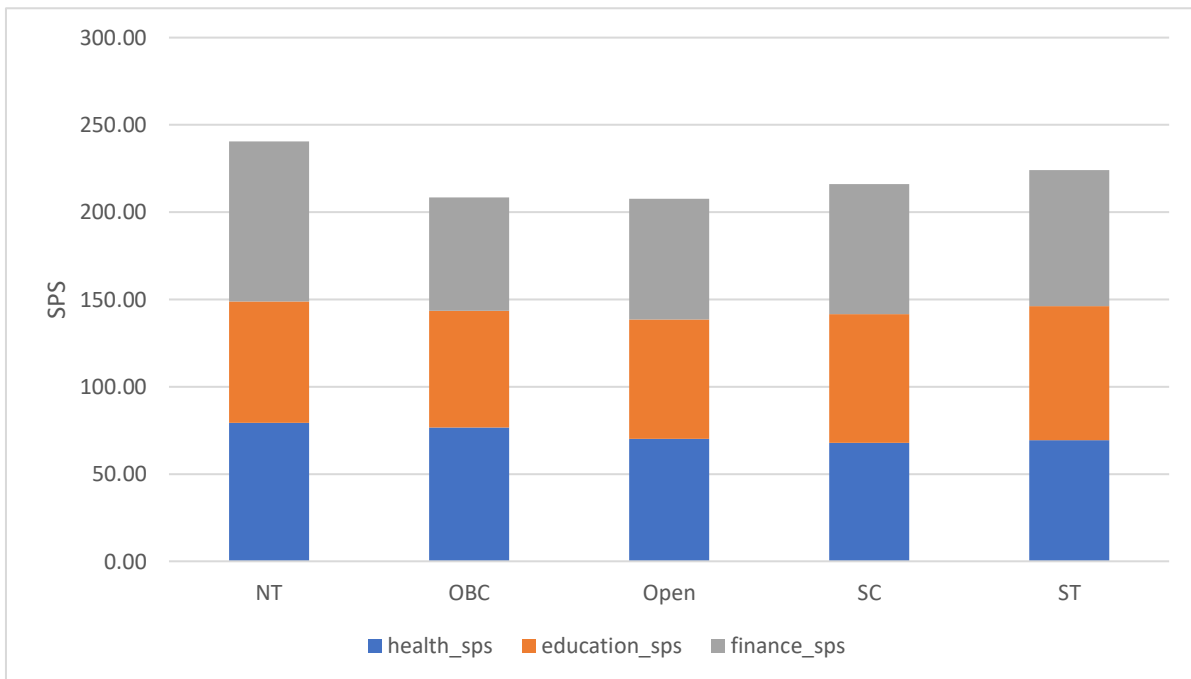
Figure 12. Average household SPS across castes

Quintile class comparison across castes

The SPS of households of different quintile classes across caste groups is shown in Table 8. Comparing Q1, the all groups have households that are extremely vulnerable, with household in NT faring a bit better. In Q2, the SPS is similar for all households across groups. Figure 12. The OBC and Open category are the most vulnerable in the present sample of households. The vulnerability stems primarily from the financial dimension followed by health and education. The caste NT fares better in terms of vulnerability while still being moderately vulnerable.

5.3 District-wise vulnerability of households

After looking at the inter- district comparison, in this section we will look into intra-district variation of vulnerability of the households.

Across quintiles OBC caste group has most vulnerable households.

The average household SPS values for different caste grouping is shown in

Panvel

In, household SPS along with the components of health, education and finance is shown for the households in Panvel. We see the substantial variation of SPS across households, with few households reaching the 300 points, which one household has a score just above 50 denoting extreme vulnerability. Finance is one of the main contributors for vulnerability of the household, followed by health.
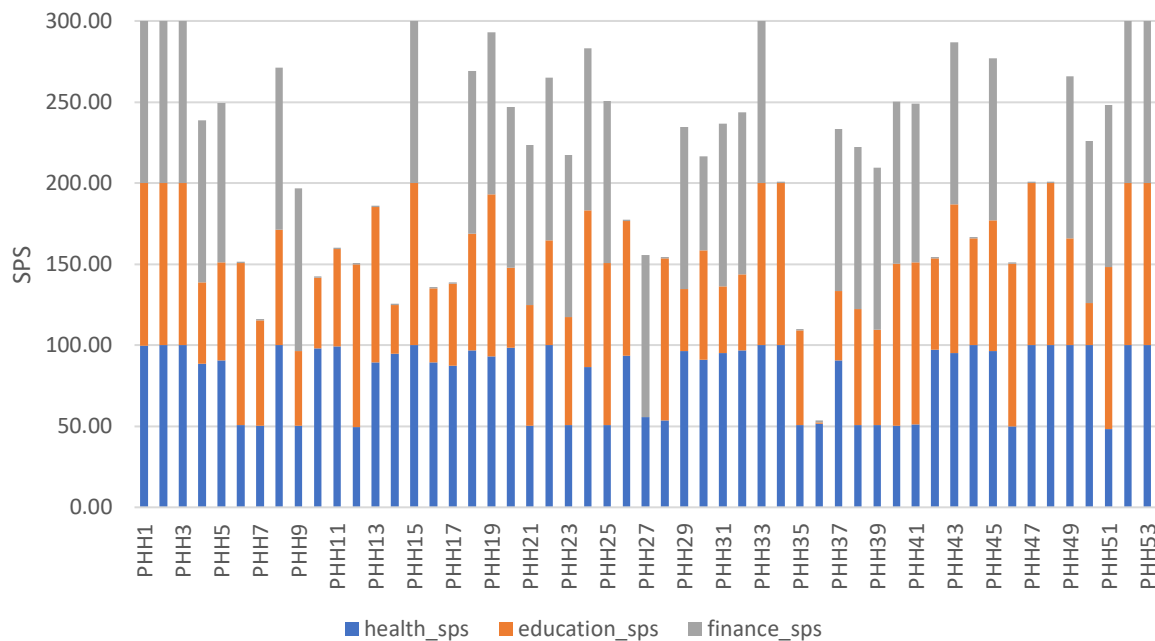

Figure 13. Household SPS for Panvel

Kagal

In

Figure 14, we see the variation of SPS across households in Kagal district. From the SPS values the overall scores is lower as compared to Panvel, with on two households reaching the score of 300. The vulnerability in the health dimension is also apparent from the figure.
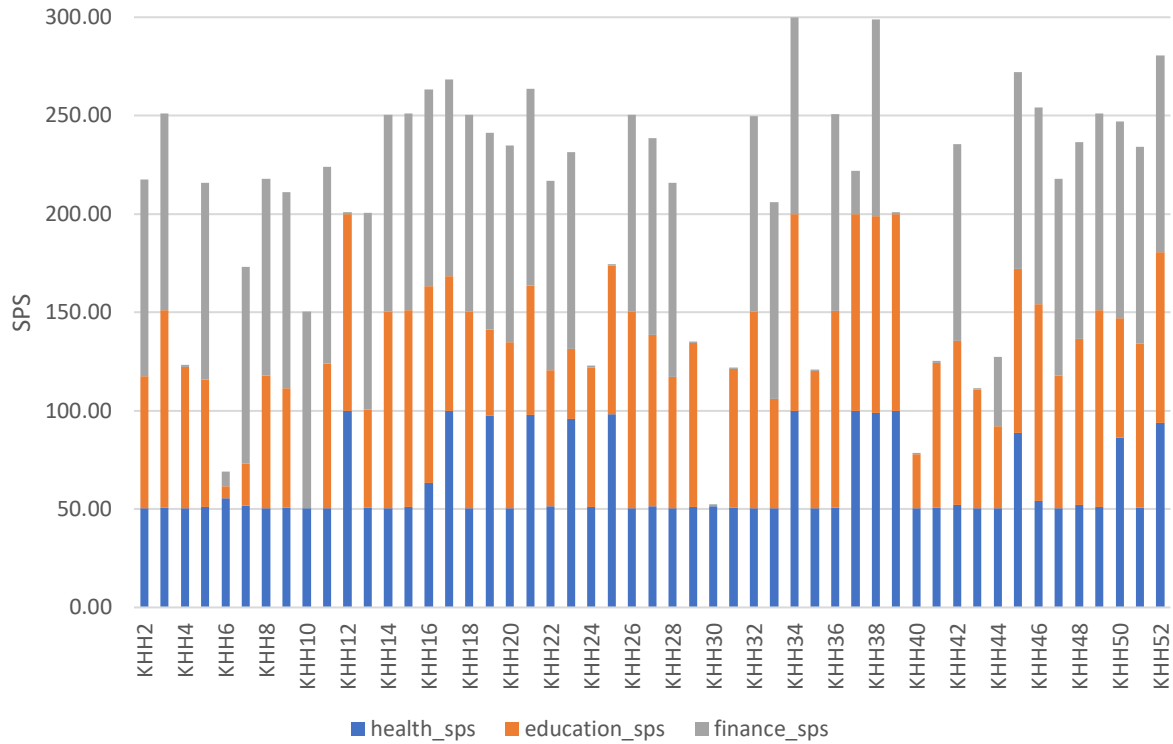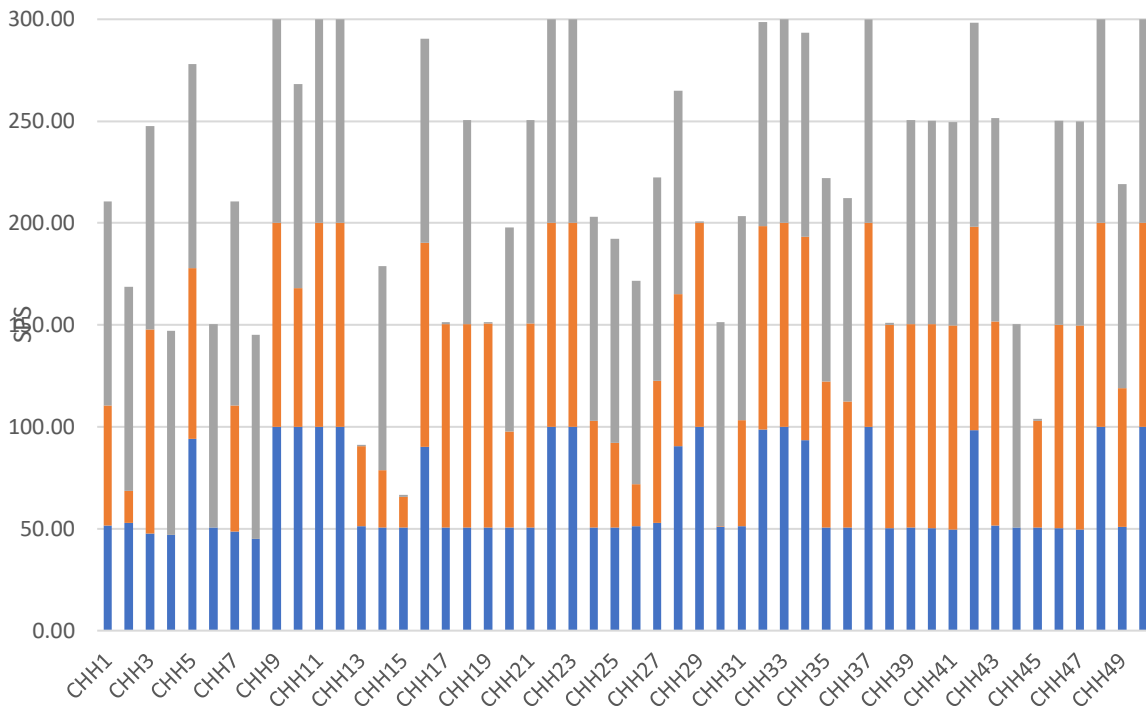

Figure 14. Household SPS for Kagal

Figure 15. Household SPS for Chikhaldara

Chikhaldara

The household SPS variation for households in Chikhaldara is shown in Figure 15. Few houses are able to have a SPS score of 300, while two households have a score of just above 50. The vulnerability in the dimension of education and health is seen.

