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Drivers of Change
Agricultural modernization and women's status in SAT India

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International Crops Research Institute
for the Semi-Arid Tropics

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Drivers of Change

Agricultural modernization and women's status in SAT India

Alison C Palacios

Outlines changes in women's status in six villages in India's Semi-Arid Tropics, and explores drivers of change with an emphasis on agricultural technologies and government initiatives.

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1. Introduction

This paper explores the extent to which agricultural modernization affects women's status. Agricultural modernization refers to the ever-increasing use of farm implements and techniques that have previously not existed or have not been used in the local setting. These implements and techniques generally intend to imitate the western model of industrial agriculture, making large-scale cultivation more feasible. Examples of agricultural modernization include, but are not limited to, improved seeds, chemical fertilizers, tractors and mechanized threshers. Improved seeds are defined as seeds that are created by a laboratory and later sold to farmers; certainly hybrid seeds in the purist sense have existed for millennia as farmers knowingly cross-bred their plants for desirable traits. Biotech or genetically modified seeds are a subset at the most technologically advanced end of improved seeds, and these are seeds that contain genes not native to their own species.

For the purposes of this paper, seed technology and mechanization were chosen as the indicators of agricultural mechanization. First, it is important to consider seed technology as it was improved seeds that heralded the Green Revolution and the expansion of modern agriculture. Moreover, use of chemical fertilizers, another indicator of agricultural modernization, is directly related to the use of improved seeds. Second, mechanization was chosen as the other indicator of agricultural modernization because it encompasses the entire range of the agricultural cycle, from tilling to planting to harvesting to processing. Finally, the two indicators of agricultural modernization outlined here may be meaningfully quantified; use of improved seeds can be measured by comparing the ratio of land under improved seed variety cultivation to the total amount of land under cultivation, and the use of mechanization can be quantified as hours per acre under cultivation.

Women's status is more nuanced; by its very nature it is qualitative and there is no easily quantifiable indicator that can adequately represent it. Women's status can be conceived as having a relative and an absolute component. Relatively speaking, women's status refers to women's position in society compared to men. Do women have the same opportunities as men? Are women as educated as men? Do women have as much autonomy and decision-making power as men? Are women treated equally as men? In absolute terms, women's status also refers to women's position independent of the position of men. This is the idea of empowerment, which refers to women's freedom and ability to make decisions for themselves and have control over their lives. What opportunities do women have? How educated are women? Do women have autonomy and decision-making power? How are women treated? Obviously, the concept of empowerment varies from culture to culture, so care must be taken to avoid imposing one's own culturally defined standard of empowerment upon another group. Both relative and absolute women's status need to be considered to create a holistic picture of women's position in society. This paper paints a well-rounded picture of women's status by relying on quantifiable indicators related to the agricultural labor market, the non-farm labor market, education, health, marriage and empowerment, as well as qualitative indicators based on focus-group discussions and expert interviews.

The research presented in this paper was initiated largely in response to literature by activists such as Vandana Shiva who denounce all forms of modernization in the agricultural sector, claiming that it disenfranchises women by changing the cropping pattern from one that is diverse and based on locally preserved seeds to one that is increasingly a monoculture grown for commercial purposes and therefore more vulnerable to weather and market hazard (Shiva 2010, personal interview). Under the premise that foods grown for subsistence are generally under women's control and that those grown for the market fall into the men's domain, the activists' line of argument proceeds in the following manner: Technologically altered seeds and their corresponding chemical inputs are all purchased from the market, meaning that they are generally controlled by men, replacing locally preserved seeds generally controlled by women.

This results in decreased decision-making power and income opportunities for women, increased probability of entering a cycle of debt since input costs are higher, and further detriment to women if they are the first to sacrifice when there is not enough to go around.

An alternative view is that the introduction of technology saves women's time that may have previously been spent on time-consuming, low-return tasks such as seed sorting and allows them to spend that time in other, more beneficial ways such as looking after their children and/or participating in some sort of income-generating activity, thereby increasing the food security and welfare of their families and themselves. This is similar to the mainstream perspective, which says that technology is, of course, good for everybody since it saves time and raises income. Raised income raises the welfare of everybody and allows for more contact with and influence from modern society.

The objectives of this research project are threefold. First, trends in adoption of seed technology and mechanization will be identified. Second, changes in women's status that have occurred over the same time period in the same locales will be explored. Third, this research will outline the connections between agricultural modernization and women's status. The final and most critical objective of this research is to identify the most influential factors or "drivers of change" that affect women's status.

This paper is organized into five subsequent sections: data and methodology, agricultural modernization, women's status, discussion, and conclusions and recommendations. The data and methodology section outlines the data source, the methodology for gathering the data, and the methodology for gathering information outside of the database. The agricultural modernization section explores trends in seed technology and mechanization, and the women's status section explores trends in six different indicators of women's status and begins to draw connections between women's status and agricultural modernization. The discussion section elaborates on findings presented in the previous two sections. The conclusions and recommendations segment gives the final analysis of the connection between agricultural modernization, explores the relative importance of other drivers of change on women's status, and identifies best practices for the advancement of women's status.

2. Data and methodology

This report draws extensively on data from ICRISAT's Village Level Studies (VLS) database. The VLS database has been called the "gene bank of social scientists," as it is comprised of a wide range of data intensively collected from an original set of 40 households in each of six villages starting in 1975 and follows the same households as much as possible until the present time. The six villages were deliberately and carefully chosen to represent a variety of SAT villages based on geography, cropping patterns, weather patterns, types of soil, irrigation, education, caste structures, technology adoption, land distribution, and other factors. Shirapur, Kalman, Kanzara and Kinkheda are in the state of Maharashtra, and Aurepalle and Dokur are in Andhra Pradesh.

The "first generation" of VLS data collection was done between 1975 and 1984, and the "second generation" commenced in 2001. Data during the first generation of VLS was also collected on four additional villages, two villages in Gujarat – Boria and Rampura and two villages in Madhya Pradesh – Papda and Rampura Kalan, but data collection in these villages did not continue in the second generation of VLS. Likewise, VLS has expanded to 42 villages since 2009, but these villages were not included in this study because data is not available for first generation years. Data was not collected in Dokur, Kalman, or Kinkheda from 1980-1982 or from 1984. Data was collected in these villages in 1983; figures from 1983 are shown on all graphs as an extended line between 1983 and 1984; however, they represent only the data from 1983 and not a trend between 1983 and 1984.

In addition to analysis of VLS data, this research also draws heavily on focus group discussions (see Appendix) held in the villages and on interviews with ICRISAT staff (see Appendix), many of whom have been working with the VLS project since its inception in the mid-1970s. Focus group discussions were semi-structured and discussion guides were prepared and revised based on feedback from ICRISAT staff who worked with the VLS villages since the project's commencement. The discussions were moderated by ICRISAT field workers, employees who are fluent in the local language, live in the VLS villages and have earned trust among the villagers. Because of traditional gender and caste norms, it was important to the design of the study to hold focus group discussions with a variety of demographics. Discussions were held with only women without attention to caste, only low-caste women, only high-caste women, only men without attention to caste, and mixed groups of men and women. Deliberately planning the focus group discussions in this way allowed for observance of how different groups of people interact with each other.

The difference between food crops and commercial crops is important to some of the analyses presented in this paper and merits a short explanation. Food crops are defined as crops that are grown mostly for subsistence purposes, and include crops categorized as grains, cereals and legumes, with the exception of soybeans, a cash crop recently introduced in the Akola region. Fruits, vegetables, oilseeds and fiber crops such as cotton are categorized as commercial crops. Though fruits, vegetables and other commercial crops are certainly consumed at home, the percentage of produce from these crops that is consumed by the household is low compared to the percentage of grain, cereal and legume produce consumed at the household level. Thus, although some commercial crops are certainly beneficial to the food security of the household, they are nevertheless grown mostly for commercial purposes and must be categorized as such.

3. Agricultural modernization

3.1 Seed technology

According to activists who oppose advanced seeds, the cropping pattern should change from being mostly subsistence-based to mostly commercial with the advent of improved seeds, and from a diversified cropping pattern to one that is increasingly dominated by monoculture. To test that theory, use of seed technology was calculated as the percentage of cultivated land on which technologically advanced seeds were planted.[1] Technology adoption in terms of the usage of improved and high-yielding variety (HYV) seeds had already begun in some of the villages as of 1975 (see Figure 1). This is most notable in Dokur, where improved or

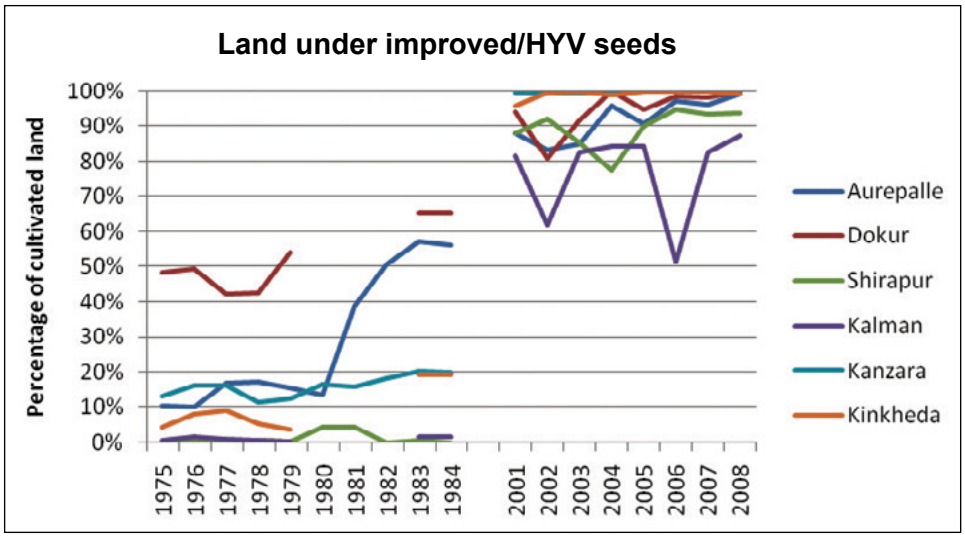

Figure 1. Improved/HYV adoption.

[1] All calculations based on percentages of land excluding seasonally fallow land.

HYV seeds were already being used on 48% of the cultivated land. Dokur's main crop during this decade was paddy, of which 95% was of improved varieties in 1975. The other village in the same region, Aurepalle, was the second in the study villages to begin using advanced seeds in large numbers in the early 1980s. Farmers in this village were using significant amounts of advanced paddy varieties as well; 62% of paddy grown in 1975 was advanced, and the introduction of an improved variety of castor, a major cash crop in the region, led even more land to be allocated to the cultivation of improved or HYV seeds.

The Maharashtra villages in Akola district, Kanzara and Kinkheda, were also using some improved and HYV seeds in 1975. Most of this use was advanced varieties of sorghum, their second-most important crop. Sorghum grown in Kanzara that year was 28% advanced varieties, while that grown in Kinkheda was 9% advanced varieties. In addition to sorghum, small amounts of cotton, the main cash crop, were being cultivated as well. By 1983, only small amounts of improved cotton were still being grown there, and the growth in adoption of advanced seeds is due to more use of advanced sorghum as well as the introduction of improved wheat.

By contrast, the remaining Maharashtra villages in Sholapur district, Shirapur and Kalman, used virtually no advanced seed varieties between 1975 and 1984. Though sorghum was their main crop and improved sorghum varieties were being readily adopted in the Akola district, it was used only in rare cases in the Sholapur district. The importance of sorghum even grew during this decade, accounting for 35% of the cultivated land in 1975 and 60% in 1983. Even so, improved and HYV varieties of sorghum, maize and wheat did not establish themselves in this region, and Shirapur and Kalman on average were still the lowest adopters of seed technology for the period 2001-2008.

Between 2001 and 2008, the Akola villages of Kanzara and Kinkheda consistently used improved or HYV seeds for virtually all of their cultivation. This increase is due to the introduction of advanced pigeonpea and soybean, which have become the most important crops in this region. Pigeonpea has also become an important crop in the Andhra Pradesh villages of Aurepalle and Dokur, with advanced varieties of cotton and sunflower outpacing paddy and sorghum in terms of land allocation in Aurepalle, while Dokur retains its original cropping pattern of paddy and sorghum dominance.

Table 1 shows the percentage of land allocated to food crop production. Only Shirapur exhibits a steadily decreasing trend, and this is due to sugarcane replacing sorghum as the main crop. Overall, however, the data show that there is no general trend of increasing commercialization, in spite of a definite increase in the use of advanced seed technologies. Therefore, the claim that the abandonment of local seeds in favor of engineered varieties displaces supposedly female-controlled food crops is not supported by these data.

