

The Dynamics of Rural Change in Dry Agriculture in Sudan

Case Study from Southern Kordofan

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ABSTRACT

The general processes of rural transformation in Sudan and elsewhere in Africa often emerged as sources of tension between various household endogenous systems and the agro-industrial system which represents the exogenous influence upon them. From the discussion of the theoretical and the underlying linkages involved in this transition in the Sudanese context, it emerges that not much attention has been paid to what is working at the micro-level of the development problems facing the subsistence households. This study attempts to fill this gap in research; it briefly reviews previous studies to establish the general terms of reference and to suggest a simple household model, based on household theory, for tracing the production-consumption nexus at the subsistence household level. The study brings into focus the agrarian household's links to the wage economy and to the subsistence production. It uses these two dimensions, firstly, to question current assumptions about the eviction of subsistence peasants, their proletarianisation, and the agrarian development that dominated the discussion on the peasant economy in Sudan, and, secondly to develop an alternative for understanding the factors that govern the agricultural behaviours of the smallholders as well as the dynamics of change in rural Sudan. These two points are explored in a case study of three types of hierarchy of places drawn from Southern Kordofan region.

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and heavily involved in putting off the initiative in mechanised farming in the Eastern and Central Regions of Sudan. The World Bank, which was active in financing the expansion of irrigated agriculture, became more involved in dry farming. Three mechanised farming projects were implemented by the World Bank. Two were implemented through the Sudanese Mechanised Farming Corporation (SMFC) in the years 1968-1973, and the last one was implemented through the Sudanese Mechanised Farming Corporation (SMFC) in the year 1978.

The influx of the mid 1970s gave the new partners for this subsection. Saudi Arabia became the main importer of the Sudanese sorghum for use in its animal feed-for projects.

As a result of these developments, the mechanised subsector in dryland areas covered an estimated 3.7 million hectares (10.2%). The main produce in this subsector is sorghum (dura), the main food crop in Sudan, according to World Bank (1990) constitutes 50% of the marketed surplus in Sudan. The two subsections, the irrigated and dry agriculture, make up 90% of the Sudan's modern agricultural sector (Figure 1 shows the main areas of irrigated and sorghum production in the Sudan).

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1. INTRODUCTION

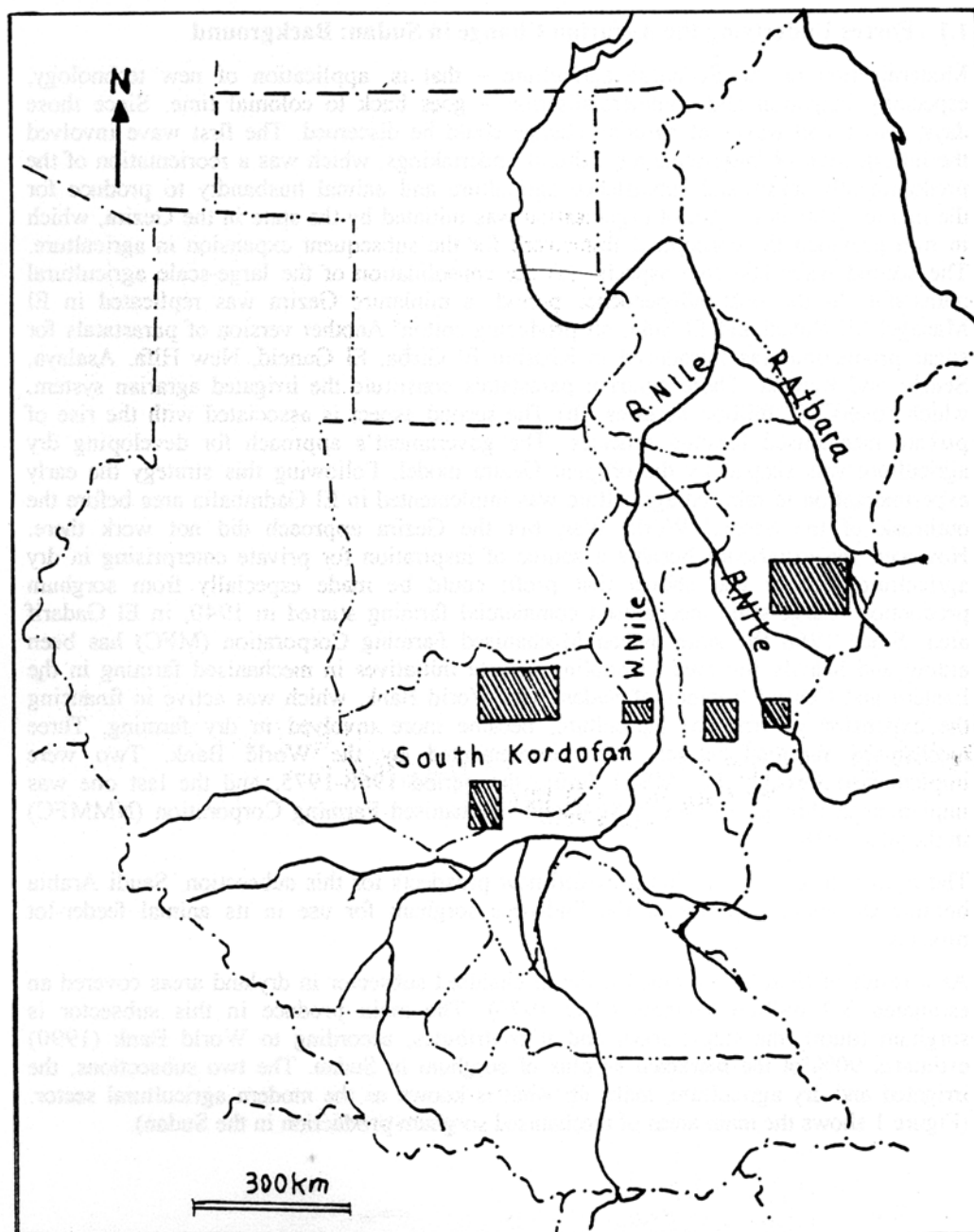
1.1 Forces Underlying the Agrarian Change in Sudan: Background