5.4 Contribution of Schemes to SPS

Having established on how the vulnerability varies at the household level in each of the districts, in this section we see how various government schemes help improve the SPS of the households and thus help in reduction of Figure 16. While on an average the scheme helps improve the SPS by 0.94, there is differential impact of the scheme on different

vulnerability. As discussed in methodology section, to arrive at the contributions the model is now run with the specific schemes switched on, and the difference in SPS with schemes switched on and base SPS is used to calculate the contribution of specific schemes towards reduction of vulnerability of the household.

Building and Other Construction Workers (BOCW)

For the household that have a member working as construction worker and having registered with BOCW, the contribution of education and pregnancy related support is shown in households, with highest contribution seen in KHH16, where the contribution of the scheme towards SPS is 27.73.
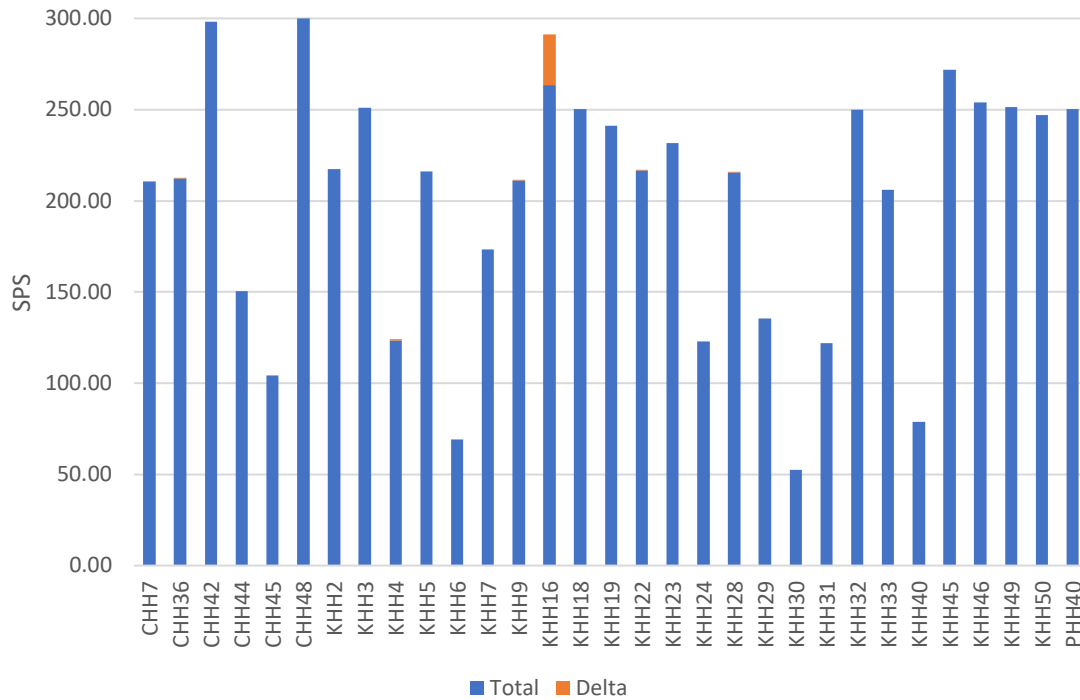
Figure 16. Contribution towards SPS of the BOCW(Education and Pregnancy) scheme

Janani Suraksha Yojana (JSY)

Only 2 households had accessed the Janani Suraksha Yojana. The average contribution of 0.02 towards reduction of vulnerability for these households as seen in Figure 17.
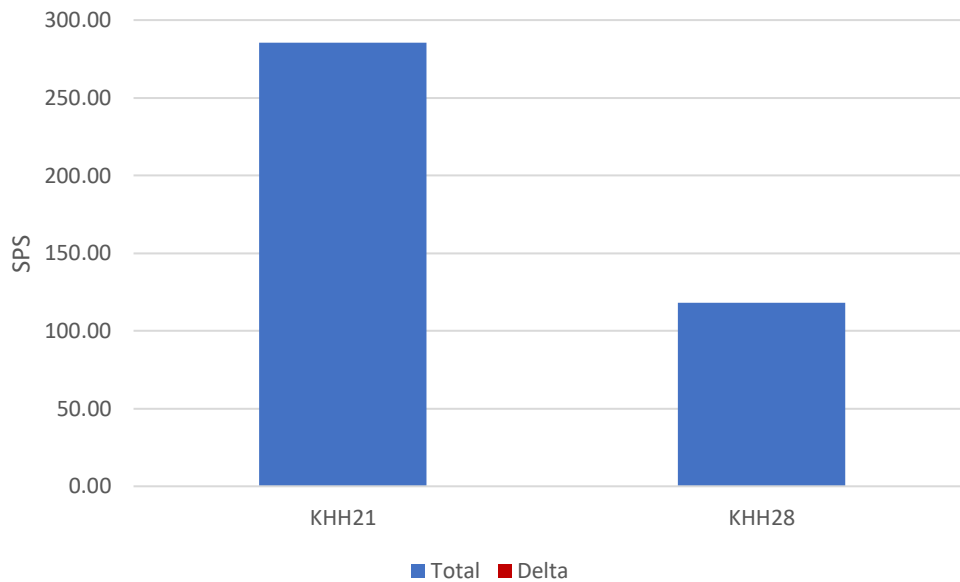

Figure 17. Contribution towards SPS of the JSY scheme

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Pension Schemes (PS)
Various pension schemes described previously provide around INR 1000 monthly to different households. The contribution of the scheme on the households that access them is on an average 5.05 points towards the household SPS. In case of household KHH15, it helps them reduce their vulnerability and increase the SPS to 300.
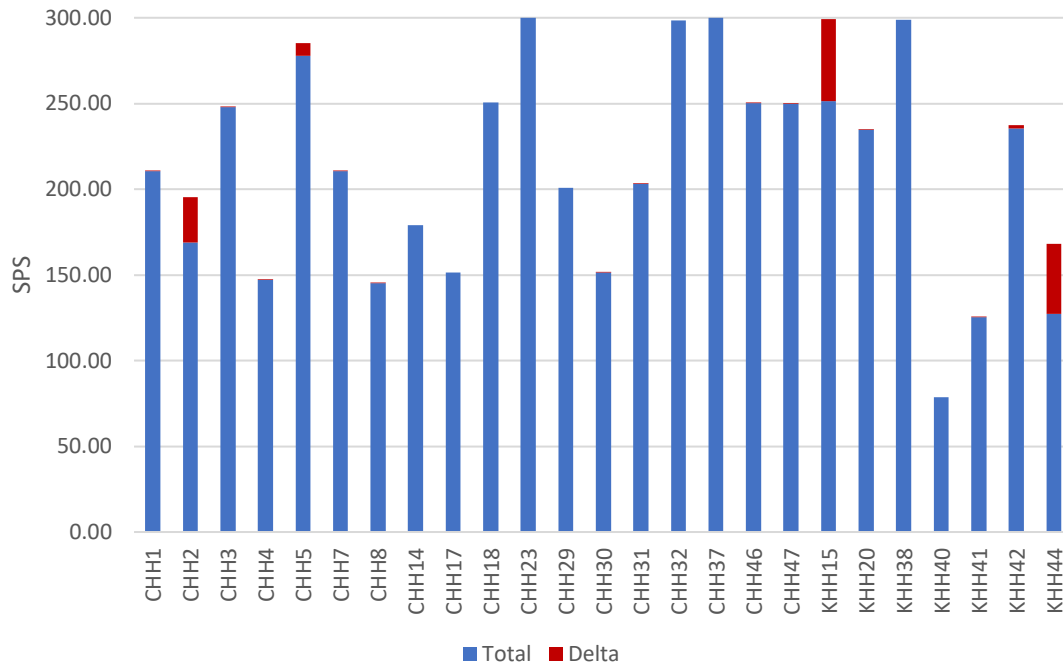

Figure 18. Contribution towards SPS of the Pension schemes

Pradhan Mantri Matri Vandana Yojana (PMMVY)

PMMVY is a cash transfer scheme to promote institutional deliveries and mitigate healthcare expenditure burden. For the households accessing the scheme, the contribution of PMMVY is on average 0.03 points.
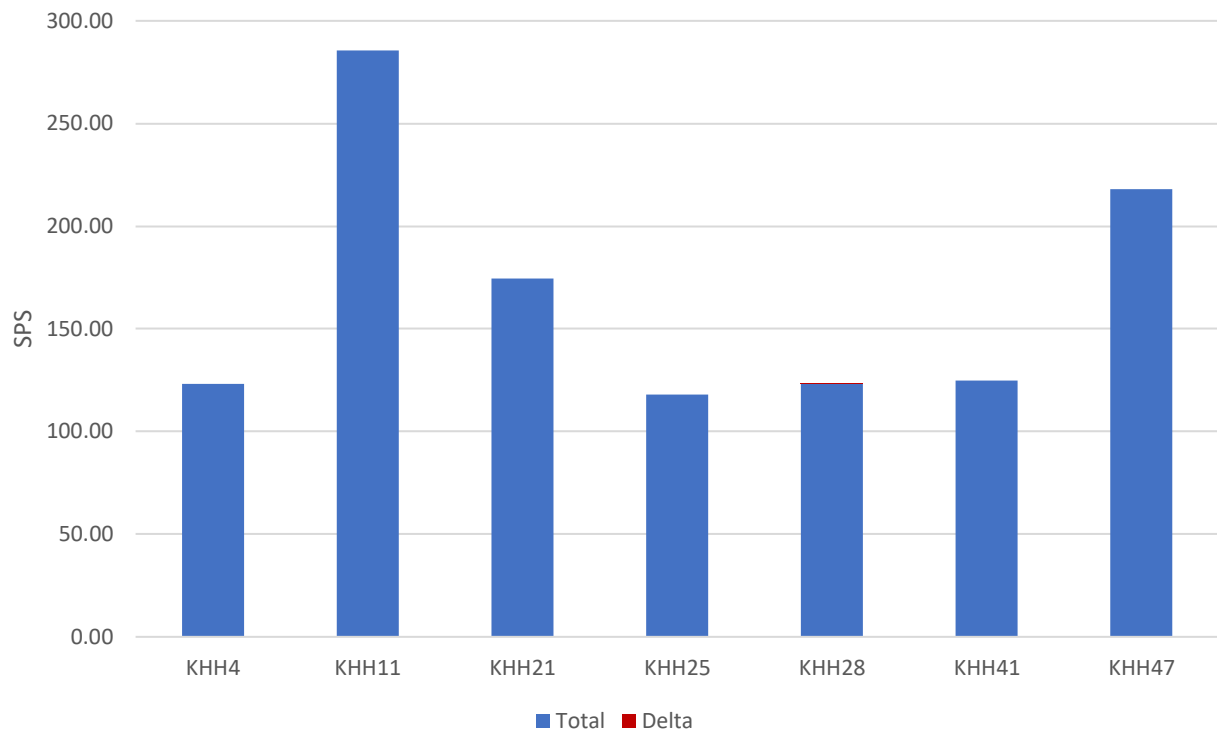