Table 1. Land allocated to food crop production (%).

	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
1975	61	79	86	93	36	56
1983	50	80	82	70	42	38
2001	29	36	78	90	33	29
2008	30	78	49	81	45	50

Neither is there strong evidence to support the claim that increased use of advanced seeds leads to cropping patterns dominated by monoculture. Table 2 shows the percentage of cropland that the two main crops occupy. The main two crops, or those that occupy the highest portion of cultivated land, are different according to village. No clear trend of "crop monopoly" is apparent, but there is strong evidence that the practice of intercropping has declined.

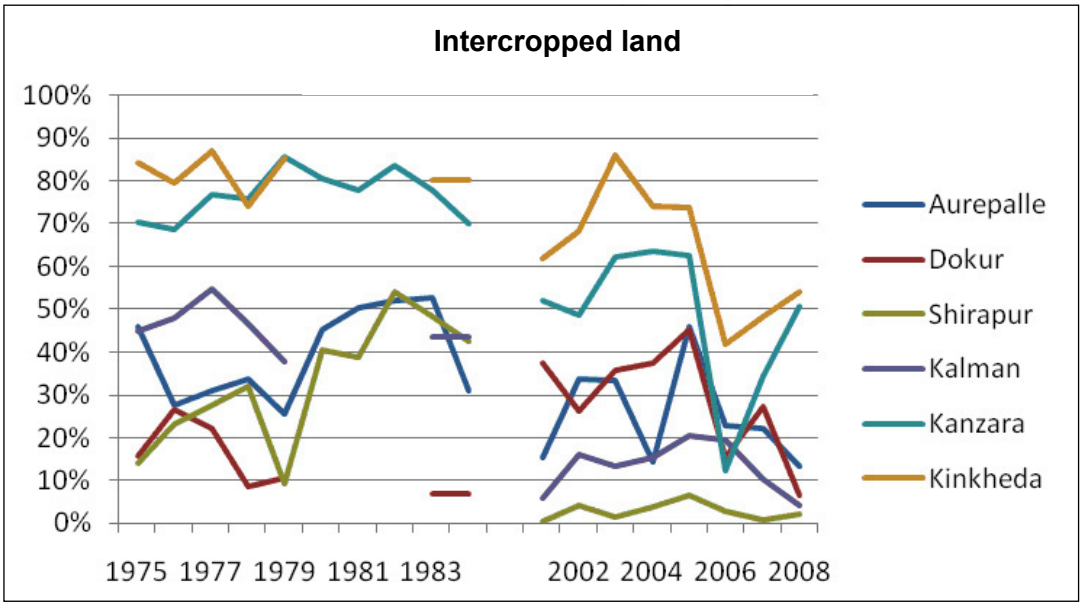

Figure 2. Percentage of cultivated land that is intercropped.

Figure 2 displays the percentage of cultivated land that was intercropped. In all villages except the Andhra Pradesh villages of Aurepalle and Dokur, the practice of intercropping has decreased since 1975. However, the rise of monoculture in this respect cannot be blamed entirely on use of advanced seeds since the Akola villages of Kanzara and Kinkheda still have the highest rates of intercropping despite the highest rates of advanced seed usage.

Table 2. Land allocated to top two crops (%).

	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
1975	70	72	52	77	80	80
1983	66	84	72	76	76	86
2001	71	83	64	79	83	78
2008	75	77	78	69	69	66

3.2 Mechanization

Areas with the highest rates of advanced seed usage also use the most mechanization. Mechanization in the villages during the first generation VLS was too rare to be meaningfully compared. All types of mechanization have increased in all of the villages. Table 3 shows hours of use of certain technologies for 2008.[2] Total hours of use have been adjusted according to the number of acres cultivated for ease of comparison across villages.[3] The Akola villages of Kanzara and Kinkheda, which also have the highest rates of improved or HYV seed usage, have the highest use of mechanization and use all forms of mechanization offered for comparison. These are the only villages that use harvesters and a significant amount of herbicide, while thresher usage is noticeably absent in the Andhra Pradesh villages of Aurepalle and Dokur.

[2] Use of herbicide was calculated by summing the hours that a person worked with a chemical input and/or a sprayer for the purpose of weeding.

[3] All original figures were multiplied by a factor relating the total cultivated acres. Since Kalman had the most acreage under cultivation, figures for this village are raw (multiplied by a factor of 1). For the other villages, Kalman acreage was divided by that village's acreage, resulting in the factor used to adjust raw figures from the other five villages. Thus, these figures provide the same comparison as hours per acre. This method was chosen over hours per acre because hours per acre yields small numbers (<1.00), which under emphasizes differences between villages.

Table 3. Use of mechanization (hours/acre), 2008.

	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Tractor	137	2661	788	57	1671	1137
Thresher	12	8	642	172	1029	1111
Harvester	0	0	0	0	19	6
Herbicide	9	0	16	0	1378	344

4. Women's status

Six indicators were chosen to represent women's status. These indicators are related to the agricultural and non-farm labor markets, education, health, marriage and empowerment. The analysis of women's status outlines connections between women's status, agricultural modernization and other drivers of change, namely government interventions.

4.1 Agricultural labor market

A phenomenon that has been observed and accepted by world development organizations and in academic and activist circles is that as the agricultural sector becomes more modernized and the economy diversifies into sectors outside of agriculture, the burden of agricultural labor falls more on the shoulders of women to the extent that women do a disproportionate amount of the physical work.

Table 4 lists the most labor-intensive agricultural tasks in 1975 and the portion of the total annual labor hours spent on each task. The right slide lists the most feminized tasks, meaning the tasks for which women make up more than 50% of the labor force. Tasks such as weeding, harvesting, application of chemical fertilizers, planting and threshing were feminized in 1975. Four of these tasks–harvesting, weeding, planting and threshing–were also the most labor-intensive tasks. This means that in the time before mechanization, women contributed the most labor to the most labor-intensive agricultural tasks; weeding and harvesting alone accounted for nearly half of the labor hours, and it was overwhelmingly women who performed these tasks. Moreover, these data demonstrate that the technologies most likely to decrease the demand of female labor over time are herbicides, harvesters, sprayers, mechanized planting and threshers.

By 2008, irrigation appeared in the top five most labor-intensive tasks, while fertilizer application outpaced harvesting and threshing outpaced planting in the list of most feminized tasks (Table 4). Since irrigation has become much more mechanized in the last 35 years, the relative importance of labor to this task should have decreased over time. However, its rise in importance is most likely explained by an increase in irrigated area. At the same time, the other task that was in the top five most labor-intensive tasks in 1975, threshing, has had its labor requirements reduced by the increase in thresher usage. Harvesting and weeding grew in relative labor intensity in 2008, accounting for over 60% of annual labor requirements; technology usage in these areas is still low compared to other tasks that can utilize tractors. This is significant to women's status because relative labor requirements for all other tasks except harvesting and weeding have decreased since 1975.

Table 4. Most labor-intensive and most feminized tasks, 1975 and 2008.

1975			
Most labor-intensive tasks	Total annual labor spent on task (%)	Most feminized tasks	Task-specific labor force that is female (%)
Weeding	27	Weeding	97
Harvesting	17	Harvesting	75
Land/seedbed prep	15	Fertilizer application	74
Planting	14	Planting	69
Threshing	10	Threshing	52
Irrigation	9	Land/seedbed prep	25
Interculturing	5	Manure application	12
Manure application	2	Interculturing	3
Fertilizer application	1	Irrigation	2
Pesticide application	~0	Pesticide application	2
2008			
Harvesting	37	Weeding	93
Weeding	24	Fertilizer application	73
Irrigation	8	Harvesting	66
Land/seedbed prep	8	Threshing	60
Planting	5	Planting	60
Threshing	5	Manure application	33
Fertilizer application	2	Land/seedbed prep	22
Interculturing	2	Pesticide application	12
Pesticide application	1	Irrigation	6
Manure application	1	Interculturing	1

The most widely used technologies, tractors and mechanized irrigation, save labor in male-dominated tasks such as irrigation and plowing. Technologies that should save or displace[4] female labor in weeding and threshing are doing just that in areas where they are used in significant numbers. In the Akola villages of Kanzara and Kinkheda where herbicide is more widely used (Table 3), weeding is less feminized than in the other four villages; women make up 82% of the workforce for weeding versus 99%, respectively. Similarly, threshing is more feminized in the villages (Aurepalle and Dokur) where threshers are not widely used. Women make up 80% of labor used for threshing in those villages but only 38% in the other four villages where threshers are more commonly used. As of 2008, harvesters were not yet used in sufficiently high numbers to have a measurable impact on the female agricultural labor force. Seed drills are now commonly used in planting, but the time requirement has not changed. Thus, for tasks that are highly feminized, the introduction of mechanization saves or displaces a relatively large amount of female labor and adds a relatively small amount of male labor to utilize the machinery, resulting in women comprising a smaller percentage of the task-specific labor force. Mechanization (ie, tractors) has been more utilized in traditionally male tasks, meaning that more male than female labor has been saved or displaced over time.

[4] "Save or displace" because labor is saved from the perspective of women in landowning households who would otherwise be working on their own family's farm and can now allocate their labor toward other productive tasks. Labor is displaced from the perspective of women from landless households or households that own very small parcels of land who depend on the agricultural labor market for their livelihood. Of course, this "save or displace" concept applies to male labor as well.

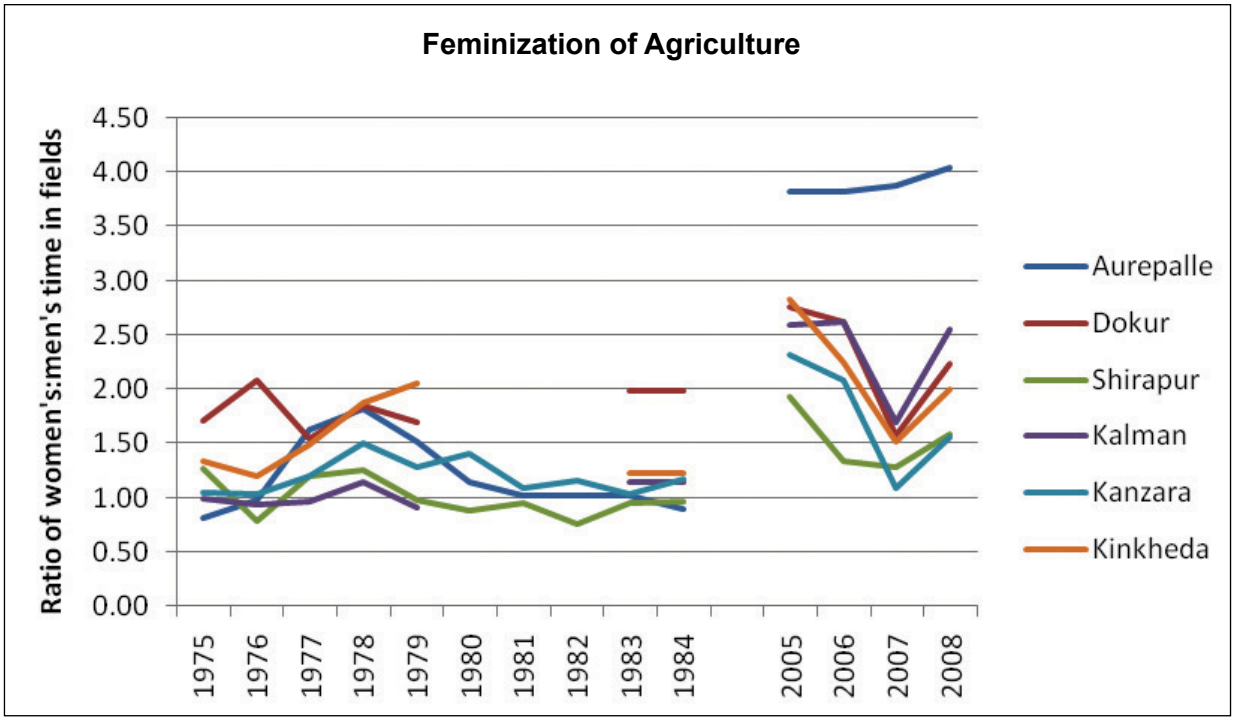

Figure 3. Trends in feminization of agriculture.