Modernisation of the Sudanese agriculture – that is, application of new technology, especially irrigation and commercialisation – goes back to colonial time. Since those days, two broad waves of agrarian change could be discerned. The first wave involved the introduction of large-scale agricultural undertakings, which was a reorientation of the predominantly traditional subsistence agriculture and animal husbandry to produce for the market. This new form of organisation was initiated by the state in the Gezira, which in turn provided the conceptual framework for the subsequent expansion in agriculture. The second wave had two aspects: (a) the consolidation of the large-scale agricultural parastatal. In the post-independence period, a miniature Gezira was replicated in El Managel, El Rahad and El Suki, all producing cotton. Another version of parastatals for sugar production was introduced in Khashm El Girba, El Guneid, New Hlfa, Asalaya, Sennar and Kenana. These agrarian parastatals constitute the irrigated agrarian system, which covers 1.7 million hectares. (b) The second aspect is associated with the rise of private mechanised farming schemes. The government's approach for developing dry agriculture was shaped by the original Gezira model. Following this strategy the early experimentation in rain-fed agriculture was implemented in El Gadmbalia area before the outbreak of the Second World War, but the Gezira approach did not work there. However, the experience became a source of inspiration for private enterprising in dry agriculture after it had shown that profit could be made especially from sorghum production. Large-scale mechanised commercial farming started in 1940, in El Gadarif area. Since 1968 the state owned Mechanised Farming Corporation (MFC) has been aiding and heavily involved in pooling private initiatives in mechanised farming in the Eastern and Central Regions of Sudan. The World Bank, which was active in financing the expansion of irrigated agriculture, became more involved in dry farming. Three mechanised farming projects were implemented by the World Bank. Two were implemented through the (MFC) during the period 1968-1975, and the last one was implemented through the Nuba Mountain Mechanised Farming Corporation (NMMFC) in the year 1978.

The *infatih* of the mid 1970s provided new prospects for this subsection. Saudi Arabia became the main importer of the Sudanese sorghum for use in its animal feeder-lot projects.

As a result of these developments, the mechanised subsector in dryland areas covered an estimated 3.7 million hectares (ILO 1976). The main produce in this subsector is sorghum (*dura*), the staple food, and it contributes, according to World Bank (1990) estimates 90% of the marketed surplus of sorghum in Sudan. The two subsections, the irrigated and dry agriculture, make up what is known as the modern agricultural sector. (Figure 1 shows the main areas of mechanised sorghum production in the Sudan).