Figure 19. Contribution towards SPS of the PMMVY scheme

Public Distribution System (PDS)

The contribution of PDS on SPS of households in Panvel, Kagal and Chikhaldara is shown in Figure 20, Figure 21 and Figure 22 respectively. The average contribution of PDS is around 1.53 points towards the SPS of the household. The maximum contribution is seen for household PHH27, where PDS leads to increase of SPS by 37.85 points.
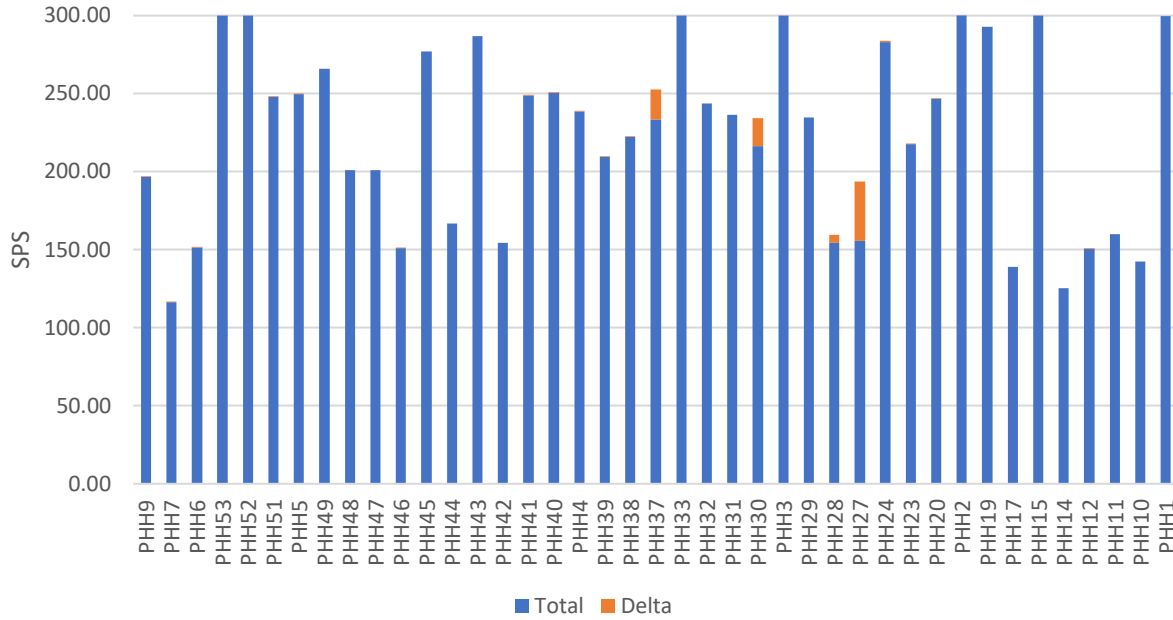

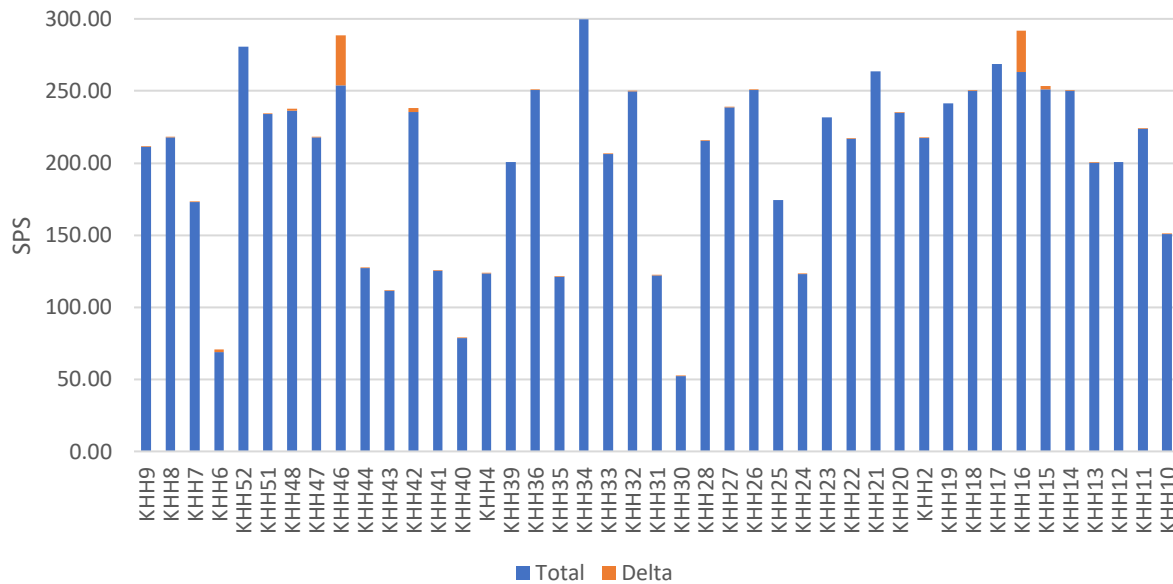*Figure 20. Contribution towards SPS of the PDS in Panvel*

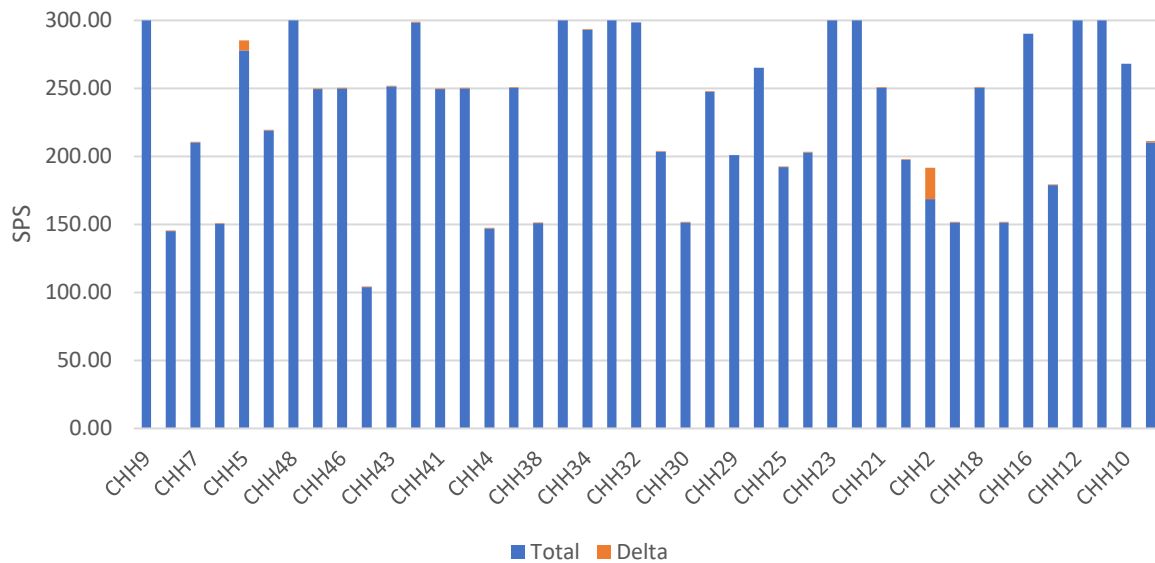*Figure 21. Contribution towards SPS of the PDS in Kagal*

Figure 22. Contribution towards SPS of the PDS in Chikhaldara

The households above has access to either of the two types of PDS cards, i.e. Antyodaya or Pradhanya Orange, Antyodaya card being meant for the poorest sub-section of the population. The comparison of their relative contribution towards SPS is shown in Table 9. Comparison of contribution of two types of PDS cards on the SPS
. The Antyodaya card showing greater impact
as compared to Pradhanya orange.

	Antyodaya	**Pradhanya Orange**
Mean	1.88	1.23
Median	0.11	0.04
Max	34.69	37.85
Size(n)	57	69

Table 9. Comparison of contribution of two types of PDS cards on the SPS

Scholarships

The contribution of scholarships on SPS is shown in Figure 23. Scholarships contribute around 0.16 points on an average towards the household SPS.
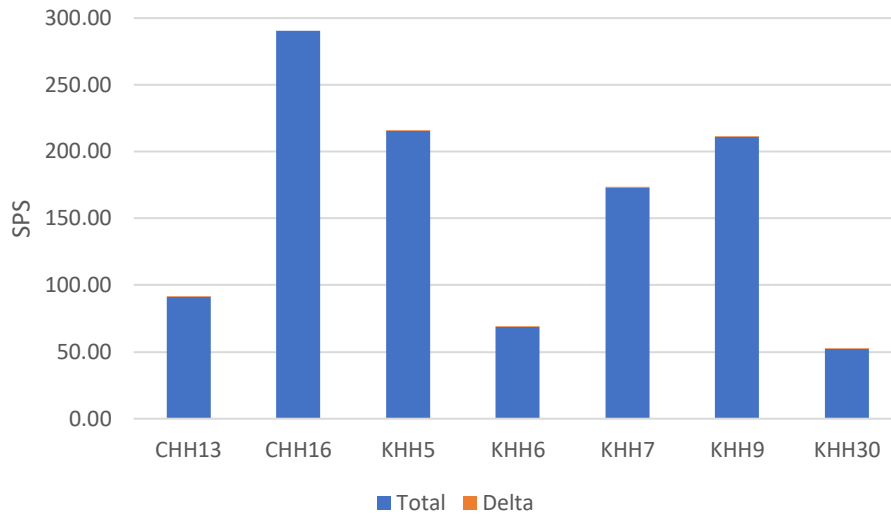

Figure 23. Contribution towards SPS of the Scholarship towards SPS

Supplemental Nutrition Food Programme for Children (ICDS – C)