Figure 3 shows the levels of feminization of agriculture since 1975.[5] "Feminization" of agriculture refers to an agricultural labor force that is increasingly female. The ratio includes hours worked by family, hired, exchanged and servant labor and does not include children.[6] In all villages, feminization of agriculture has increased over time, though the increase is much more dramatic in some villages than in others. Women in Aurepalle, for example, worked slightly fewer hours in the fields than men in 1975, but by the early 2000s they were working nearly four times as many hours as men. Again, this does not mean that women are working longer hours in the fields, since mechanization has lessened their workload in some tasks, but that they are working relatively more hours than men now than in the past. The sudden decrease in feminization of agriculture in 2007, a year in which there were widespread crop failures, serves as evidence that female labor is the first to be cut when demand for labor falls.

Since mechanization has decreased the male workload relatively more than the female workload because of the tasks for which it is designed and utilized, mechanization has a direct link to feminization of agriculture: mechanization has relieved men's workload more than that of women's, resulting in a higher female to male work ratio. Thus, mechanization is offered as an explanation for the general trend in increasing feminization of agriculture. Of course, the connections between types of mechanization and intensity of mechanization do not perfectly align with feminization of agriculture; other factors will be considered in the discussion of non-farm opportunities. It is important to remember that feminization of agriculture means that women are working relatively more than men, though they may not be working more than they did 35 years ago in terms of actual hours worked. So, feminization of agriculture is not good or bad in and of itself, but it is relevant to women's status and has important implications for agricultural development projects when the burden of work is increasingly falling primarily on women.

[5] For all data related to agriculture, a sharp drop in 2007 is apparent. Thus, it deserves mention that 2007 was a bad year with widespread droughts and crop failures, so it should be considered an outlier.

[6] Years 2001-2004 are not included in the analysis of feminization of agriculture because VLS data on agricultural inputs did not include contributions from family labor during those years, resulting in female to male hours ratios that are artificially low. Inclusion of child labor is certainly important to analysis of feminization of agriculture (anecdotally, girls are more burdened with field work than are boys, which can make girls more vulnerable to being pulled from school when their labor is needed or not being enrolled in school to begin with) but VLS data did not differentiate between boys' and girls' labor.

Figure 4 and Figure 5 illustrate how dramatically real wages for agricultural laborers have increased since 1975.[7] The sharp increase in men's and women's wages between 2004 and 2005 can be largely attributed to the announcement of higher wages and guaranteed work that would soon be offered by the NREGA program (see page 10). The sharp decrease in wages visible for the Maharashtra villages (Shirapur, Kalman, Kanzara and Kinkheda) between 2006 and 2007 is explained by the widespread crop failures during that year. As with the trends in feminization of agriculture (Figure 3), 2007 illustrates that female agricultural laborers suffer most during downward swings in demand for labor as women's wages decreased more sharply than men's in that year. Though real wages have risen over time, women are still paid considerably less than men; in fact, in real terms women in the early 2000s were earning approximately the same wages as men in the early 1980s.

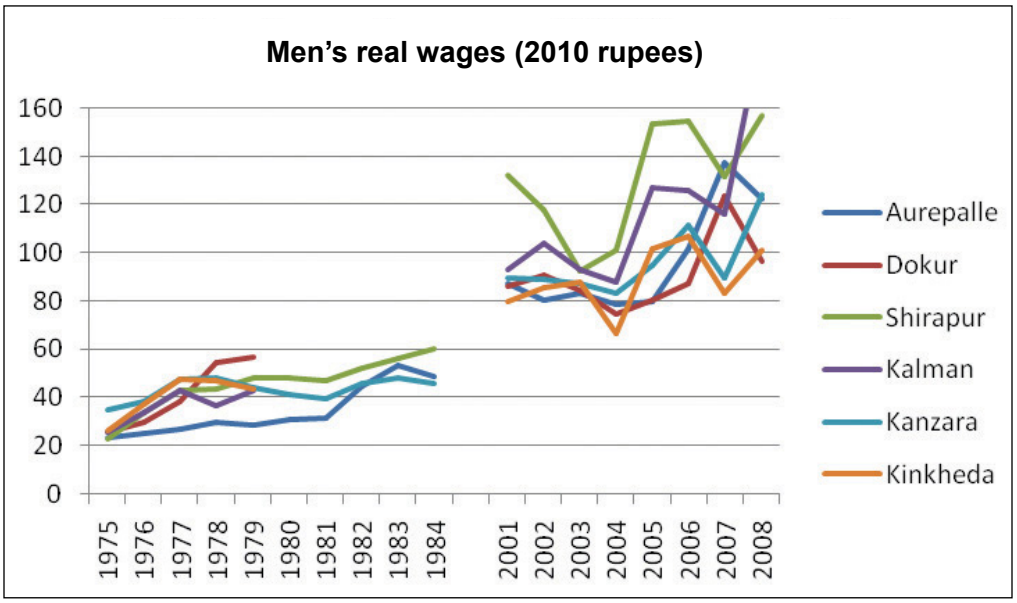

Figure 4. Trend in real wages for male agricultural laborers.

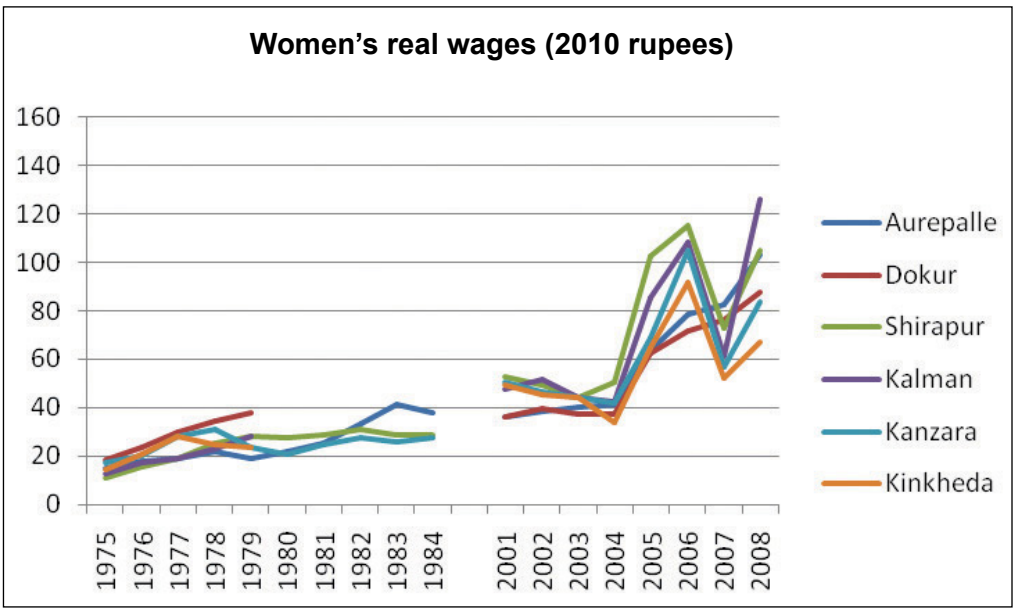

Figure 5. Trend in real wages for female agricultural laborers.

[7] Wages were adjusted for inflation using the state-level CPI for Agricultural and Rural Laborers from the Central Bank of India webpage.

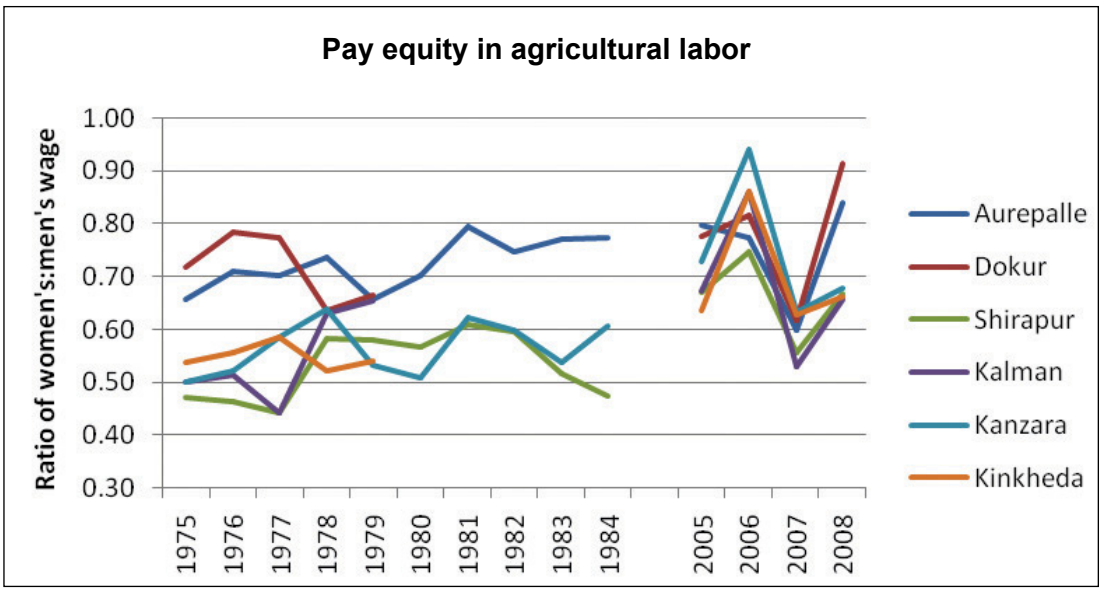

Figure 6. Trend in pay equity in agricultural labor.

Figure 6 shows the ratio of women's daily wage to men's daily wage for agricultural labor. There is only a slight increasing trend in pay equity over time. In the villages, this gap in pay is widely accepted, and justified by the idea that men are stronger and work harder than women. But, considering that highly feminized tasks such as weeding and harvesting require more speed than brute strength, wage inequality indicates that, despite four- to nine-fold increases in real wages for women and gains in pay equity ranging from 12 to 20 percentage points, women and their labor continue to be valued less than men and their work. Wage parity seems to depend to some extent on the local culture as the villages' wage parity ratios are grouped by region. Aurepalle and Dokur in Andhra Pradesh have the highest wage parity for women, followed by all of the Maharashtra villages.

A significant factor in wages and pay equity is the presence of a government employment scheme called the National Rural Employment Guarantee Act (NREGA), which guarantees 100 days of paid, unskilled labor for participating families. There is a very direct relationship between the effectiveness of this program and wage parity; Aurepalle and Dokur had strikingly higher wage parity in 2008 than the Maharashtra villages. Since NREGA often pays wages higher than the local rate and pays women the same as men, it puts enormous upward pressure on wages in general and especially on women's wages. Men and women in villages where this program is active are acutely aware of NREGA wages, and the result is that women can and do demand higher wages in exchange for their labor. NREGA is a relatively new government scheme implemented in 2005, which is replacing older work programs such as the Employment Guarantee Scheme and food for work programs.

Figure 7 shows that more than half of all households in Aurepalle and Dokur report having benefitted from this program in 2008, a lesser number are benefiting in Kanzara, and the program is more or less inactive in the other villages. Effectiveness of the NREGA program itself seems to rely heavily on local governance. However, this does not explain why Kanzara and Kinkheda had higher wage parity in 2006 and 2007 than did Aurepalle and Dokur.

4.2 Non-farm labor market

Table 5 shows the growing percentage of villagers over 16 whose primary occupation is not related to farming or domestic work. It is evident that non-farm employment is a growing trend, most notably in the

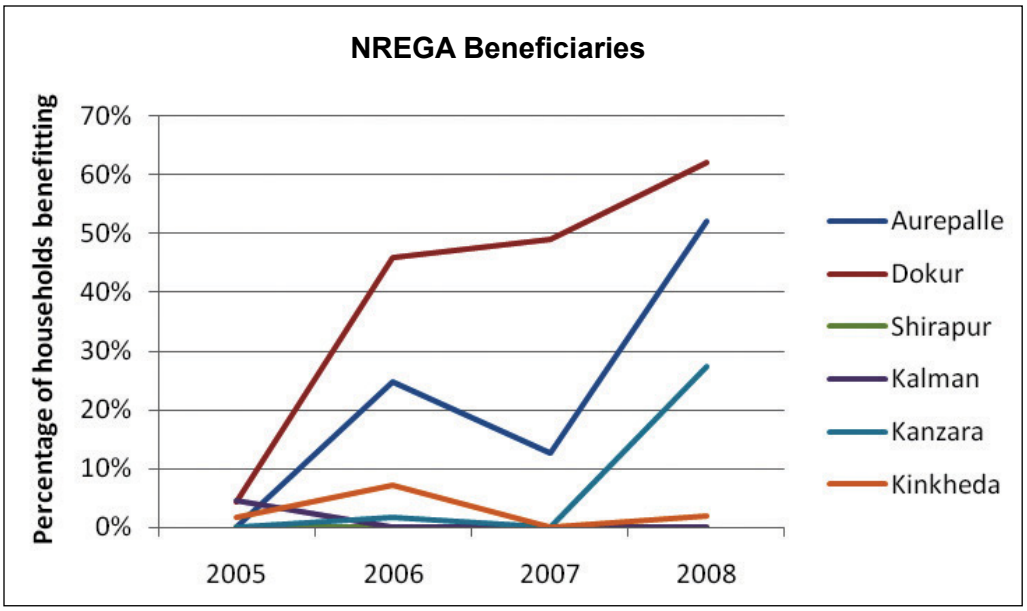

Figure 7. Households reporting benefits from NREGA.