Fig. 1. Distribution of the Main Areas of Mechanised Sorghum Production in Sudan



The distinguishing features of each of the waves outlined above could be maintained not only in terms of the policies associated with each, but also in terms of the underlying model of accumulation. We do not intend to pursue this point here. However, the broad theme of this study is to provide a critical evaluation of previous research on the effects of tractorisation of dryland agriculture and the attendant commercialisation process upon subsistence farmers in Sudan.

1.2 Objectives of the Study

Much of the expansion in dryland agriculture was carried out by "new" units organised into privately owned schemes large enough to permit profitable use of a tractor and heavy disc harrows per unit. The rapid growth of such ventures has been the subject of a raging debate. Although no conclusion has been reported, as we will see later, the general verdict on this transition is that subsistence farmers were being proletarianised, evicted from the land and transformed, en masse, into wage labourers. This sweeping generalisation, which is based on highly aggregated data, has blurred important details of the working of the rural economy. An important research task in this context is to examine the subsistence household responses to the opportunities and constraints created by the expansion of tractorisation and commercialisation.

The general objective of this study is to highlight the nature of the interaction between the subsistence agriculture and non-farm activities in the study region. The study has two specific objectives.

First the study seeks to identify subsistent household links to the mechanised farming subsector that stimulate particular outcomes. The main behaviour to be examined is the allocation of time to farm and off-farm activities, and the outcomes to be considered are the attendant aspects of household incomes. In particular we use an approach based on household theory to identify key rules that determine the behaviour of the subsistence household in Sudan with respect to their orientation in consumption, production and allocation of men and women labour time. An aspect of the endogenous effects of tractorisation and commercialisation that we consider relates to the household decision to allocate time between subsistence and non-subsistence activities. It may be hypothesised that a reduced share of time allocated to subsistence production induces the household to diversify its resources out of food crops into cash crops and vice versa. To understand how this decision is affected by tractorisation and commercialisation we shall consider the other indirect effects such as changes in the time allocation of men and women and changes in the control over the household's income and resources, since different members show different preferences for allocating their time.

Second the study attempts to improve our understanding of how differentials in levels of welfare of the subsistence household broadly defined are brought about in areas such as the study region, where farmers are expected to share the same technology and goals, and therefore the agricultural practice and productivity should be uniform. Any economic explanation of variability of agricultural practice, and hence variability in welfare levels, must involve the idea of imperfect markets (labour market, credit market, etc.) as a binding constraint (Kevane 1992). While the present study takes full cognisance of this critical condition, it adds the dimension of household's time use

analysis which offers the possibility of extending the scope and definition of 'productive activity' beyond that relating to the income generation process – or the generation of welfare attributes – as that often defined in and used by the conventional models of the analysis of variation of agricultural practice.

1.3 Effects of Tractorisation and Commercialisation in Sudan: Overview of the Literature

The shift in development strategy towards the expansion of large-scale mechanised farms constitute the main source of exogenous influence upon the subsistence farms sector. The general terms of the debate about this transition espouse different arguments that give different explanation for the effects of tractorisation and commercialisation of dry agriculture upon the rural economy.

The major controversy evolved around the central question of whether subsistence farmers operate within a political economy or a market economy.

On the one hand, the political economy approach accepts the capitalist nature of peasant economy, but goes further to examine the interactions among the agrarian classes and the state-peasants relations. Within this strand of literature a theoretical discussion inspired by the dependency and underdevelopment theories and by dissolution/reservation "theses" has been grounded to feature the process of the penetration of the capitalist agriculture and the 'disarticulation' of rural economy. The analysis of an "elite agrarian bourgeoisie", who exemplifies an up-to-date version of Baran comprador bourgeoisie and were supported by the state was taken as a general starting proposition that offers explanation for the patterns of agrarian accumulation. Different and often contradictory conclusions seemed to be reported. Among others, Shaaeldin (1982a, 1982b), Kursany (1983, 1988), Shepherd (1983) and El Hassan (1988) described the subsistence farmers as having been evicted, proletarianised, transformed and captured by the capitalist mode of production. Ali and O'Brien (1984), on the other hand, referred to them as being uncaptured, as having maintained possession of their land and retained formal independence from capital in the disposition of family labour. This result contradicts O'Brien's earlier finding that "in a very real sense, the story of the development of agriculture in Sudan has been the creation of the agricultural wage labour force" (O'Brien 1983, 16).