The contribution of Supplemental nutrition programme under the ICDS is shown in Figure 24 for children component of the scheme. On an average ICDS-C contributes 0.68 points towards the SPS of the households.
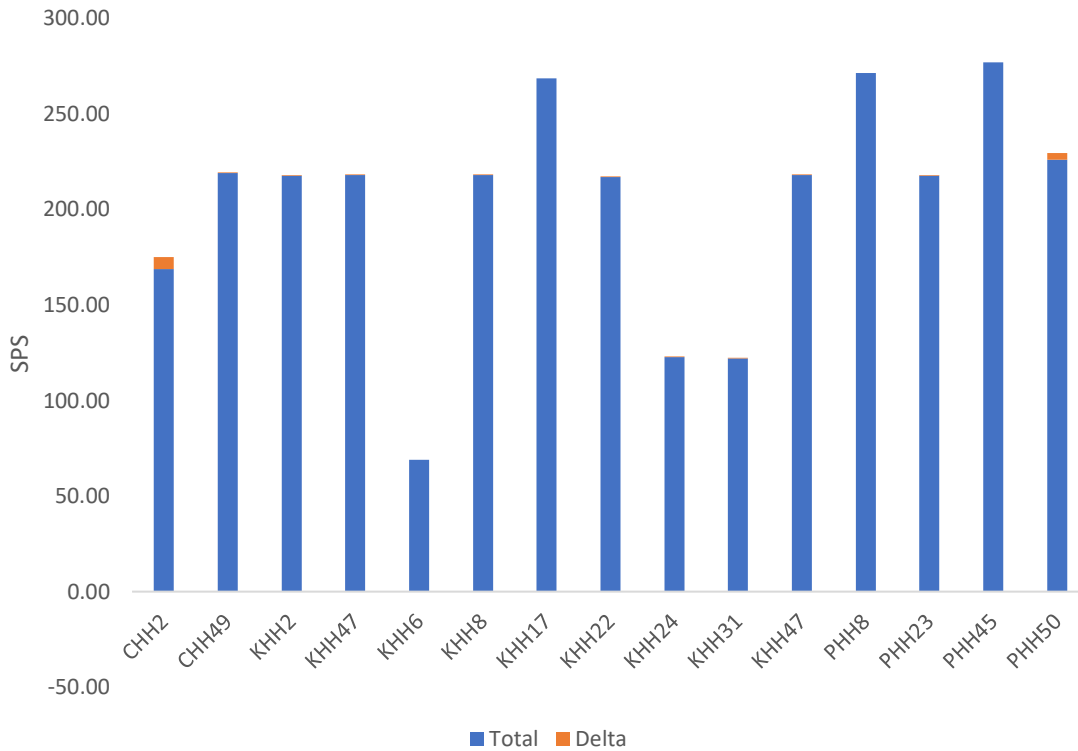

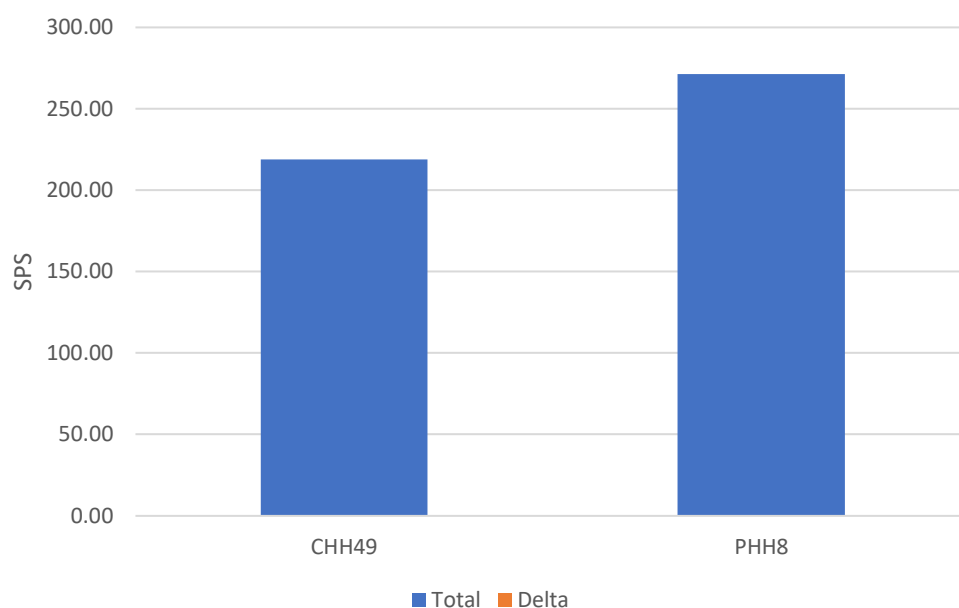*Figure 24. Contribution towards SPS of the ICDS-C*

Figure 25. Contribution towards SPS of the ICDS-P

Supplemental Nutrition Food Programme for Pregnant Women (ICDS – P)

The contribution of the supplementary nutrition programme for pregnant women is shown for the two households accessing it in Figure 25. However, for both the household the contribution of the scheme is close to zero, owing to the household priorities and socio- economic conditions. The summary of contribution of the various schemes discussed above is shown in Table 10. Among schemes acting individually Pension schemes provide a greater contribution followed by PDS. When all scheme are acting together, the net contribution is higher. The compounding effect would be further explored in the next section.

	PDS	PS	PMMVY	ICDS_P	ICDS_C	JSY	BOCW	Scholarships	All
Mean	1.53	5.04	0.03	0.00	0.68	0.02	0.94	0.16	5.68
Median	0.04	0.04	0.00	0.00	0.02	0.02	0.00	0.10	0.13
Max	37.85	47.93	0.18	0.00	6.15	0.04	27.73	0.60	72.01
Size (n)	127	25	7	2	15	2	31	7	59

Table 10. Summary of contribution of various schemes towards Household SPS
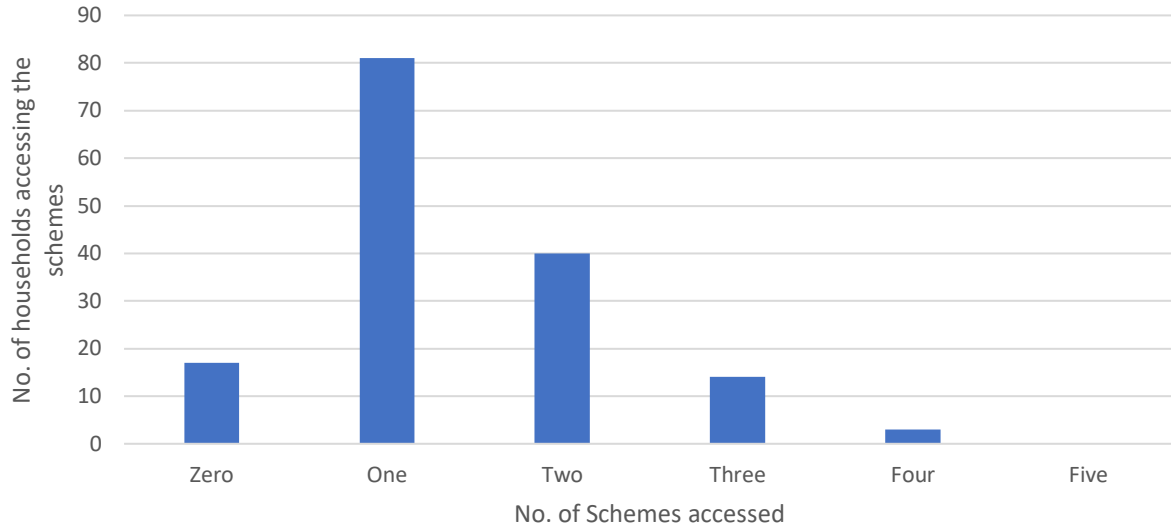
Figure 26. Number of households that access one or more schemes

Cumulative contribution of various schemes

So far, we saw the schemes impact on the household when applied individually, we next look at the households which has access to more than one scheme, and how the cumulative effect has a role to play on the household SPS. In Figure 26, we can see that 3 households have access to 4 schemes, 14 households has access to three schemes, and 40 households has access to two schemes, while 17 households has access to no schemes as well.

The three households that has access to four schemes are KHH4, KHH6 and KHH28, the individual scheme contribution and cumulative contribution is shown in Figure 27, Figure 28 and Figure 29 respectively. We can see that for KHH4 and KHH6, the net effect of all schemes together is greater than the sum of contribution from individual schemes. While for KHH28 the net effect is of all schemes together is less than the sum of individual contribution of the scheme, but still greater than contribution of any of the individual scheme.
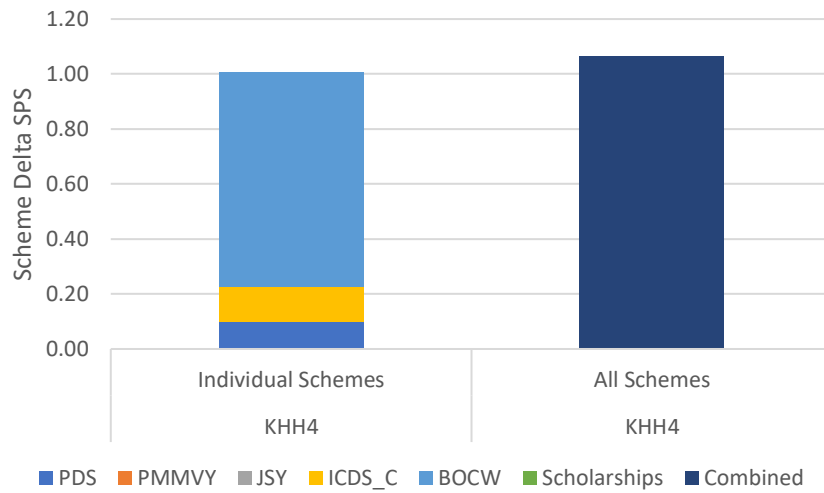
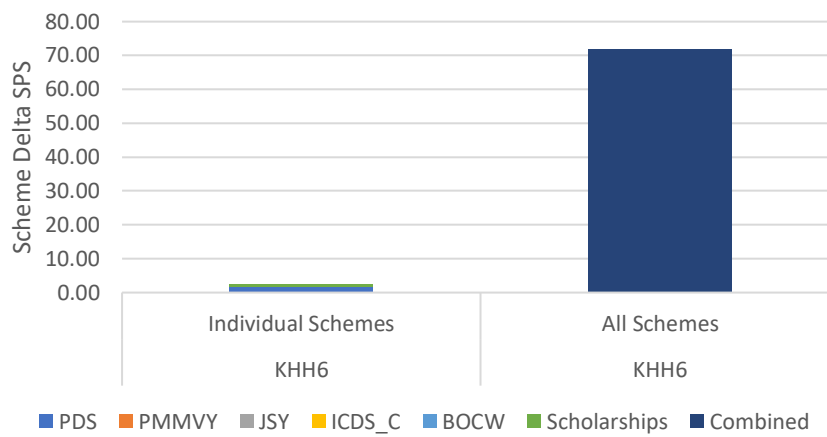*Figure 27. Cumulative effect of the schemes for KHH4*