Andhra Pradesh villages of Aurepalle and Dokur, where the non-farm sector has nearly doubled in Aurepalle and more than tripled in Dokur since 2001. Of course, unpaid domestic work is still overwhelmingly a female responsibility in all villages; both men and women report that women work longer hours than men because very few men help even minimally with household chores.

Regarding the relationship between mechanization and non-farm opportunities, it is obvious that both mechanization and the incidence of non-farm employment have increased over the same time period. However, a causal relationship is not clear since the villages with the highest rates of mechanization, Kanzara and Kinkheda, have the lowest share of people employed in non-farm opportunities. Accordingly, it is not clear that mechanization is the driving factor behind the increase in non-farm opportunities. For agricultural laborers that have been displaced by mechanization, laborers in Aurepalle and Dokur report that they are able to find work through government programs and private work such as construction. NREGA is most active in those villages (see Figure 7), likely contributing to the high percentage of people employed in non-farm work.

Table 5 also shows the percentage of people in non-farm occupations who are women. The differences between villages are striking. Women account for approximately half of non-farm workers in Aurepalle and Dokur, while their presence in non-farm occupations is insignificant in Kalman and Kinkheda after a high in 2001. In relation to feminization of agriculture, this data shows that off-farm opportunities for women are not limited in Aurepalle and Dokur and therefore cannot be said to contribute to the feminization of agriculture in those villages. For the other villages, it is mostly men who take non-farm opportunities, certainly contributing to the feminization of agriculture, but not explaining differences in levels of feminization of agriculture among the villages. For example, men and women in Aurepalle participate in non-farm occupations at approximately equal rates, but agriculture in Aurepalle is extremely feminized (Figure 3). Likewise, agriculture in Shirapur is the least feminized but has the third highest rate of non-farm occupations and a low female participation rate in the non-farm sector. Therefore, non-farm opportunities are not a main contributor to the feminization of agriculture. In relation to women's status, these figures do indicate that women's status is higher in Aurepalle and Dokur where they are represented nearly equally in the non-farm labor force. Men and women from all villages report that women are increasingly becoming self-employed with their own businesses in tailoring, shopkeeping and other endeavors.

Table 5. Non-farm employment (%).

	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Percentage of population employed in non-farm sector						
1975	18	7	5	4	14	1
1984	18	9	5	3	7	1
2001	26	16	22	11	17	28
2008	44	50	24	19	14	9
Percentage of non-farm labor force that is women						
1975	23	20	0	0	19	0
1984	42	21	0	0	18	0
2001	53	50	41	29	42	48
2008	49	45	13	5	13	0

Migration is the final factor offered as a cause of feminization of agriculture.

Table 6 shows the percentage of the population that is living outside of the village for the purpose of work or accompanying a person who is working. Migration is highest in Dokur and Aurepalle, and while the percentage of migrants who are women is highest there as well, the fact remains that it is mostly men who migrate from the villages. Migration seems to contribute to the feminization of agriculture to a higher extent than do off-farm opportunities within the village for two reasons; first, because a lesser percentage of women migrate than work in non-farm opportunities, and second, because the villages with the most feminization of agriculture, Aurepalle and Kalman, have relatively high, albeit not the highest, rates of migration. Like the data on non-farm opportunities, the data on migration indicates that women's status is higher in Aurepalle and Dokur where women make up a larger percentage of migrants, implying that it is more acceptable for them to travel outside of the village. Overall then, women's status in the non-farm labor market seems to be highest in the Andhra Pradesh villages of Aurepalle and Dokur where women's participation in the non-farm agricultural market is equal to that of men's and it is more acceptable for women to work outside of the village.

Table 6. Migration (%).

	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Percentage of population that has migrated for work						
1975	1	2	1	0	2	0
1984	0	2	1	1	3	0
2001	6	18	2	0	2	1
2008	8	14	0	3	3	2
Percentage of migrants who are women						
1975	0	0	0	0	40	0
1984	0	0	0	0	38	0
2001	28	43	25	50	0	0
2008	20	28	0	15	8	0

4.3 Education

During the first generation of VLS, very few children went to school. Women from laboring households in Aurepalle reported that maybe only one or two boys from their caste went to school during those years, because everyone in the family needed to work for their daily bread.

Figure 8 shows that enrollment for all castes was especially low in Dokur and Kinkheda and that no girls were enrolled in these villages during the years 1976 to 1979. The gap between boys' and girls' enrollment was especially pronounced during those years in all villages except Kalman and Kanzara, but by 1984 there were more girls than boys enrolled in Dokur, Shirapur and Kanzara. It is clear that improvement in school enrollment for boys and girls has been dramatic and even reached 100% for both boys and girls in Kanzara in 2001. Though gains in enrollment have been made, girls are being left behind in Dokur, where girls' enrollment for 2008 is the lowest and the gap between boys and girls is the highest. In the other villages, girls are sent to school at virtually the same and even higher rates than are boys.

The increase in enrollment is partly explained by mechanization, which has decreased the need for children's labor and therefore decreased the opportunity cost of their education. However, the village of Dokur has a relatively high level of mechanization but also the lowest enrollment rates. Clearly, other factors are important. Government schemes are seen as having the most impact on raising enrollment rates for both boys and girls. These schemes include the Mid-Day meal program as well as other incentives such as free books, uniforms and busing. The Mid-Day Meal program encourages school enrollment by providing a free, rice-based lunch at school, increasing incentive for families, especially for those who might not be able to provide their children with a lunch at home, to send their children to school. In Dokur, where girls' enrollment is quite low, relatively few households benefitted from this program (Figure 9).

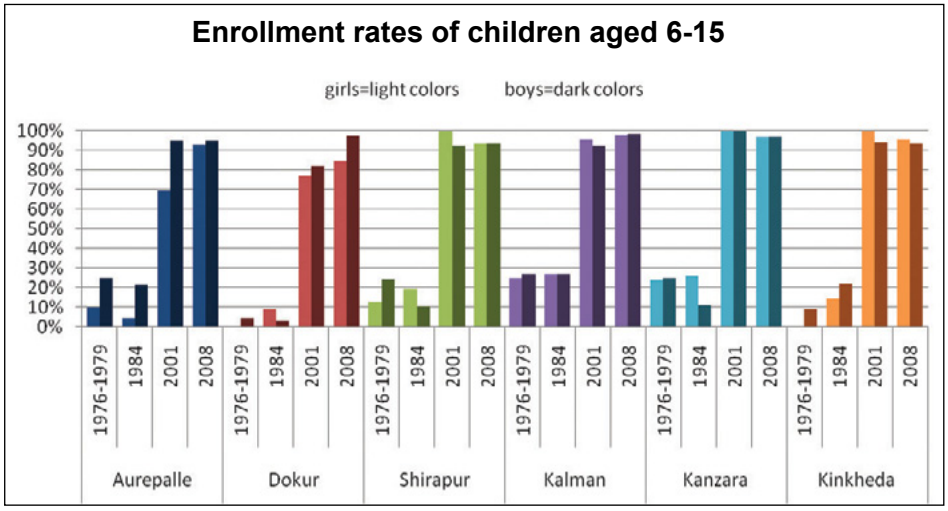

Figure 8. Gender-disaggregated trends in school enrollment.

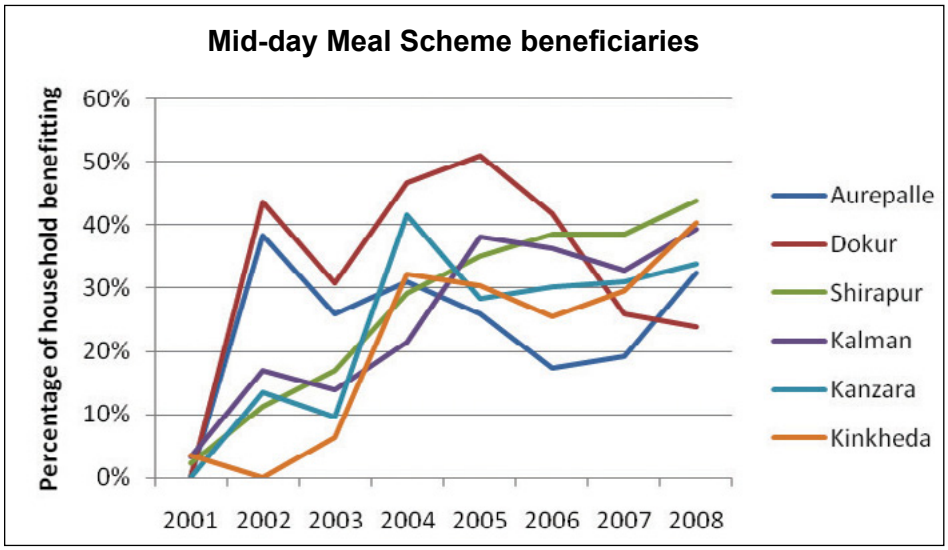

Figure 9. Percentage of households reporting benefits from Mid-Day Meal program.

The statistics on the Mid-Day Meal program do not make as good a case for its efficacy as anecdotal evidence from village parents themselves who participated in focus group discussions; overall enrollment rates in Aurepalle and Dokur have risen substantially since 2001 while the percentage of households benefitting from the scheme has fluctuated. In Maharashtra, enrollment rates have stayed constant or even decreased over the same period while the breadth of the program has grown. Parents in the villages cite the Mid-day meal scheme as a reason for enrolling their children in school, and non-parents attribute rising enrollment rates partially to schemes such as these and partially to increased value placed on education for girls as well as boys. The fact that the Andhra Pradesh villages were quickest to capture benefits from this scheme, as they were with NREGA, provides further evidence that the villages in this state have better governance than the Maharashtra villages.

Agricultural modernization has indirectly contributed to rising literacy in rural communities through its link to increased school enrollment. Literacy rates for men have stagnated in the Akola villages of Kanzara and Kinkheda, while women's literacy there has made such large gains that the literacy rate for women is now higher than that for men. Women's literacy is still lower in the other villages, but like girls' enrollment, women's literacy is lowest and the gap between men and women is greatest in Dokur.

Table 7. Literacy rates (%).

	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Male literacy rates						
1975	29	36	56	50	60	75
2001	49	50	75	76	90	94
2008	80	75	74	77	63	76
Female literacy rates						
1975	8	10	22	18	29	32
2001	14	17	54	50	67	75
2008	70	57	68	74	67	80

Figure 10 and Figure 11 track the generational changes in literacy rates. Clearly, enrollment and literacy rates are influenced by local culture as the villages are paired over time according to region; the Akola villages of Kanzara and Kinkheda have historically had higher literacy rates for both men and women, while the Andhra Pradesh villages of Aurepalle and Dokur have had the lowest. The generation of men born between 1970 and 1979 in Kanzara and Kinkheda were the first to reach 100% literacy, while women born between 1980 and 1986 were the first generation of women to do so, from those same villages plus Shirapur. The youngest generation of adults as of 2008, those born between 1987 and 1992, are 100% literate in all villages except Aurepalle and Dokur.

Not only has enrollment and literacy improved for women as well as men, women and men are attaining higher levels of education. During the first generation VLS studies, literate men and women had only attained a primary school education, with some having begun the next level of studies. In the last decade, a high school education has become the norm. Figure 12 demonstrates that girls in all villages are completing more years of school now than they did in 2001, though an average gap of a year or so exists between their attainment and that of boys'. Notice that in Dokur, where girls' enrollment most lags behind that of boys,' girls who are in school are completing the second-most years of school after Kanzara, and the gap between their attainment and boys' is the smallest. During focus group discussions, all villagers stated the value that they put on girls' education, and that the girls are encouraged to remain in school for as long as they want and to achieve levels as high as they can. Parents want their daughters and sons to pursue an

education in order to land salaried positions, either in government service or in the private sector because of the corresponding economic benefits and social status.