Furthermore, in a recent contribution, O'Brien (O'Neil and O'Brien 1988) refined the historical relationship between absolute and relative surplus value and the primary accumulation; he applied this discussion to the process of rural differentiation in the Sudan. He concluded his study by noting that the decade of the 1970s unfolded a growing pressure towards the removal of constraints on surplus value, and that subsistence farmers were engaged in direct surplus production. These adjustments were taken to indicate the complete transformation of the subsistence economy and its integration into the markets.

Thus the political economy approach seems to suggest that the expansion of the capitalist agriculture made possible by tractorisation and commercialisation is just a short lived bonanza that initially increased the output of sorghum, the staple food, but this increase is not socially beneficial and the subsistence farmers are the net losers. At the sectoral

level, O'Brien (1988) noted that subsistence farmers suffer from a deteriorating productivity rather than from a deteriorating terms of trade as is the case elsewhere. Accordingly the ethnic structure of labour and the extended family unit as an organiser of labour allocation had broken down giving way to increasing individualisation! At the national level the long run effects of the transition were more catastrophic; the country as a whole lost. The process of the penetration of capitalist agriculture had sown the seed of famine (O'Brien 1986) and cultivated hunger (Ali 1989).

On the other hand, the market economy approach argues that the economic relations in rural Sudan are based on rational decision making. Subsistence farmers were guided by contractual forms, however sub-optimal, but are precise and well defined (Kevane 1992).

While accepting the idea of viewing subsistence farms as an autonomous system of enterprising, a variant of this approach analyses it as an integral and subordinated part of a larger system rather than as an independent system in its own right (Duffiel 1978, 1981) and (Bernal 1991). In one of these studies it has been argued as follows:

The integration of peasants into the capitalist economy... is not necessarily a process whereby peasants become landless workers or capitalists. Peasant agriculture persists, but the conditions of production and the behaviour of farmers are increasingly determined by the capitalist relations of production in which peasants participate (Bernal 1991, 8).

In the context of our study area, we accept Schumpeter's (1961) observation that neither the process of capitalist development nor its effects are harmonious, but they are discontinuous, uneven and lopsided. Thus, it is difficult if not impossible to view the subsistence farmers as 'capitalist peasants'. It is also hard to sustain the view that the effects of the exogenous sources of tension work only through the expansion of the capitalist mechanised farms and eventually result in reducing subsistence farmers' resource base. The increasingly rising production costs, inflation, indebtedness, the interlining of rural factors markets and the disadvantageous movements of the terms of trade between agriculture and other sectors of the economy equally count as exogenous sources of tension and have varying influence upon subsistence farmers. However, the present study will not concern itself directly with the disentanglement of the effects of each of these extra-domestic factors, but only with their aggregate effect, which overwhelm the ability of the household to sustain itself through labouring on its own resources. Under such a condition, we maintain that although wage labour has become an essential mode of livelihood in the Sudanese rural economy, wages are not guaranteed nor sufficient and hence the subsistent peasantry is still important for the reproduction of wage labour and the households.

1.4 Some Alternative Hypotheses

In general the full effects of technological change and commercialisation are mediated through a complex interrelationship, especially when one comes to the real world of the subsistence household characterised by institutional rigidities, structural imbalances and changing internal and external conditions. In spite of these dynamic effects, testable hypotheses could be generated by separating the internal and external effects of the technological change and commercialisation. The external effects related to a set of policies concerning the agricultural sector as a whole, import of technology, exports and

the influence of the quality of governance, etc. The internal effects relate to a set of decisions by the household concerning the subsistence orientation in consumption and production. The debate on the rural change in Sudan evolved mainly, but not solely, around the latter theme. One strand in the debate, especially within the political economy approach – with a Chayanovian bent – gives much attention to household composition and less attention to the exogenous relationships in determining household farming strategies. The subsistence household, it is said, is abbot resistant to the capitalist penetration and hence remained uncaptured. However, the analysis in that literature does not show how the self-sustaining character of the households manifested itself and, more important, how households balance subsistence needs against the need for labour, consumption against labour inputs as determined by family size and ratio of working and non-working members as determined by the demographic changes. The other strand of literature emphasised the “pure” technological effect, the large-scale mechanised farming, in directly evicting the rural farmers. Here, again, the main issue remains unanswered, that is: to what extent is the appearance of wage labour a result of eviction and dispossession or a result of the inability of the peasant household to subsist from its own production or due to the declining productivity ala O’Brien’s thesis, for example?