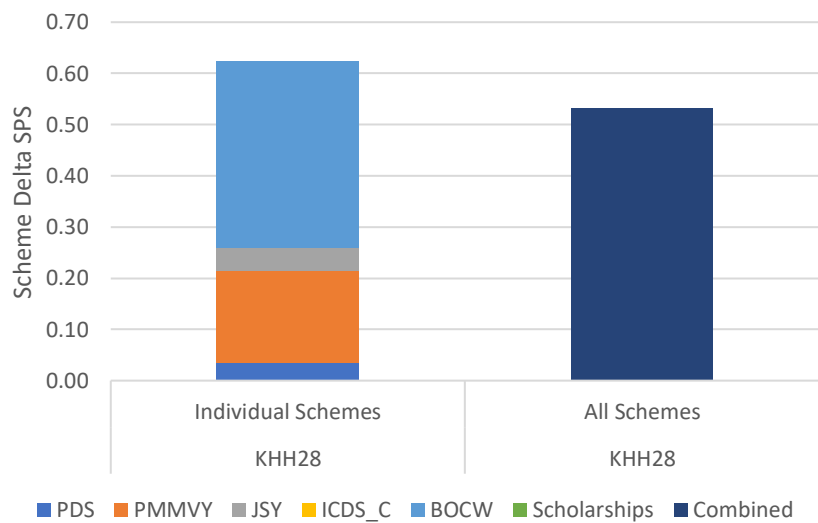*Figure 28. Cumulative effect of the schemes for KHH6*

Figure 29. Cumulative effect of the schemes for KHH28

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Such effect of either positive or negative compounding is seen when the household SPS is closer to either threshold or critical value of SPS in any of the dimension. For KHH28, the household prioritizes loan repayment and utilities over groceries, and when all the schemes are acting together, the household reaches the threshold (100) of SPS finance, and any further support is used towards expenditure of utilities, and hence we don't see the effect on education or health SPS. For KHH4, PDS and ICDS-C when acting together leads to a greater improvement of SPS health dimension due to targeting of different family members, which is the cause for positive compounding. The cumulative effect on SPS for households with access to three and two schemes are shown in

Table 11 and

Table 12 respectively.

HHN	PDS	NPS	PMMVY	ICDS_P	ICDS_C	JSY	BOCW	Scholarships	All
KHH2	0.04	-	-	-	0.02	-	0.00	-	0.08
KHH7	0.14	-	-	-	-	-	0.03	0.04	0.34
KHH9	0.11	-	-	-	-	-	0.00	0.00	0.12
KHH21	0.00	-	0.00	-	-	0.00	-	-	0.00
KHH22	0.22	-	-	-	0.13	-	0.01	-	0.49
KHH24	0.30	-	-	-	0.13	-	0.01	-	0.44
KHH30	0.36	-	-	-	-	-	0.00	0.10	0.65
KHH31	0.13	-	-	-	0.10	-	0.00	-	0.30
KHH40	0.11	0.00	-	-	-	-	0.00	-	0.13
KHH41	0.29	0.25	0.00	-	-	-	-	-	0.42
KHH47	0.03	-	0.00	-	0.01	-	-	-	0.05
CHH2	23.14	26.52	-	-	6.15	-	-	-	46.77
CHH7	0.31	0.15	-	-	-	-	0.04	-	0.48
CHH49	0.17	-	-	0.00	0.19	-	-	-	0.52

Table 11. Cumulative effect on SPS for Households with access to 3 schemes.

HHN	PDS	NPS	PMMVY	ICDS_P	ICDS_C	JSY	BOCW	Scholarships	All
PHH8	-	-	-	0.00	0.00	-	-	-	0.00
PHH23	0.04	-	-	-	0.01	-	-	-	0.06
PHH40	0.07	-	-	-	-	-	0.00	-	0.07
PHH45	0.00	-	-	-	0.00	-	-	-	0.00
KHH5	-	-	-	-	-	-	0.11	0.23	0.28
KHH8	0.05	-	-	-	0.02	-	-	-	0.08

KHH11	0.04	-	0.00	-	-	-	-	-	0.04
KHH15	2.29	47.93	-	-	-	-	-	-	47.93
KHH16	28.34	-	-	-	-	-	27.73	-	28.34
KHH17	0.00	-	-	-	0.00	-	-	-	0.00
KHH18	0.34	-	-	-	-	-	0.00	-	0.34
KHH19	0.00	-	-	-	-	-	0.00	-	0.00
KHH20	0.08	0.04	-	-	-	-	-	-	0.13
KHH23	0.00	-	-	-	-	-	0.00	-	0.00
KHH25	0.00	-	0.00	-	-	-	-	-	0.00
KHH32	0.04	-	-	-	-	-	0.00	-	0.04
KHH33	0.06	-	-	-	-	-	0.00	-	0.06
KHH42	2.38	1.67	-	-	-	-	-	-	40.28
KHH44	0.05	40.71	-	-	-	-	-	-	40.75
KHH46	34.69	-	-	-	-	-	0.00	-	34.69
CHH1	0.59	0.53	-	-	-	-	-	-	4.88
CHH3	0.30	0.12	-	-	-	-	-	-	0.64
CHH4	0.11	0.04	-	-	-	-	-	-	0.19
CHH5	7.58	7.23	-	-	-	-	-	-	7.89
CHH8	0.39	0.23	-	-	-	-	-	-	0.58
CHH14	0.04	0.00	-	-	-	-	-	-	0.05
CHH16	0.00	-	-	-	-	-	-	0.00	0.00
CHH17	0.17	0.00	-	-	-	-	-	-	0.20
CHH18	0.40	0.00	-	-	-	-	-	-	0.51
CHH23	0.00	0.00	-	-	-	-	-	-	0.00
CHH29	0.00	0.00	-	-	-	-	-	-	0.00
CHH30	0.31	0.31	-	-	-	-	-	-	0.70
CHH31	0.35	0.30	-	-	-	-	-	-	1.46
CHH32	0.00	0.00	-	-	-	-	-	-	0.00
CHH37	0.00	0.00	-	-	-	-	-	-	0.00
CHH42	0.01	-	-	-	-	-	0.00	-	0.01
CHH45	0.09	-	-	-	-	-	0.00	-	0.10
CHH46	0.12	0.01	-	-	-	-	-	-	0.13

CHH47	0.15	0.01	-	-	-	-	-	-	0.20
CHH48	0.00	-	-	-	-	-	0.00	-	0.00

Table 12. Cumulative effect on SPS for households with access to two schemes

4.4 Scenario-based Analysis

In this section we test the scenario of income shock to understand its effect on the household SPS, we then see the role of various government schemes in providing resilience measure to the households.

Figure 31 and
Figure **33** respectively. We see the differential impact of the similar income shock on different households. The impact of income shock on

Mapping the effect of income shocks on SPS

In this section, we look at the effect of income shock on the household SPS, we simulate a 2-month long income shock that reduces the household income by 50% and repeating every 2 years. The effect of it on households in Panvel, Kagal, and Chikhaldara is seen in Figure 30

household SPS varies from near zero to -46 points. The effects are more pronounced in Panvel as compared to Kagal and Chikhadara.
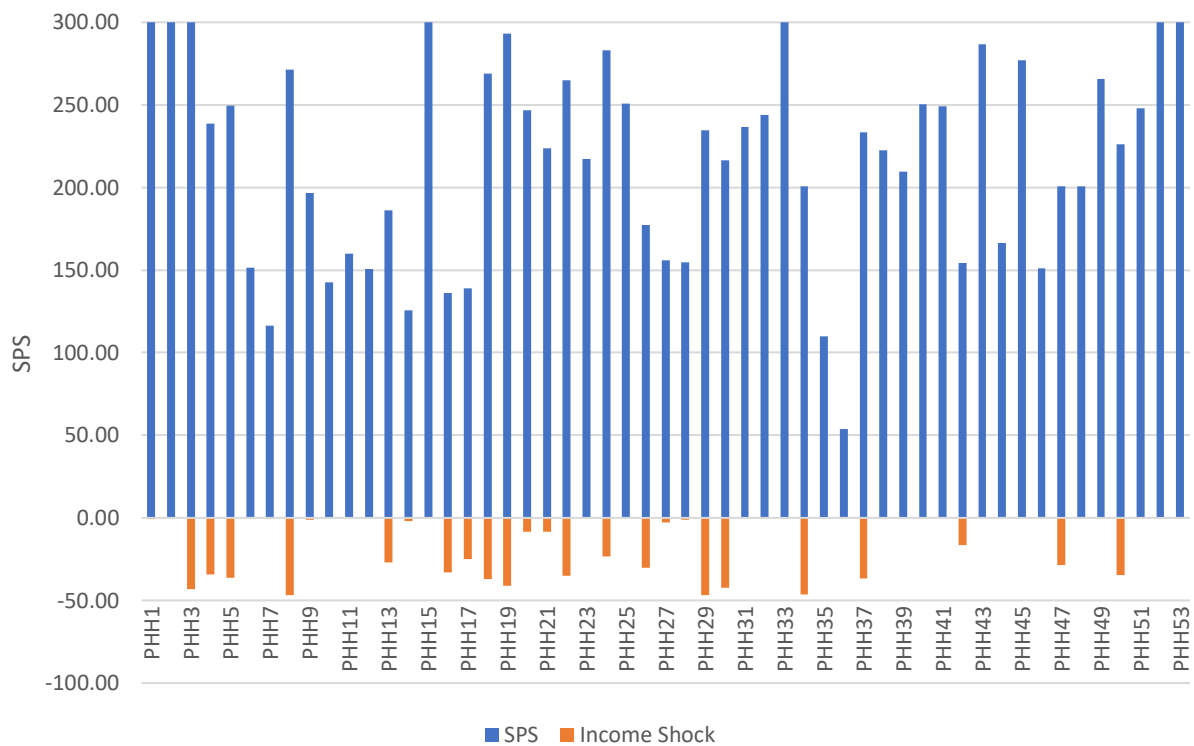
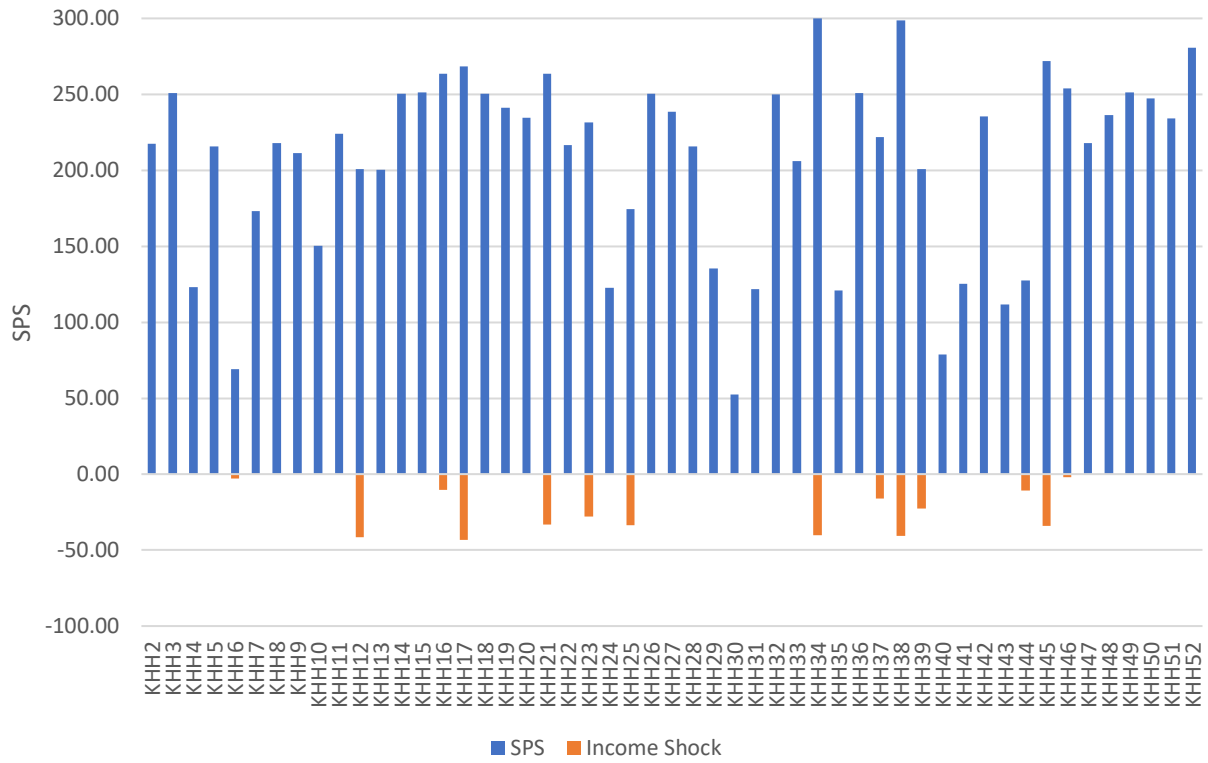*Figure 30. Impact of Income shock on Household SPS in Panvel*