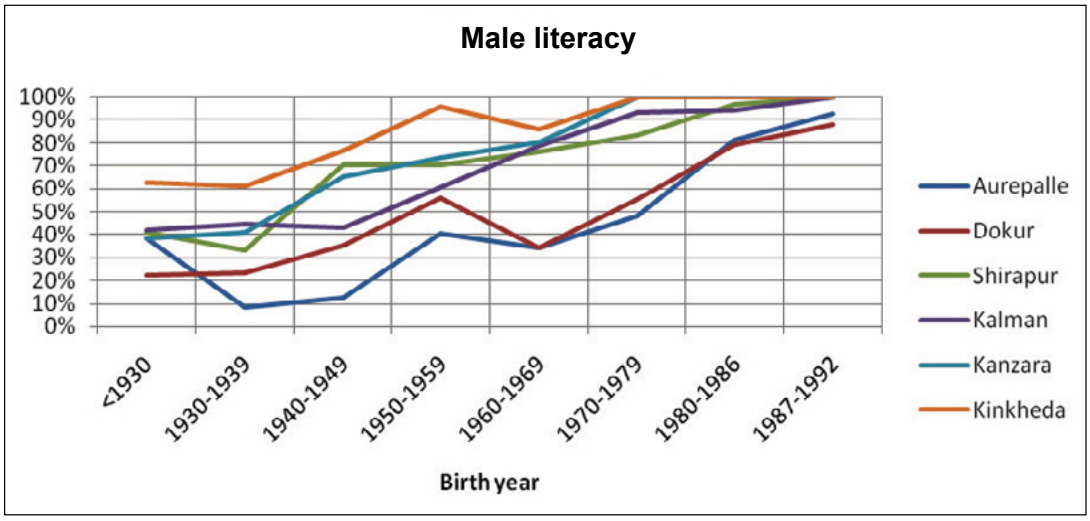

Figure 10. Trends in male literacy.

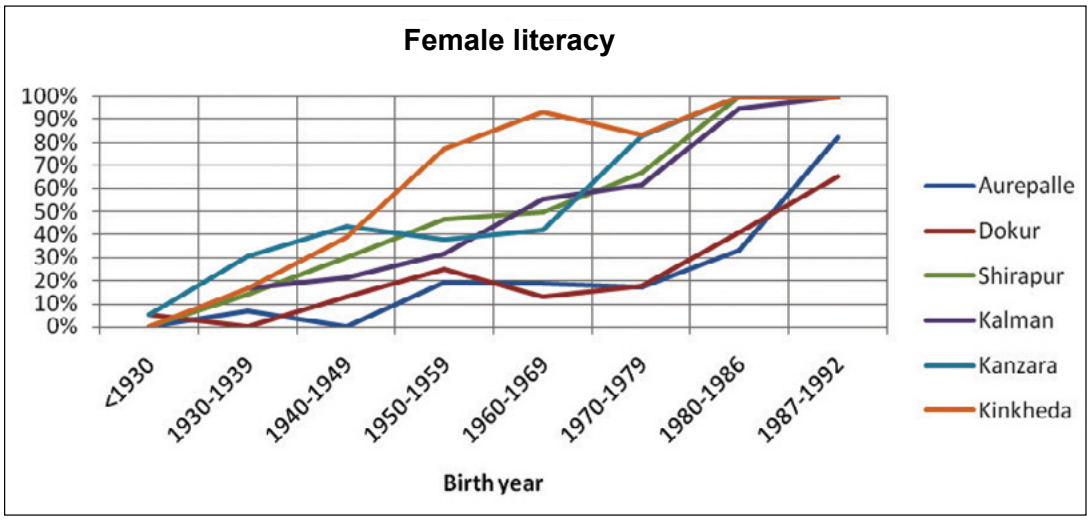

Figure 11. Trends in female literacy.

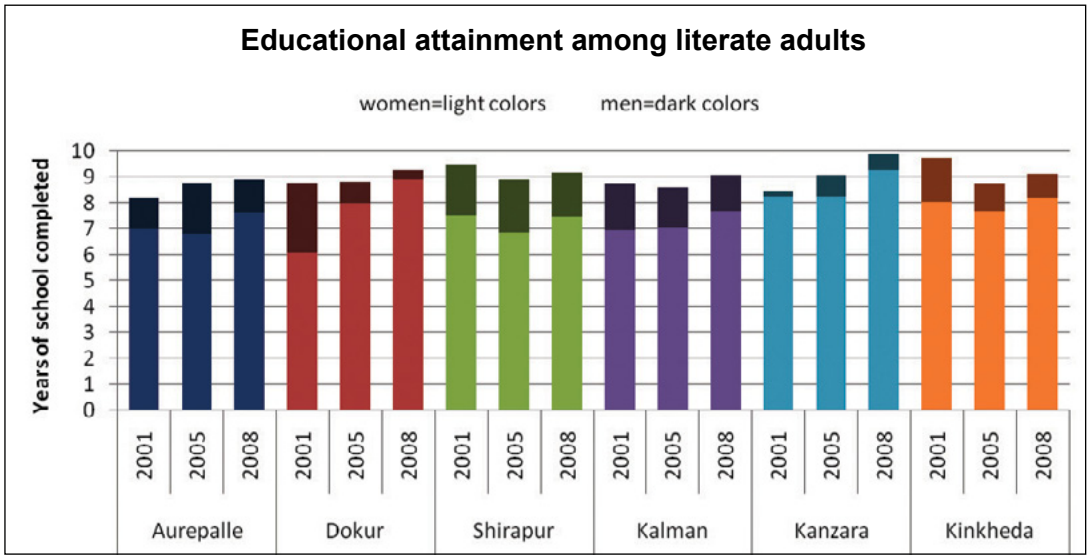

Figure 12. Gender-disaggregated educational attainment.

As of 2008, education did not seem to be causing an increase in rural to urban migration from these villages, at least not statistically speaking since migration is lowest in the villages with the highest educational indicators (see Table 6). Overall, trends in education in terms of enrollment, literacy rates and attainment levels indicate increasing women's status in all villages. Though Aurepalle and Dokur lag behind in this respect, there has been an enormous shift in attitudes toward education there, so these villages are expected to catch up soon.

4.4 Health

An increase in modernization and subsequent increase in income should improve women's ability to access health care and should improve their general health status. Two indices were used to measure changes in health. Dr Kim Chung, then a PhD candidate, collected food-security related information in four of the six VLS villages in the early 1990s. From this dataset, the average body mass index (BMI) for women (and men where possible) was calculated.[8] In all villages for which 1992 data was available, average BMI fell below the 18.5 malnourishment threshold (Figure 13). From this graph, it is clear that general health as indicated by average adult BMI has improved since 1992; likewise, malnourishment rates have fallen as well. Surprisingly, the average men's health BMI was lower than women's in most cases, which may indicate that women are not necessarily the first to sacrifice their own food intake when there is not enough.

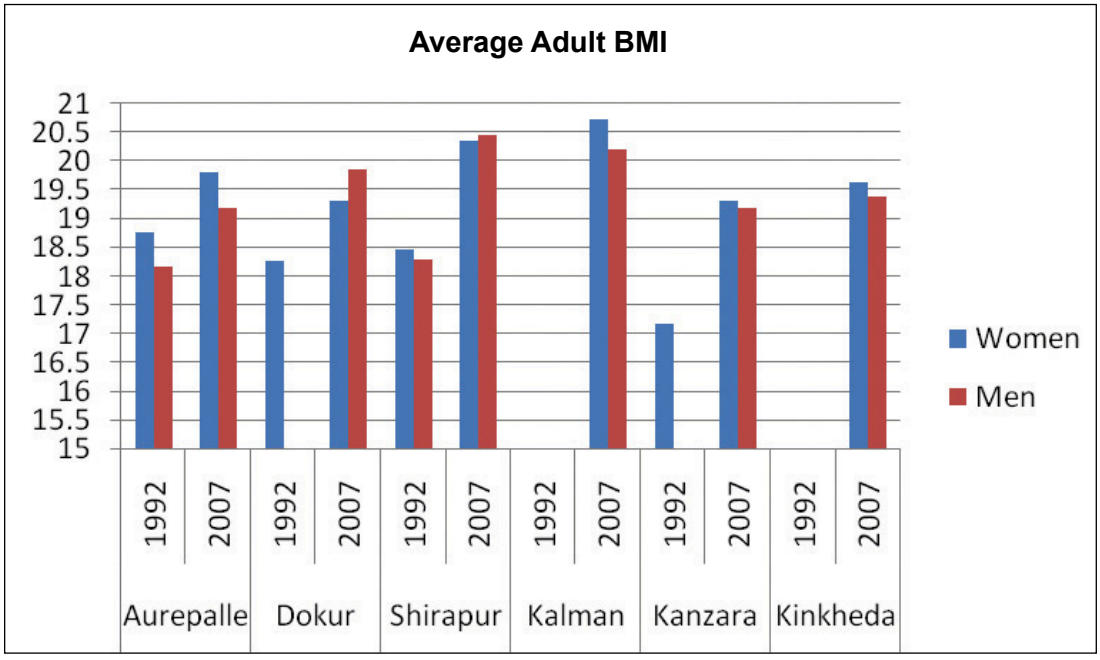

Figure 13. Average BMI for adults over 15.

A second indicator of women's health status is access to prenatal and maternal care for healthier pregnancies, safer deliveries, and healthier children. Women in all six villages reported that 40 years ago, all women gave birth at home in the presence of a few female family members, with no trained medical staff. Procedures and customs that were routinely followed in the villages in the recent past include pushing on the woman's abdomen during labor (leading to hemorrhage), using cow dung as an antiseptic on open wounds, secluding the new mother and infant in a single room for 21 days, and not feeding the infant colostrum (the first and most nutritious milk). These practices resulted in high rates of maternal and child mortality. Now, women report that everyone goes to at least a government hospital if not a private hospital to

[8] BMI is basically a ratio of weight to height (BMI=height in cm/(weight in kg/100)2) and is considered a decent indicator of overall health. A BMI between 18.5 and 23 is considered normal range, and BMI below 18.5 implies malnourishment or eating disorders.

give birth. Government hospitals do not charge for delivery and even provide 1000 rupees' worth of quality food to the mother. Prenatal, maternal and child health has improved in the villages due to the presence of government health care workers, some stationed permanently in the villages and some who make regular weekly rounds to check up on women and children and distribute medications. At a discussion in Dokur, one of the village health workers was present, and reported that in the six years that she had been there, she only had to deliver a baby once. Based on these basic indicators, health status of both women and men has improved, as has access to maternity care.

4.5 Marriage

The age at which girls are married is an important indicator as to women's status in their village, and the trend is rising age at marriage for girls across all villages (Figure 14). In the Sholapur villages of Shirapur and Kalman, the first reason given for this increase was always that the government had banned child marriages. As a secondary explanation, focus group participants there explained that young girls (it was common for girls to be married off between 8 and 12 years) were not mature enough to handle family life, reproduction, et cetera. Local culture does not seem to play as strong a role as other factors in girls' age at marriage, since the age of women who were most recently married are not grouped by region. Primary reasons given for a drastically rising age at marriage for girls in Aurepalle and Dokur were that girls could pursue an education and ideally salaried work. This explanation is supported by the data; girls' educational attainment is highest in Dokur and Kanzara, where the average age at marriage is also highest. Attainment and age at marriage statistics align for the lowest two villages, Shirapur and Aurepalle, as well.