The most pressing empirical issue, we feel, can be posed in terms of what role the household plays in and how it is linked to the processes glossed over as commercialisation, proletarianisation and capitalist penetration in the Sudanese context. We argue that these issues are more relevant to study of subsistent the peasantry in Sudan, especially under the present conditions where both agriculture and industry are underdeveloped and where migrant labour, as such, can not reproduce itself without the pooling of resources (through the household as a unit of resources allocation).

The general workable proposition we intend to develop and substantiate is that the initial high supply response in the capitalist agriculture, made possible by tractorisation and commercialisation, reduces the prices of dura, the subsistence good that subsistence farmers gained as consumers, at least in the short-run. More resources, especially labour, can be transferred from production for own-consumption to the production of cash crops, and other off-farm activities (mainly employment in the mechanised farms sector). It follows that instances where households were unable to benefit from the transition in the dryland farming were brought about not by displacement of labour, eviction or proletarianisation, but by increased specialisation in the production of cash crops the income effect of which is very uncertain; the standard farm model seems to be at work here. This commodity aspect of the transition, we maintain, is the right start for the analysis of the processes of rural change in Sudan. In the second chapter, we will develop a simple model of household based on this aspect and use it as a formal statement of hypotheses.

For the time being and to build testable hypotheses, we can restate the debate on technological change and commercialisation as follows:

- i. Farmers are captured and hence evicted and/or proletarianised.
- ii. Farmers are uncaptured and hence have maintained possession of their land.

As pointed by Kevane (1992), we can conceptualise subsistence households in the study area as attempting to move towards an optimal resource allocation position in cultivation by adjusting their endowments through factor market transactions. Thus, on this ground alone, it is difficult to accept the notion of uncaptured peasantry. Hence, we will proceed with the first line of reasoning.

Eviction occurs before the introduction of the technology, proletarianisation occurs after the introduction of the technology. If one is to maintain the separation of the two effects, following Binswanger and Braun (1991), eviction implies failure of policy and not failure of technology. Hence it could be hypothesised that; pressure on land is not due to increased demand for subsistence needs, but mainly due to unwarranted expansion of commercial agricultural production. It follows that intensification of the frequency of land use for a given agricultural practice, is a direct result of bad commercialisation policies. In this case subsistence farmers become users of the marginal land and need more labour for direct production and for transport, to maintain the old level of subsistence, thus implying that eviction represents a push towards greater subsistence.

If the intensification of land use is interpreted in a neo-classical sense, then, farmers with a low land/labour ratio will end up with high land/labour ratio (through the use of more land of poor quality, for example). Thus it may be hypothesised that variation in land/labour ratio in different locations is significantly explained by land quality alone (different degree of fertility), rather than by other factors such as assets holding, observing the right time for inputs application, etc. If this is supported by data, then land reform, in the sense of redistribution of land from the mechanised farming sector to the subsistence sector, does make sense.

If proletarianisation means selling more labour to the mechanised farming sector, then we hypothesise that for each household, this labour:

- i. is drawn from the previously under-utilised labour augmented further by the reduction of the subsistence ratio;
- ii. is drawn from labour previously committed to own farm.

The rest of the study is organised as follows: chapter two outlines the theoretical framework; it also points to the research methodology, the sampling procedure and to the source of the data that forms the basis of our analysis. Chapter three discusses the main results; it also describes labour time use, especially the determinant of off-farm agricultural work, the determinants of labour productivity and productivity of time. Chapter four provides the main conclusions and their policy implications.

2. THEORETICAL FRAMEWORK, DESIGN OF THE SURVEY AND SAMPLING PROCEDURE

2.1 Theoretical Framework: Towards a Simple Model of Household Economy

From the outset, at one stage, the effects of technological change and commercialisation of agriculture on production, income and employment take many different forms. The gainer-loser situation is very intricate because the flow of resources among households, between them and outsiders is an on-going process. At another stage, the subsistence

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household itself is a production and consumption unit, and what is produced, consumed or exchanged through market transaction constitutes, on a micro level, a resource flow system also involving gainers and losers. Thus the complexity of the relationships involved in the process of technological change and commercialisation suggests that a comprehensive model of the household would be helpful in deriving testable hypotheses. No such model of peasant behaviour is advanced here nor are we enthusiastic about reproducing some of the established models. However, a very brief summary of these models relevant to our purpose may be suitable.