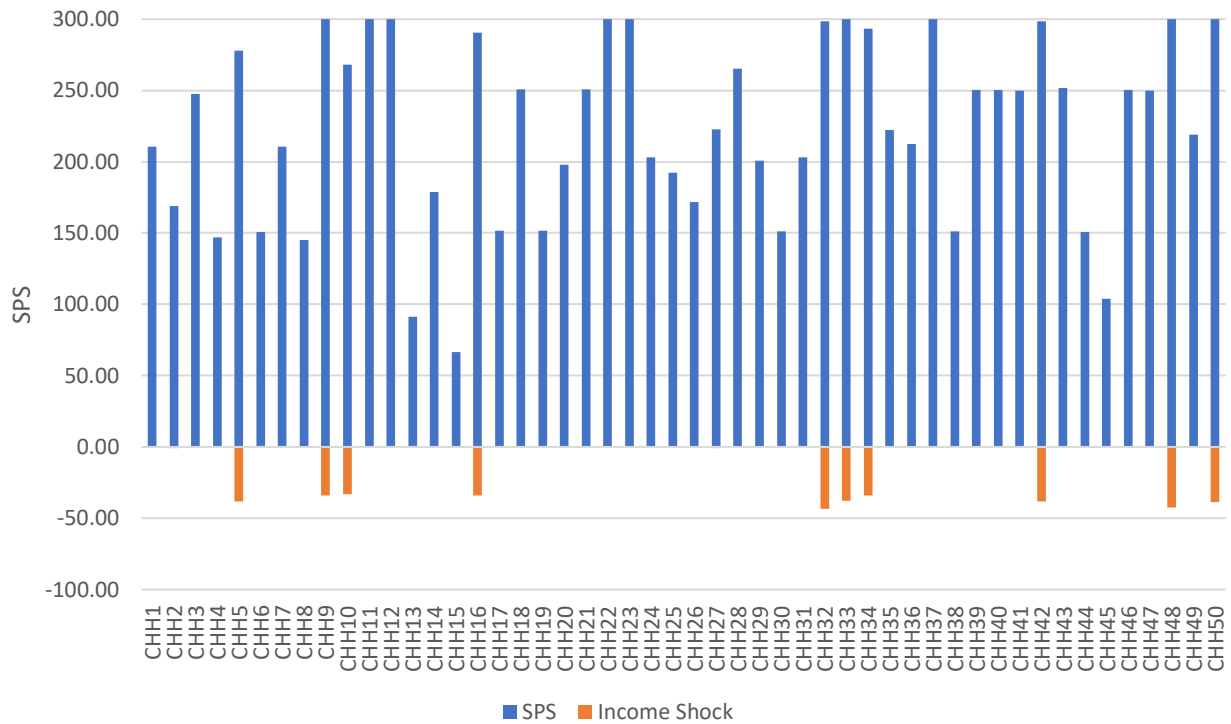*Figure 31. Impact of Income shock on Household SPS in Kagal*

Figure 33. Impact of Income shock on Household SPS in Chikhaldara
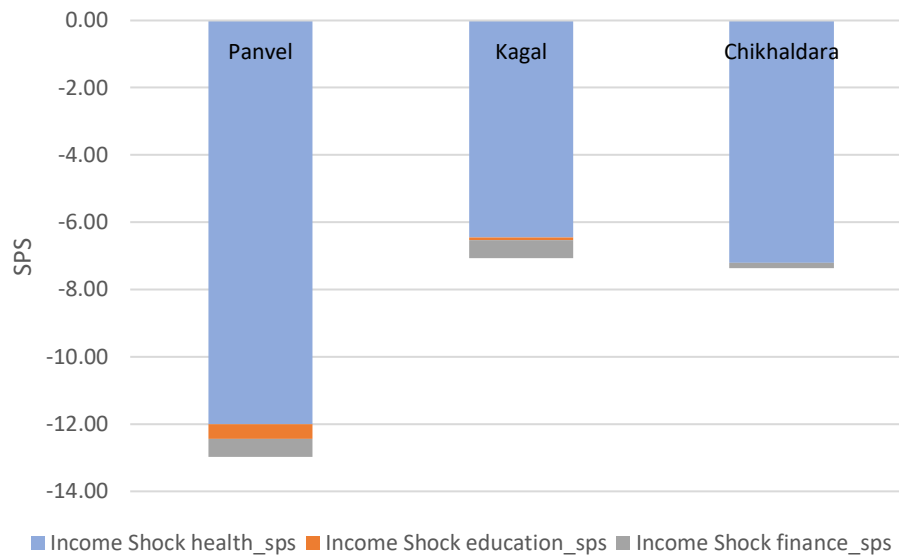

Figure 32. Impact of Income shock on different dimension of SPS

The impact of income shock on different components of SPS is Figure 32. We can see that on an average the health is impacted more followed by financial SPS. In Panvel the impact of income shock is also impacting the education SPS more in comparison to Kagal and Chikhaldara.

Impact of govt. schemes on social protection levels during income shocks

After having looked at the impact of income shock we next explore the contribution of all the different social protection schemes the household accessed towards improving the SPS and, hence reducing the vulnerability. In Figure 34, Figure 35 and

Figure 36 respectively. The impact of schemes as a resilience mechanism can be seen more in Chikhaldara followed by Kagal. For household this scenario we have also considered the household which accesses NREGS, to be able to get work from there during the income shock period. The contribution of schemes as means of resilience during income shock is shown for households in Panvel, Kagal and Chikhaldara in

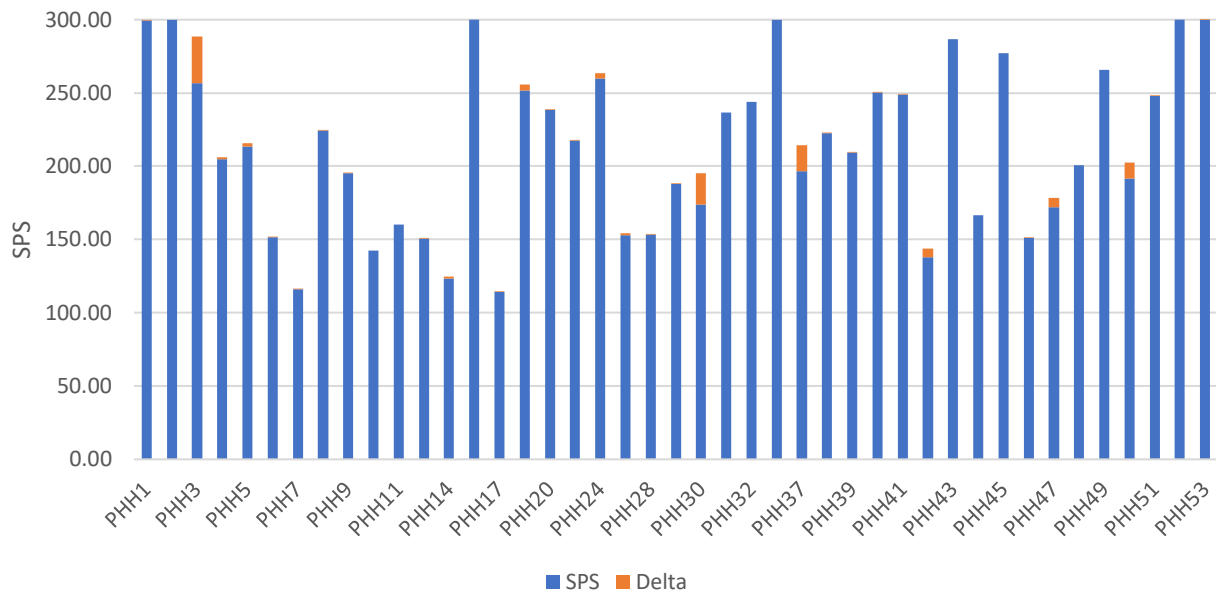KHH38, the schemes allow to ensure the SPS is maintained at 300 even during income shock.