Another significant reason given for increasing age at marriage for girls was because families need more time to save enough money to pay for the girls' dowry, which has increased in terms of the amount required as well as the social strata that practice it. Even though dowry is a factor in increasing the age at marriage for girls, the increase in age at marriage itself is an undoubtedly positive sign for women's status. They are entering into marriage as adults, and they will not face the unnecessary health risks of having their first children as young teenagers. While the age at marriage for girls has been steadily increasing, that for boys has either stagnated or increased slightly compared to that for girls. The implication of this is that the age

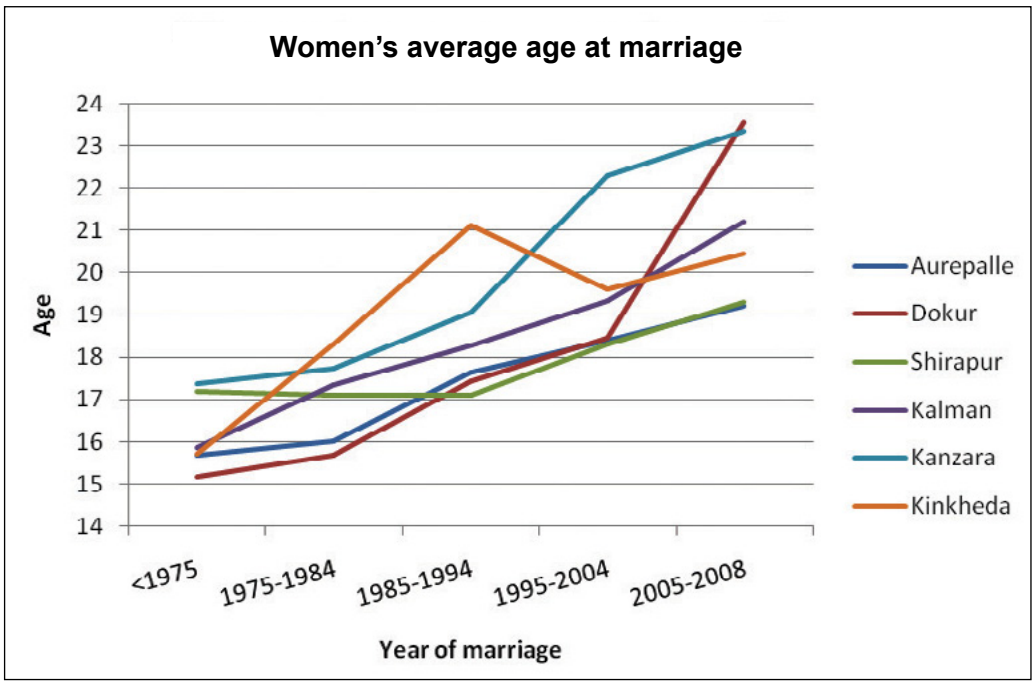

Figure 14. Trends in women's age at marriage.

gap between husband and wife has decreased, increasing women's status since they are no longer children marrying grown men, but women marrying men at a more similar age level.

Rising age at marriage for girls has a direct impact on family size. Simply because she has missed out on reproduction during her teenage years, there are fewer years left during which she can bear children. Not only that, but rising costs of raising children, education, and less demand for family agricultural labor are also reported as factors that have deceased the desirability of large families. Government family-planning schemes play a very important role in bringing down the birth rate; villagers report that knowledge of family planning and access to the prescribed methods was and continues to be provided by the government. The overwhelmingly used method of family planning is tubal ligation, which is provided free of charge at government hospitals. Though giving women control of reproduction is a positive development for women's status, the fact remains that such control is seen as a female responsibility; male vasectomy is less invasive and carries less risk than the female operation, but is not used. Villagers in the Sholapur area added that the operation for women is only free after two children, providing incentives to keep family size small. Many villagers have also repeated the government slogan, "Small family happy family."

Lower-caste women in the villages recall that 40 years ago, women of their status had as many children as they could; true, family planning knowledge was lacking but numerous children were like insurance because starvation was a looming threat, children over 6 were income-earners, and child mortality was high. Upper-caste women say that women of their standing had or wanted around 4 children in previous years. Nowadays, however, women and men from all castes report that one or two children are sufficient. The caveat is that one child means one son, and two children means one boy and one girl or two boys. With varying degrees of forwardness, villagers conceded that if they have two girls, they will keep trying to have a boy. In a society where girls move out of their families' homes at marriage, and where a son is needed to perform the last rites of the parents, this preference for boys is unlikely to change. This preference for sons is also increasingly related to dowry.

Traditionally, dowry was the practice of the girl's family giving her valuables, usually gold, at the time of marriage that she took with her to her in-law's house. Nowadays, dowry price has increased dramatically and has become a gift paid by the bride's family to her new in-laws that may include vehicles, gold, appliances, land and cash. The government has outlawed the practice of dowry, but this ban has been ineffective.

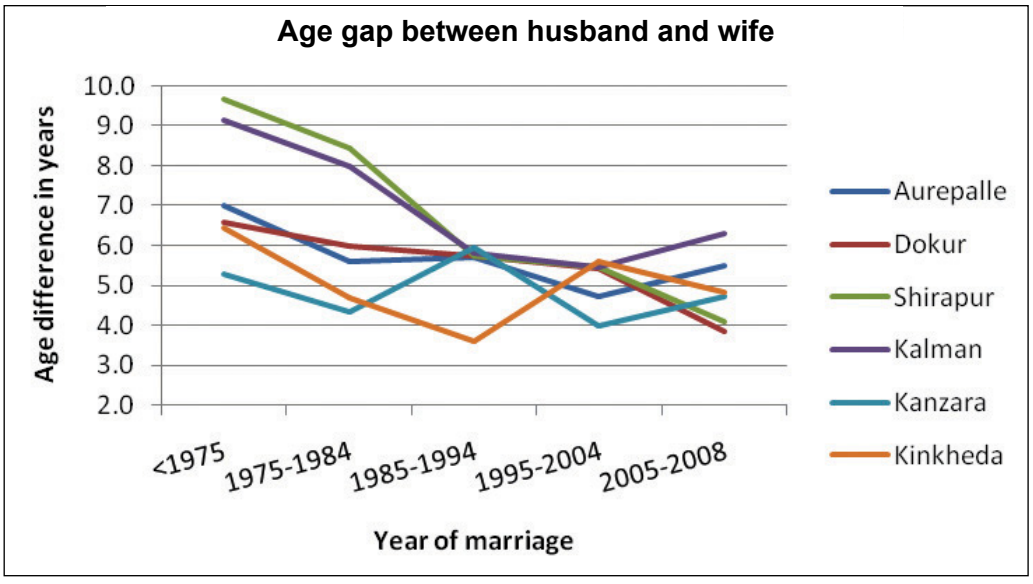

Figure 15. Trend in age difference between husband and wife.

Figure 16 below displays the average amount of cash paid in dowry since 2002.[9] This shows only a slight real increase in dowry over the last several years, but this figure only includes cash as it is virtually impossible to determine which other household purchases might be explicitly for dowry. Furthermore, the sample size is relatively small (n<10 marriages per village household sample per year) and households may not report dowry transactions accurately since it is illegal. Dowry is noticeably higher than in the other villages in Dokur and is especially high in Aurepalle.

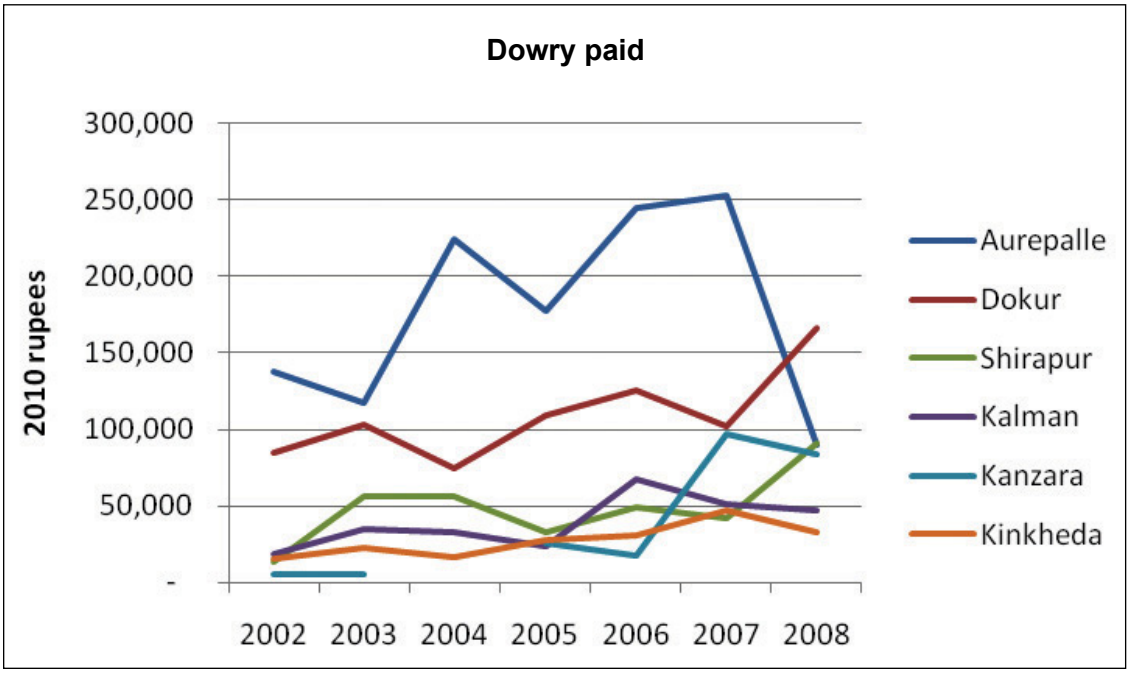

Figure 16. Dowry paid in 2010 rupees, outliers removed.

The two main reasons for increasing dowry, which are consistently given in all focus group discussions, are rising disposable incomes (supply-side) and increasing education (demand-side). In other words, the price of dowry has been allowed to increase because there is simply more money to be spent on such things. Education plays into dowry because an educated boy is obviously more desirable than an uneducated one. The boys' families are acutely aware of this, so dowry price increases according to the level of education and the salary of the boy.

Wealthy male farmers in Dokur explained that they welcomed the new, exaggerated dowries because through it they feel they are able to ensure their daughters' happiness by providing a comfortable lifestyle in their in-laws' homes. All other focus group participants have expressed grave concern, especially for the laboring and low caste households. A man present during the lower-caste women's discussion in Dokur added that their caste used to practice reverse dowry, where the boys' family gave modest gifts of food and alcohol to the girls' family. He attributed rise in dowry among his caste to rising incomes, but also what can be called more market awareness–families are very aware of what others are paying and asking for dowry. There are stories of families who, not having any land or other assets, have sold off their house and live alongside the road just to see that their daughter could be married, or, seen as worse still, their daughters have not gotten married at all. One woman repeated a rumor that one laboring household had recently asked the equivalent of USD 9,000 in dowry.[10]

[9] Figures first became available in the 2002 data. Dowry in terms of 2010 rupees. Four outliers in the data set were replaced with averages, namely an outlier of 45,480 rupees in Dokur in 2005, 754,329 rupees in Aurepalle in 2005, 134,081 rupees in Shirapur in 2006, 241,543 rupees in Kinkheda in 2005. Data on dowry-related transactions were not gathered in Kanzara in 2003 or 2004.

[10] As a rumor, this claim cannot be verified. It is not so relevant that it is factually true, but that it is a viral rumor that is adding to "market awareness" and thus raising the bar for dowry price.

During a focus group discussion about dowry, a male village elder in Kalman reported that sex-selective abortion happened, albeit in rare cases.[11] The more telling evidence came in Dokur. After the focus group discussion concluded and the women began chatting amongst themselves, a topic of much fanfare broke out. The village investigator interpreted that they were talking about the increasing number of baby girls being found abandoned at the bus station in the larger city of Mahbubnagar for orphanages to find or just discarded in dust bins. Because the women offered up this unsolicited information about a sensitive topic, it is obviously a trend they find very disturbing. This group explained that some doctors can be bribed to provide the information and then perform an abortion, which they know happens, but always very silently. The even more grave danger of dowry is for women of lower classes who may not even have the means to bribe a doctor; the same women in Dokur were also discussing how one can tell if the fetus is male or female by looking at how the woman is carrying. Though lost in translation, this seemed to be a reference to do-it-yourself type, late-term abortions. More often though, women feeling pressure to bear a son may be offered "ayurvedic" solutions guaranteed to ensure that the fetus is male, but the contents of such mixtures are unknown and can be harmful. Like the older man in Kalman observed, the women in Dokur and even ICRISAT staff members have noticed that there seems to be a shortage of girls in the villages.

4.6 Empowerment

Women's self help groups (SHGs) have been extremely important to women's empowerment and were formally introduced to the villages by the government, which continues to supply funds. Through SHGs, women save money and then use that money to make loans to the group's members, essentially creating a small-scale bank. Since women have traditionally not had access to banks as a source of credit, creation and participation in SHGs has had an enormous, empowering effect on women.

Figure 17 shows the percentage of households reporting benefits from women's SHGs. Participation is considerably higher in the Andhra Pradesh villages of Aurepalle and Dokur, precisely where women of all castes appear to be most empowered according to observation and personal interaction.