Figure 34. Contribution of various government schemes towards SPS in presence of Income Shock in Panvel
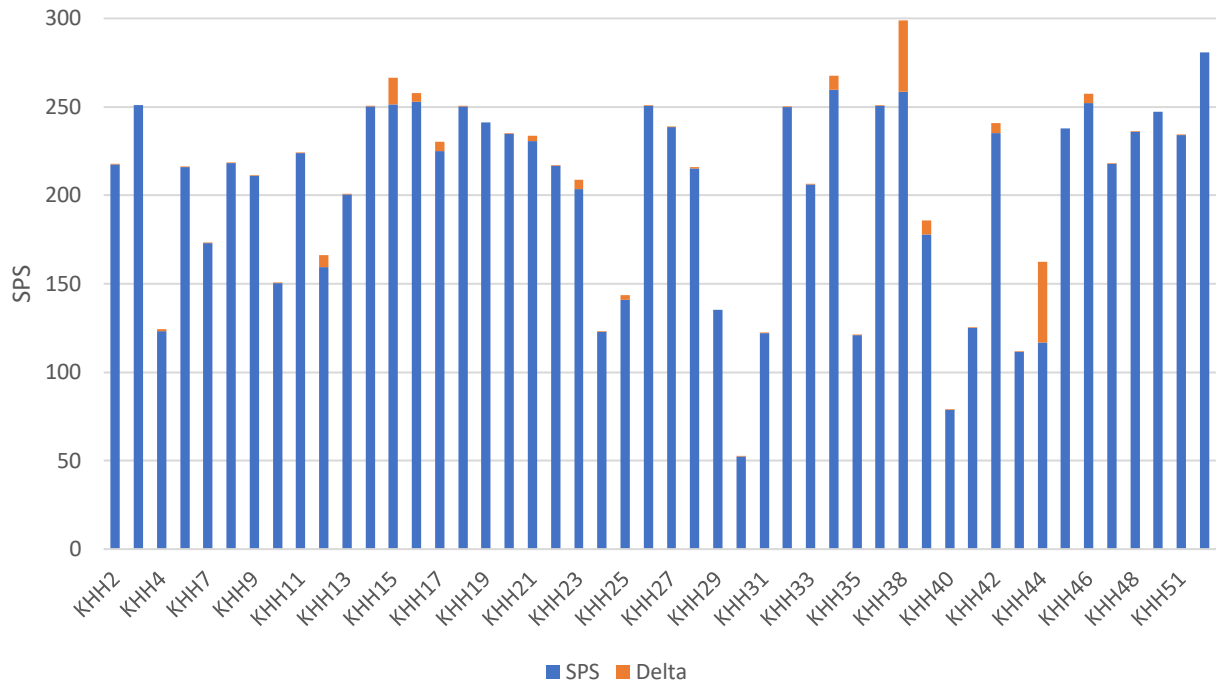
Figure 35. Contribution of various government schemes towards SPS in presence of Income Shock in Kagal
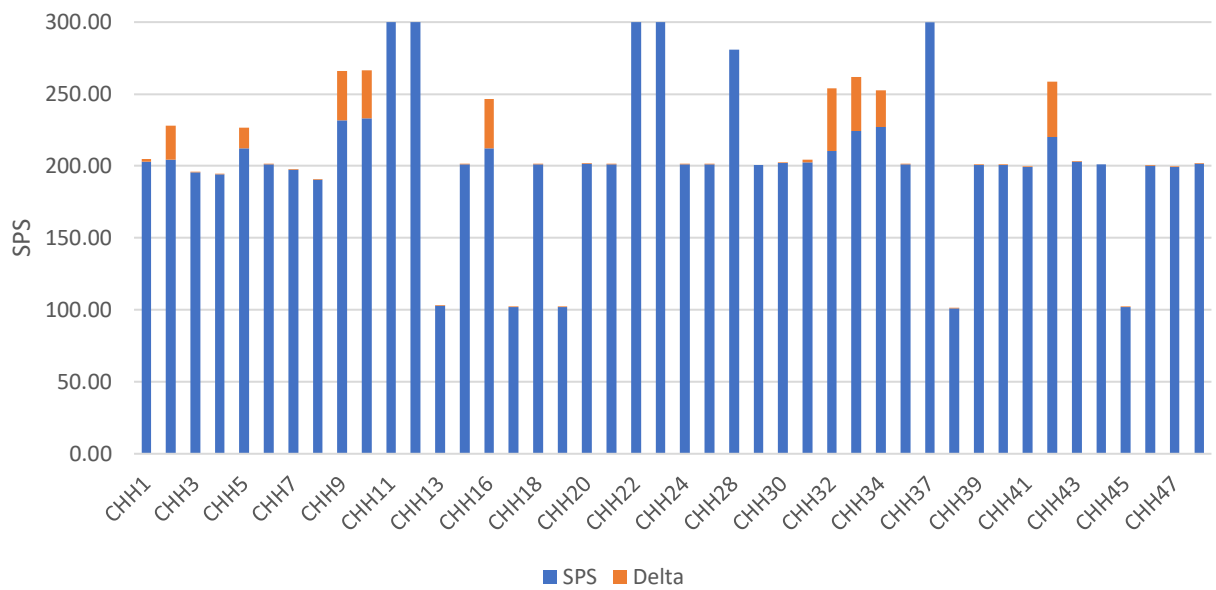

Figure 36. Contribution of various government schemes towards SPS in presence of Income Shock in Chikhaldara

In
Figure 37, we can see the impact of schemes during the income shock and its contribution of dimensions of SPS in each of the district. The schemes help improve majorly the health SPS in all three districts. In Panvel and Kagal, the impact of schemes on finance and education SPS can also be seen.
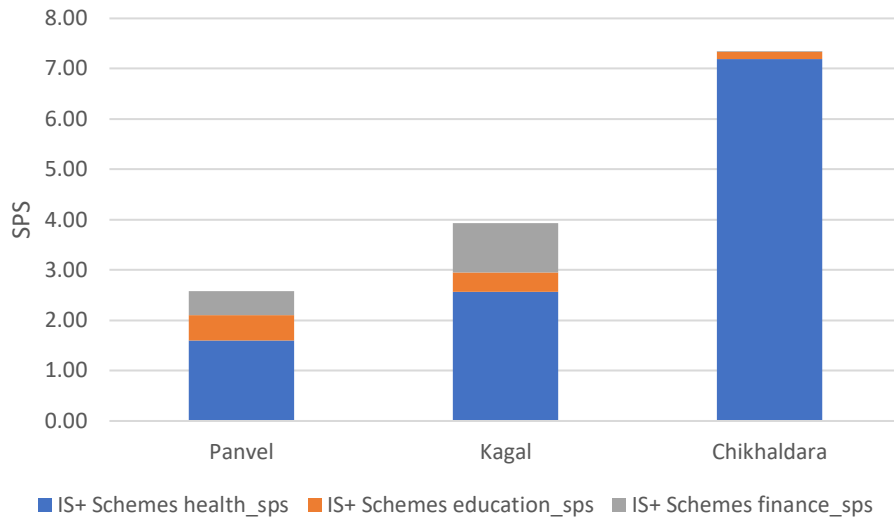
Figure 37. Average contribution of government schemes towards different dimensions of SPS during Income shock

6. Comparison with SDG Indicators

In this section we look at the links of SPS with various SDG indicators. For the purpose of this study we limit ourselves to SDG 1, SDG 2, and SDG 4, which are aligned with the dimension of finance, health and education. Further we limit ourselves to the following indicators:

- 1.1.1. Proportion of the population living below the international poverty line by sex, age, employment status and geographic location (urban/rural)
- 1.2.1 Proportion of population living below the national poverty line, by sex and age
- 2.1.1 Prevalence of undernourishment
- 2.2.2 Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight)
- 4.1.2 Completion rate (primary education, lower secondary education, upper secondary education)

6.1 SDG 1 – No Poverty

For SDG indicator 1.1.1 and 1.2.1. we use the International Poverty Line (IPL) (World Bank, 2022) and Tendulkar Committee Poverty line (TPL) (Gaur & Rao, 2020) adjusted to 2022 respectively[8]. The IPL comes to monthly Figure 38. We can see that across the three districts, while IPL, TPL are able to ascertain only a proportion of households as poor, while the SPS indicated vulnerability of all the households with varying intensity (even those who are marked as non-poor as per IPL and TPL). Further while IPL lacks distinction between urban and rural income, leading to higher poor households in rural areas of Kagal and Chikhaldara, the TPL adjust for it to some extent, but lacks finer distinction within the districts and leaves a large proportion of

income of INR 2092.25 per person, while the TPL comes to consumption expenditure of INR 1766.5 and INR 1441.5 per person per month in urban and rural areas respectively. The comparison of IPL, TPL and SPS is shown in

population marked as non-poor. Both these are overcome by SPS as seen below.

In the Figure 39, Figure 40 and Figure 41 below, we look at comparison of IPL, TPL and SPS category-wise in Panvel, Kagal and Chikhaldara respectively. Across all three categories of SPS, we see both IPL and TPL categorizes several households as non-poor, despite the households being vulnerable.
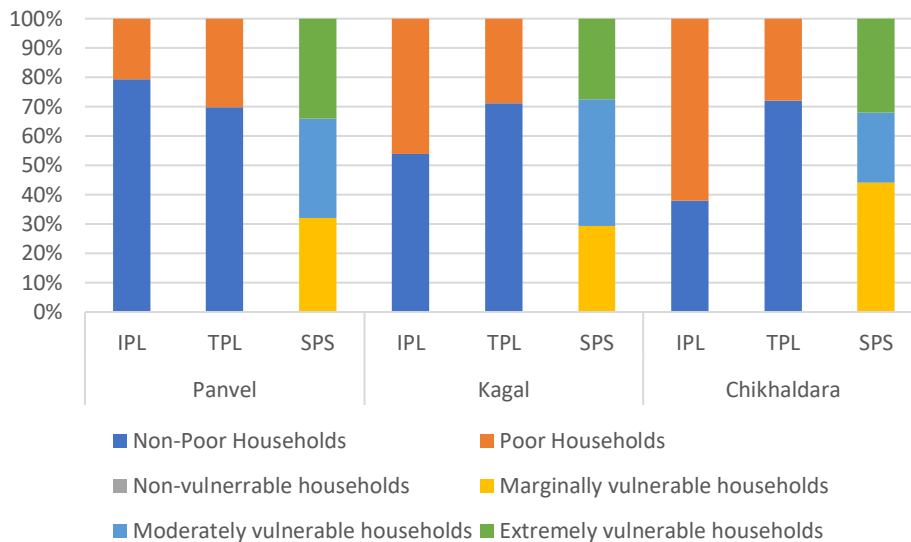

Figure 38. Comparison of SDG indicator 1.1.1 and 1.2.1 with the SPS score

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[8] The adjustment is based on inflation and PPP conversions, for inflation in India CPI values are used.
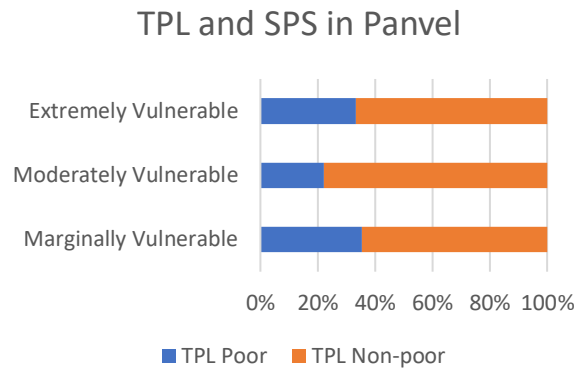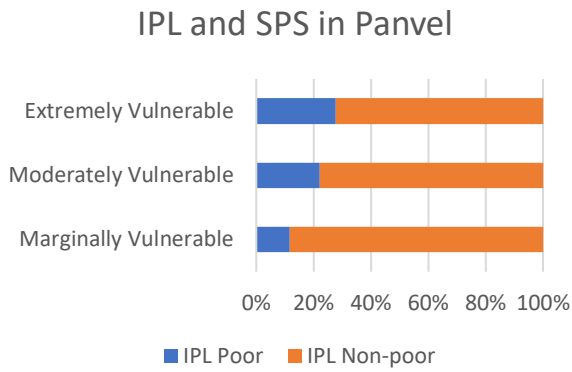
IPL and SPS in Panvel

TPL and SPS in Panvel
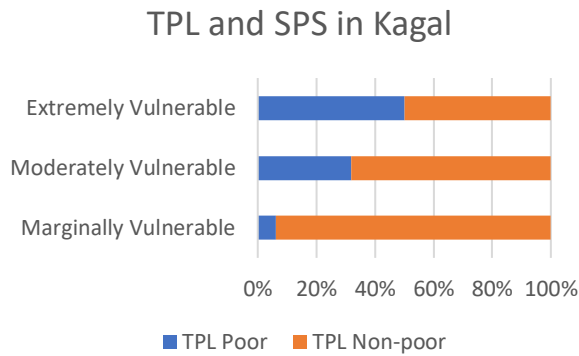

Figure 39. Comparison of IPL, TPL and SPS in Panvel

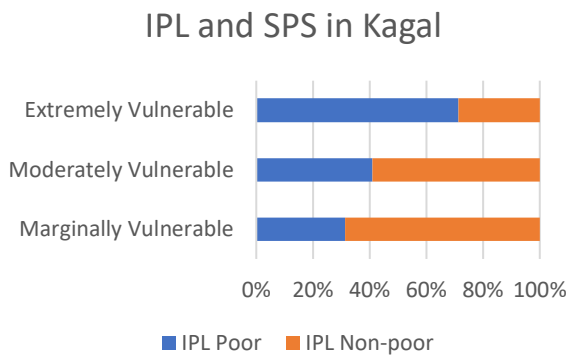## IPL and SPS in Kagal

TPL and SPS in Kagal

F*igure 40. Comparison of IPL, TPL and SPS in Kagal*

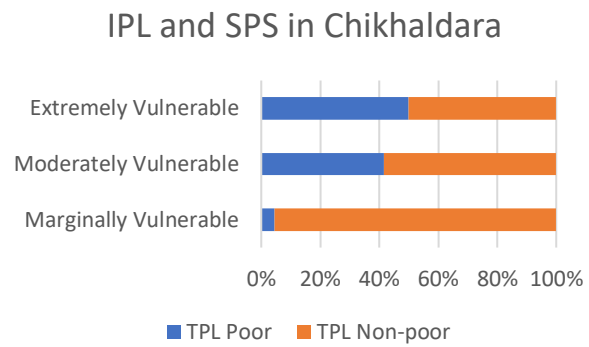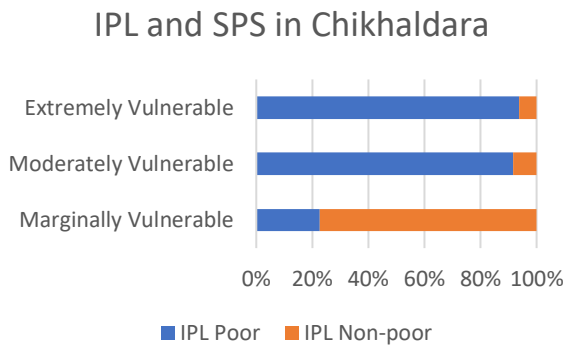## IPL and SPS in Chikhaldara

IPL and SPS in Chikhaldara

Figure 41. Comparison of IPL, TPL and SPS in Chikhaldara

The overall degree of underestimation increases as one moves from the extremely vulnerable category to the marginally vulnerable category across both IPL and TPL. While using IPL, given it's an income-based measure, for the marginally vulnerable category it categorizes 12%, 33% and 26% as poor in Panvel, Kagal and Chikhaldara, leading to greater underestimation of vulnerability in rural areas as compared to urban areas. While in case of TPL for the same category it categorizes 35%, 7% and 5% as being poor, leading to greater underestimation at a rural area than an urban area.

6.2 SDG 2 – No Hunger

For SDG indicator 2.1.1 and 2.2.2, the SPS dimension of health tracks presently both undernourishment and malnutrition. The Figure 42. In Figure 43, split of number of children who are malnourished and those who are not is shown

proportion of households in each district which would have undernourishment among members and malnourished children is shown in

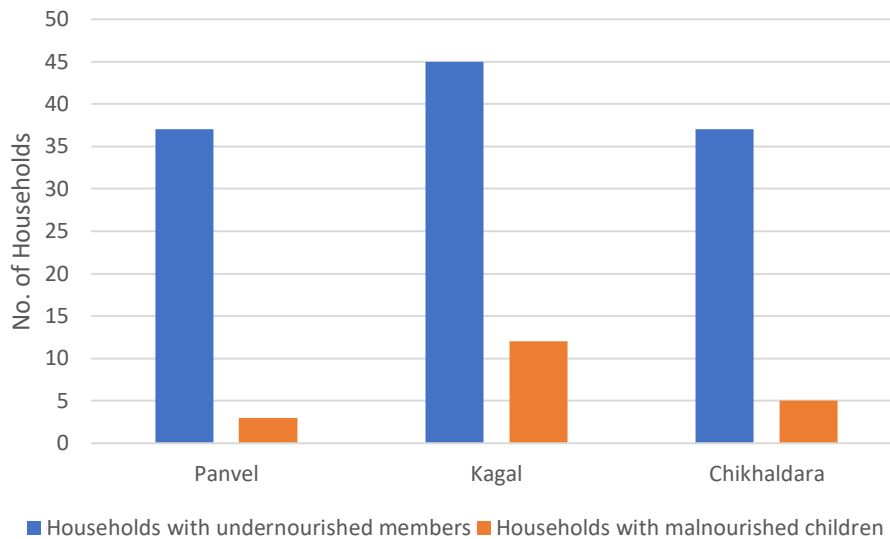which is one of the measures used the compute the SPS among other factors.

Figure 42. Linking components of SPS with SDG 2.1.1 and SDG 2.2.2
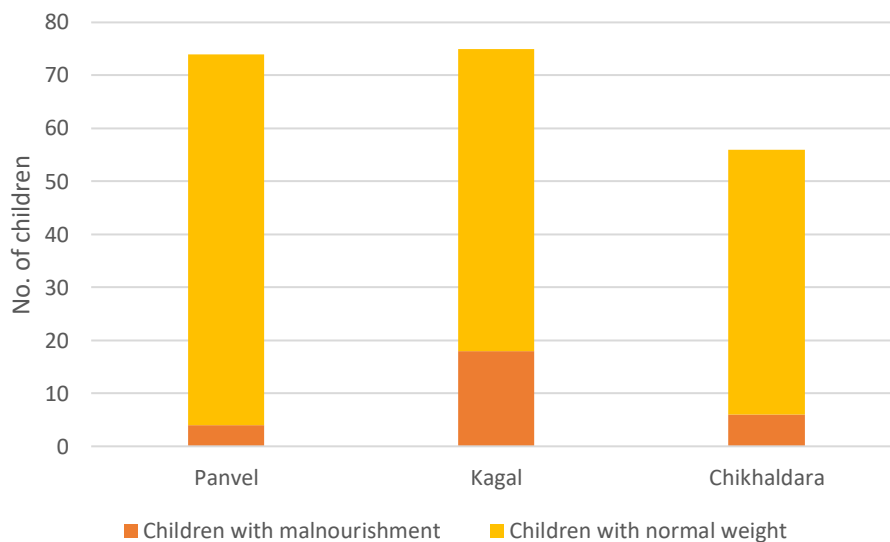
Figure 43. Linking components of SPS with SDG 2.2.2

6.3   SDG 4 – Quality Education

SDG 4.1.2 tracks the completion rate of education at various level, for the households Figure 44 shows the expected and actual education attainment as computed in the E-QLT model. In Panvel, the gap in education is seen at the upper secondary level, while in across districts, the SPS education tracks the same and measures the gap between expected and actual educational attainment.

Kagal and Chikhaldara the gaps can be seen across all three stages of education. Across the district there is higher gap at the level of upper secondary.

Figure 44. Linking components of SPS with SDG 4.1.2.

7.Future Work and Impact Potential

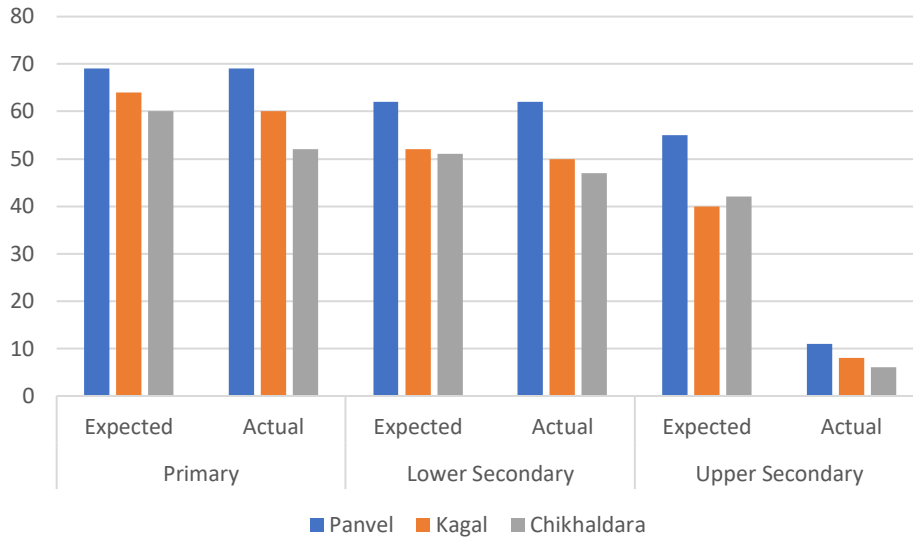In this study we demonstrated how E-QLT builds upon the current approaches and helps address various gaps to allow for more comprehensive, responsive, and adaptive method to understanding vulnerability and social protection.

We seek to build modules over E-QLT that would enable to take the knowledge of vulnerability assessment on step forward to guide the scheme design at different level by different stakeholders.

We also seek to strengthen the tool by connecting it to various databases that exists to enable leveraging of existing datasets to improve our understanding of vulnerability and to allow to plan for resilience.

We are also seeking to make the tool more accessible over the web, to enable citizens to access to tool remotely, input their data to measure their SPS and to get recommendation on pathways towards resilience for them.

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