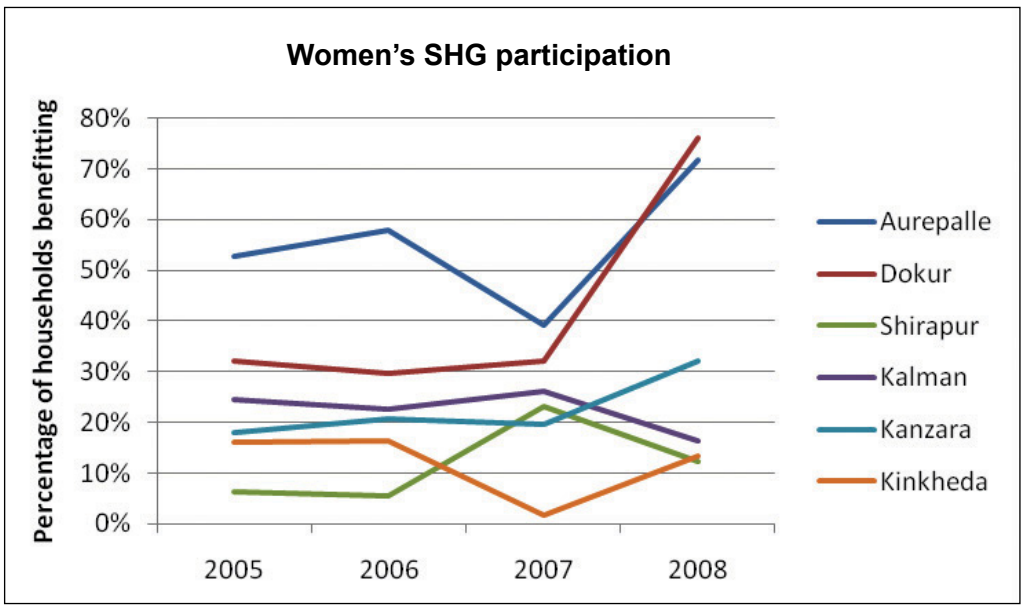

Figure 17. Percentage of households reporting benefits from women's self-help groups.

[11] This man was asked specifically about sex-selective abortion after he mentioned that the female population was less than the male population, suggesting that the village sex ratio is noticeably low.

Not only do women gain some financial independence through SHG savings and loans, they also get the opportunity for fellowship with other women to discuss other aspects of their lives. As one woman from Dokur explained, her SHG always has a discussion of problems the women are facing and possible solutions to those problems. Men in Dokur report that the women's SHG have made the women more aware and "developed"–they actually use the English word "development". The men say that women are even buying their own agricultural inputs such as seeds and fertilizers without any help from the men now, and that the ladies queue for fertilizers is given preference over the men's queue! From the men's perspective, the only negative aspect of the women's SHGs is that when the women go for their meetings once a month, they are gone from morning until early afternoon, so the men are hungry waiting for their lunch in the fields. Overall, men and women in Aurepalle and Dokur are quick to point out how much women's status and empowerment has improved in the last 40 years, and all but one man in the group was happily accepting of the women's higher status. One of the men joked that they actually take orders from the women in their homes now. Women in Shirapur and Kalman report that their lives have improved in the last 40 years as well, but the women in Aurepalle and Dokur seem especially empowered, a sentiment reflected by the high rates of SHG participation there.

Enormous changes have taken place for women in the public sphere. Thirty or 40 years ago, women generally did not go out in public, much less vote or run for public office. Now they participate in all of those affairs. Whereas women in Shirapur and Kalman said that they decide for whom to vote by asking their husbands, women in Aurepalle and Dokur said that they decide for whom to vote as a household or a group of households, getting together to debate which candidate will better serve their needs. In all of the villages, women are running in elections, the 30% ladies quota in the panchayat (local government) is being observed, and the sarpanch (village mayor) in Kalman is a woman. Of course, women in public office may be puppets for their husbands, but it is still significant that they are being afforded these rights.

Another aspect of empowerment that is relevant to women's status is their access to productive resources and their decision-making power over said resources.[12]

Figure 18 shows the percentage of resources owned jointly, solely by men and solely by women in 2008. In the Andhra Pradesh villages of Aurepalle and Dokur, where SHGs are most active, women own more resources either through joint ownership or in their own right. As is evident by comparing Figure 18 with Figure 19, resource ownership is positively related with decision-making power over those resources. In villages where more resources are owned at least partially by women, women have more decision-making power; shared decision-making power is the norm where women own more resources, and the percentage of resources over which women have sole decision-making power is more equal to the percentage of resources over which men are the sole decision-makers.

Further analysis confirms that when women own a resource, they are more likely to have sole control over that resource. Table 8 shows that women have control only through shared decision-making over resources that are owned by men and that shared decision-making power for women over male-owned resources varies widely by region, again with women having more say in Aurepalle and Dokur. Conversely, women have sole control over nearly all resources that they own themselves, as the percentage of female-owned resources controlled solely by women is much higher than for resources controlled solely by men. Not only do these figures demonstrate the importance of resource ownership to women's decision-making power, but they also demonstrate that women can be empowered to have shared decision-making power over male-controlled resources, and men can be educated or re-socialized to allow women to take part in decision-making.

[12] Resources analyzed here are land, seed, own labor, machinery, fertilizer, pesticide, livestock, credit, investments and the primary produce from crops.

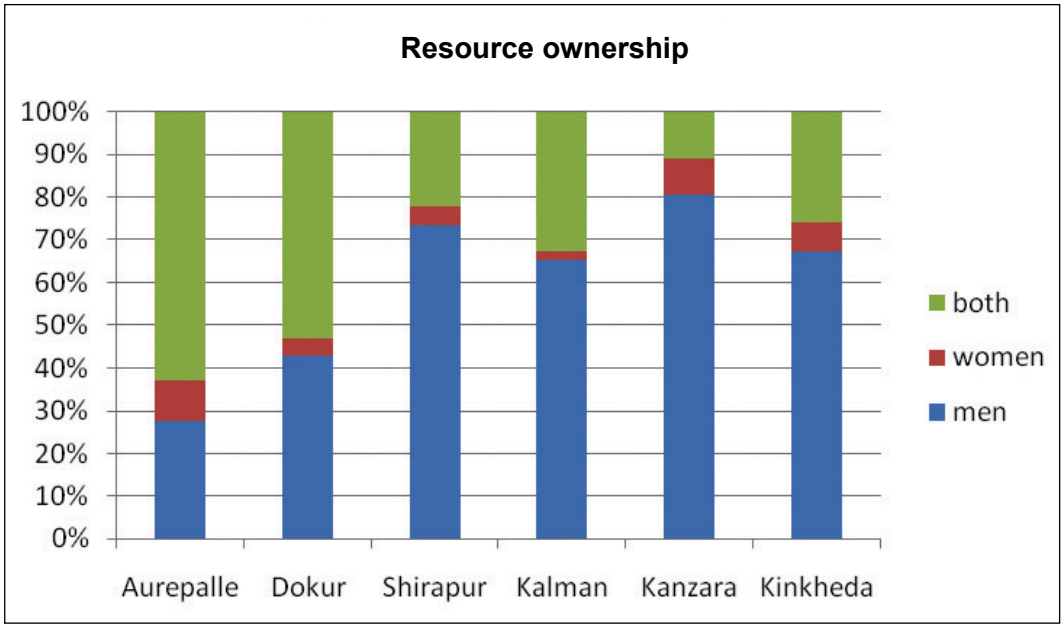

Figure 18. Gender-disaggregate resource ownership.

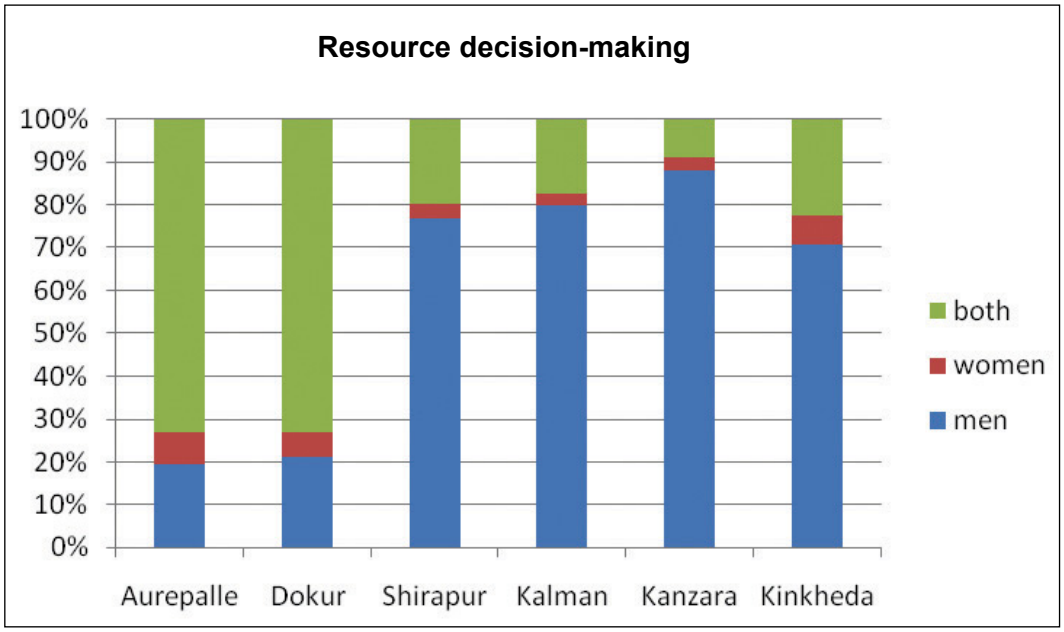

Figure 19. Gender-disaggregated decision-making power over resources.

Table 8. Effect of ownership on decision-making (%).

	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Men sole owners, women sole decision-makers	0	0	0	0	0	0
Men sole owners, decision-making shared	46	68	5	7	1	18
Women sole owners, women sole decision-makers	89	63	89	93	90	99
Women sole owners, decision-making shared	11	37	7	7	5	1

5. Analysis and Discussion

The main idea promoted by Vandana Shiva and other activists that increased use of advanced seeds leads to the dominance of monoculture and adoption of commercial crops, is not supported by data gathered during this study. Though use of advanced seeds has steadily increased in all six of these villages to varying degrees, there is no clear trend of abandonment of food crops. Neither is there a clear trend of increasing monoculture defined as the portion of land used to grow the top two crops. Therefore, the theoretic connection between increased use of advanced seeds and decreased influence of women based on the premise that women are the guardians and controllers of local varieties of food crops, is not supported by this study.

As women in all villages have observed, technology has improved their lives by eliminating some of the hard labor in the fields, but it is undoubtedly men who have benefitted more from this technology in terms of reduction of hard labor, meaning that their time can be spent on other productive tasks and on leisure. Interestingly, when asked about the effect that technology has had on their lives, women talk more about domestic appliances such as mixers and grinders and LPG gas connections than about benefits from agricultural technology. Firewood collection and grinding spices and vegetables into curries by hand required a lot of time, but with these appliances, cooking fires and grinding are instantaneous. So far, technology aimed at reducing the domestic workload seems to have had more of an impact on women's lives than has agricultural technology. Of course, this is from the vantage point of a woman who has such appliances, as most do,[13] and not from the viewpoint of the poorest women who may not have such things and who depend on the labor market for their livelihood.

In spite of gains in wage parity, women continue to be afforded a lesser status than that of men in the agricultural labor market, even though women work more hours in agriculture than do men. Women are still paid less than men for the same work, and women's wages are more negatively affected than men's wages by decreases in the demand for labor. In addition, said decreases in demand for labor are more severe for women's than for men's labor during years of widespread crop failures. Though NREGA is certainly a positive force for improving women's status through its indirect effect on agricultural wages, more expensive human labor is driving demand for more mechanization and more seed-chemical combinations (reduced intercropping), which further displaces [14] agricultural labor (especially women) and makes programs like NREGA more necessary to absorb excess labor (see Figure 20). The danger present in this cycle is the heavy reliance on a government program (NREGA) that gives artificial price signals. If NREGA were suddenly stopped due to political discord, which is entirely possible, wages would likely plummet and the excess labor would be only slowly reabsorbed, if at all, into an agricultural system heavily invested in labor-saving technology. Thus, women's status in the agricultural labor market has improved but is perilous since it is largely based on a relatively new government program that has yet to demonstrate its sustainability or be implemented on a meaningful scale in some of the villages.

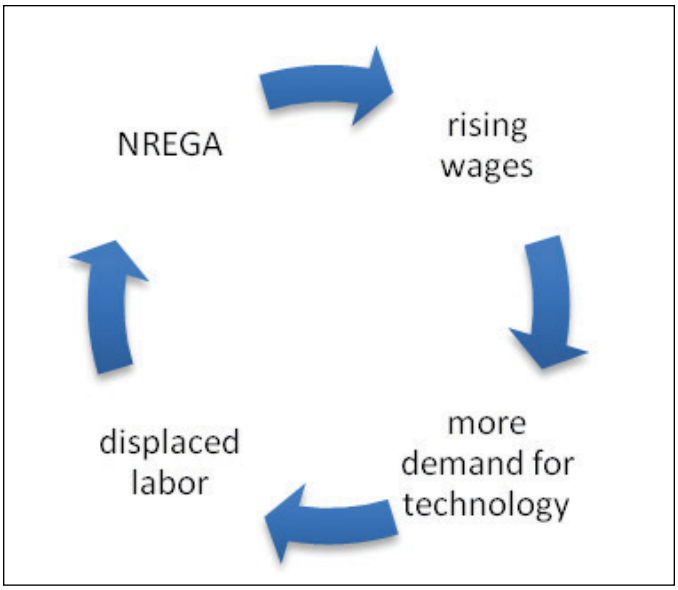

Figure 20. Cycle of rising wages and displaced labor.

[13] There is even a government scheme providing free/subsidized LPG gas connections and cylinders.

[14] The term "displaced" is used here with the logical assumption that as this cycle continues, family labor has already been "saved" and reallocated, and that the remaining human labor in agriculture is that of laboring/smallholder families whose livelihood strategy depends largely on the agricultural labor market.

An unintended and potentially negative consequence of NREGA through its effect on wages is the previously-mentioned decrease in intercropping (see Figure 2). According to anecdotal evidence gathered during focus group discussions, intercropping is being replaced by monoculture for two reasons: the cost of labor has increased, and "roundup ready" style seed-herbicide pairs are more available. More labor is required to weed and harvest intercropped fields, and labor, especially female labor used for weeding and harvesting, has become increasingly expensive due to the introduction of NREGA.

Figure 5 shows that female real wages increased tremendously between 2004 and 2005 and into 2006, precisely the time that the NREGA program was announced.[15] During the next cropping season (2005-2006), labor was more expensive due to this increased wage parity, especially in Kanzara and Kinkheda, exactly where intercropping decreased so sharply between 2005 and 2006. Moreover, herbicide use is highest in those villages (see Table 3). The decrease in intercropping should be some cause for concern since intercropping has positive benefits for soil productivity, implying that a decrease in intercropping may lead to a subsequent increase in chemical applications.

Mechanization, in either freeing people's time or displacing labor, has either allowed former agricultural laborers to establish themselves in non-farm endeavors or has made it a necessity. As education has increased as well, enough people have taken to non-farm opportunities that villagers are actually reporting a labor shortage during peak seasons nowadays. There is no doubt that this has worked in laborers' favor; whereas 30 or 40 years ago there was a surplus of laborers, they had little choice but to accept whatever pay was offered. Now the laborers have significantly more bargaining power due to the relative shortage of labor. In fact, in a focus group discussion, farmers from Aurepalle and Dokur reported that large landholders from nearby villages will go on a campaign of sorts to recruit laborers for peak season work, advertising their wages and other benefits such as free transportation that they are providing. Landowners explained that this labor shortage, along with government employment schemes that pay higher wages, which exacerbates the labor shortage, have worked to increase the price of labor.

Laborers report that wages are high enough now that they do not worry about what they will eat if they do not work every day and that their children do not have to work like they did and can go to school. Women from labor class households report that there is still work to be done in agriculture, especially in weeding and harvesting, and if they are not able to find work in agriculture, they find work in the less preferred private sector, doing construction and mud work, or in government schemes. Agriculture is the most preferred since they say that the labor is not as hard as in the private sector jobs, and government schemes are the second choice since they pay more and still do not require work as hard as that in the private sector.

Though higher income has brought a myriad of benefits, it has also led to inflation in the price of dowry. Women from higher castes will say that dowry is bad for women, citing its illegality, but will fall short in explaining why it is bad for women, only saying, as women in Shirapur did, "we give dowry, but we receive it too." Dowry has a direct and negative impact on women's status through at least two channels. First, couples (especially women) of child-bearing age face huge financial incentives to have sons and even larger disincentives to have daughters. With the advent of affordable ultrasound technology in the last two decades, couples have been able to know the sex of the unborn child. Millions of women are purportedly "missing" in India due to sex-selective abortion and female infanticide. It is virtually impossible to determine through statistical analyses if the sex ratios in these villages are significantly different than they should be at a meaningful level of confidence, simply due to insufficient sample size, but anecdotal evidence through focus group discussions shows that it is a concern.

[15] Though male wages increased as well, female wages were more affected. Male wages rose most sharply in the Sholapur villages of Shirapur and Kalman, but the focus in explaining decreased intercropping is on the sharp drop in Kanzara and Kalman and to a lesser extent, Aurepalle and Dokur, between 2005 and 2006.

The second reason that dowry is detrimental to women is that, with so much money on the line, women risk becoming objects of extortion in situations where the boy's family demands more dowry after the original, agreed-upon dowry is delivered. Some say that such cases are rare and some claim that extortion happens more commonly than can be known, since girls' families have little choice but to resolve the issue swiftly and silently. The media has covered cases of domestic violence and even "dowry deaths" due to this type of situation, but the more common scenario is that the boy's family will threaten to divorce the girl if the family does not deliver.[16] The boy's family may abandon the girl and any children at her family's home, without paying a sum of money as is customary in cases of divorce. A divorced woman without children may remarry, but if she has children, she may not remarry since she is seen as having been "spoiled" by her ex-husband. Women feel there is nothing they themselves can do to change the dowry system; they could refuse to pay dowry, but then their daughters remain unmarried. They could not ask for dowry for their sons, but then no girl's family will want to make an "alliance" with them, wondering what could be wrong with the boy. Clearly, recent inflation in dowry, especially in Andhra Pradesh (refer to Figure 16), is severely detrimental to women's status and threatens to outweigh the positive developments in other aspects of women's status.

Regarding divorce, women in Shirapur and Kalman insisted that it is illegal for an Indian woman to get divorced. This is obviously not true, but they are under the impression that it is simply not possible. Even in cases of ongoing domestic violence, they are very firm in their belief that everything is solvable within the family. Conversely, the women in Aurepalle and Dokur know that divorce is legal, that it does happen, and that the boy's family has to compensate the girl in the case that she cannot remarry.[17] Though this demonstrates that the participating women in Aurepalle and Dokur are more aware of their rights than are those in Shirapur and Kalman, there is much room for improvement. It is legal for women in India to remarry whether or not she has children from a previous marriage, but as mentioned earlier, a previously married woman with children is seen as "spoiled," while men might have two wives at the same time. Overall, women's status in aspects related to marriage and family life has improved since women are getting married as legal adults to men of a similar age and have more control over reproduction, but preference for male children persists and dowry has soared.

In both sets of villages where focus group discussions were held, it is telling that when ICRISAT first started the VLS, it was very difficult to talk to any women at all, and that a high-caste, prosperous farmer had to use his way with the sarpanch to allow any investigators to work in the village. Before, women in Dokur recalled that they would not go to meetings with men because they did not know anything about what was being discussed, and they feared not agreeing with the men's opinions. Now, men and women have meetings together, and women say that they are aware of the issues and want to be involved. The women in Aurepalle and Dokur were much more vocal in the meetings where men were present than the women in Shirapur and Kalman. In fact, the focus group discussion with low-caste, laboring women in Dokur took place in front of the village sarpanch! The women had animated conversations and freely advanced their opinions even in his presence. Women in all of the villages say that they feel equal to men now.

[16] This paragraph draws heavily on the focus group discussions in both Andhra Pradesh villages of Aurepalle and Dokur where dowry is higher and thus a more imminent issue than in the Maharashtra villages.
[17] This is the local custom, not a legal obligation.

6. Conclusion and Recommendations

This report analyzed three main drivers of change in women's status. First, seed technology has increased incomes over time. Farmers choose advanced seeds in increasing quantities year after year for a reason. Increased income allows more families to send their children to school and allows better access to health care, but has put upward pressure on dowry. Thus, seed technology has indirectly improved women's status in terms of education and access to women's health care needs.

Second, mechanization has further set the stage for increasing women's status through its function of decreasing demand for human labor. Though mechanization has freed time for men more than for women, women's time has been freed to a lesser extent. Feminization of agriculture has resulted due at least in part to mechanization, and while not good or bad for women's status in and of itself, does result in lower women's status if their role in agriculture is unacknowledged, access to inputs in limited, or decision-making power is weak. Importantly, child labor is no longer as necessary, so the number of children desired has decreased while the opportunity cost for children's schooling has also gone down. Additionally, growing participation in non-farm occupations has created a shortage of labor, especially during peak seasons. Indirectly, then, mechanization has improved women's status through making education less costly, putting downward pressure on family size and putting upward pressure on wages over the long term as more laborers establish themselves in non-farm occupations.

On the debit side, agricultural modernization has also had side-effects that have implications for public health. These side effects include a noticeable increase in pests and a decrease in intercropping in recent years, resulting in more chemical use. Farmers have voiced concerns about the high use of chemicals and its effect on villagers' health, and in some areas where fertilizer application is a feminized task, this would pose another threat specifically to women's health and status.

Although agricultural technology has set the stage, the main reason for women's empowerment is government incentives and legislation. Indicators of women's status that have improved over time are girls' enrollment, female literacy, maternal health, reproductive control, age at marriage, wage parity, access to credit, economic independence, and social and political empowerment. All have been largely due to government action. By contrast, government action has so far had little impact on the practice of dowry, which has increased in the period under review.

There are several recommendations that can be made for agricultural development programs based on this research. In recognition of increasing feminization of agriculture, development programs must ensure that a certain percentage of participants are women so that they become empowered to have greater decision-making power, more market connections, and improved knowledge of inputs and techniques. Given the connection between women's ownership of resources and decision-making power, development programs must be aware of any local customs or even laws that prohibit women's ownership and devise an action plan, if feasible, to support women's ownership rights. Also, programs need to be sensitive to any additional labor that would be placed on women and girls within the household. For example, programs aimed at increasing yields must recognize that the need for labor during harvest will be that much greater, that harvesting is a highly feminized task, and create a plan to make sure that additional burdens are not placed on family female labor but siphoned to create needed employment for female agricultural laborers. Since women do virtually all domestic work, development programs should make an effort to include technologies that save women's time on domestic chores and even encourage men to participate in domestic labor. Wage parity is another issue that can be addressed by development programs by requiring participating farmers to pay equal or at least more equitable wages to women. Furthermore, women's self help groups seem essential to true empowerment, not only in terms of access to financial services and subsequent resource ownership, but

also socially and politically, and some support for such groups should be included in development projects whenever possible. Finally, increasing dowry in some regions is a cruel pressure for women to face, and perhaps raising awareness about the basic biology of sex determination would help relieve this pressure on women. Moreover, since dowry is spurred by higher income, projects that aim to increase income also need to address the issue of dowry, perhaps simply by talking about it or by encouraging community members to organize in opposition wherever dowry has become a problem. By drawing on the wealth of information from VLS, agricultural development programs can help ensure continued gains in women's status.

Appendix

Schedule of focus group discussions and interviews

Focus group discussions

ICRISAT Campus: Women farmers from Aurepalle and Dokur. 11 February 2011.

Shirapur Group 1: Women, mixed castes. 16 February 2011.

Shirapur Group 2: Women, mostly upper caste. 16 February 2011.

Kalman Group 1: Women, mixed castes. 17 February 2011.

Kalman Group 2: Men and women, mixed castes. 17 February 2011.

Aurepalle Group 1: Women, mixed castes. 15 March 2011.

Aurepalle Group 2: Women, low castes. 15 March 2011.

Dokur Group 1: Men, mostly upper caste. 16 March 2011.

Dokur Group 2: Women, mixed castes. 16 March 2011.

Interviews

Y Mohan Rao, 15 March 2011.

VK Chopde, 1 February and 12 April, 2011.

R Padmaja, 1 March 2011.

Shiva V, 21 September 2010.

About ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, and 644 million of these are the poorest of the poor. ICRISAT and its partners help empower these poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture.

ICRISAT is headquartered in Hyderabad, Andhra Pradesh, India, with two regional hubs and four country offices in sub-Saharan Africa. It belongs to the Consortium of Centers supported by the Consultative Group on International Agricultural Research (CGIAR).

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