2.1.1 A Review of Household Theory

The process of the transition from subsistence economy towards a market integrated one is usually analysed in terms of models based on the theory of subjective household equilibrium developed by Chayanov (1956). According to him the subjective equilibrium of household is an outcome of equality between demand satisfaction and drudgery of labour. Chayanov's contribution lies in the claimed link between labour input of the household and its producer/consumer ratio. He advanced this thesis of demographic differentiation in contrast to Lenin's thesis of social differentiation.

The work of Mellor (1962), Sen (1966) and Nakajima (1969) stimulated by Chayanov has been placed amongst the most sophisticated systems of analysis of the subjective equilibrium of peasant type farms. Their main concern is with the problem of peasant participation in advancing the "monetized enterprise" via cash cropping or wage labour or both. This work has been criticised in the literature for modelling this transition at the level of resource use without explicit account of the underlying causal links, such as risk aversion, that may push peasants to maintain a certain degree of self-sufficiency even at the cost of market income foregone.

Fisk (1975) assumes a complete separation of a subsistence enterprise and a monetized enterprise and then explicitly account for the underlying dynamic forces that reduce the high marginal utility of subsistence production namely the appearance of effective rural market, changes in household preferences and production technology. However, the appearance of a unique monetized enterprise is still a 'hot' debatable issue (von Braun et al. 1991).

Since Becker (1965), models based on joint utility approach are used to model semi-commercialised households, which are assumed to maximise an exogenously given joint utility function. Production and consumption decisions are integrated within the household which optimises amongst its choice of consumer goods as well as its supply of labour to the market and to household own farm. An important assumption in these models is the full co-operation between the members of the household. Another version of these models based on the bargaining approach, associated with the neo-classical game theorists and the feminist writers, is used to model explicitly the intra-household conflicts.

In general, studies on the dynamics of rural change in the LDCs usually concern themselves with the nature of the interactions between the farm and non-farm enterprises. The backward and forward linkages have been the focus of these studies (ILO 1974; Mellor and Lee 1973; Adelman and Taylor 1991; Dorosh and Haggblade

1993). In most of the cases the findings of these researches give support to Hirschman's (1958) view that agriculture usually generates much less stimulus than manufacturing to the production in other sectors.

This study attempts to identify subsistence household's links to the mechanised farms subsector, which is expected to have substantial consumption linkages that set in motion employment and income effects. In particular, the study seeks to sharpen our understanding of the manner in which these sequences of employment and income affect the pattern of household's subsistence orientation in production.

Ideally, recursive programming models should be used in a view to capture the dynamic path of these economic outcomes. How well these models perform depends upon their abilities to capture the historical trends for the variables of interest over the period for which the models are estimated. Detailed time series data of the sort needed to test such complex models is not available nor are there detailed dynamic microeconomic studies in Sudan that can be used to direct such data gathering activities. However, even if time series data is available, inter-temporal comparison of households' attributes may cause complications because of the changes over time in the composition of the household in the rural category. For example, Buatista (1994) pointed that a particular community might be initially classified as rural, but as it becomes more progressive the same household may be graduated to the urban category.

This study uses spatial cross-sectional data, first, to highlight the fundamental character of the spatial structure and the extent to which this character is explained by the interaction of the agricultural and non-agricultural activities. Second, it uses a set of identities and multivariate analyses in an attempt to quantify two sources of household income: production of farm or household enterprise and wage employment. The first source requires time inputs of household members, productive assets such as land, agricultural and other implements, technical know-how and intermediate products such as machine power, seeds, etc. The second, earnings, depends on the amount of time the household sells in the labour market, and the wage rate that each unit of time commands.

Before addressing the major research issues, we will point out three simultaneous relationships that present us with some basic analytical problems. First, as households in the case study are assumed to maximise their welfare, the level of income generated through work and the level of leisure are co-determined. Secondly, in a dynamic setting, the productive assets that determine the level of income stem from savings, which in turn depend upon past incomes. Thirdly, household size and demographic cycle determine the household's labour endowment and hence its income. Thus, over time and space some basic socio-economic outcomes (allocation of time, income and endowment of human and non-human assets) are determined in a way in which cause and effect are not easy to establish.

Having noted the above, for analytical and empirical reasons we state the following assumptions:

- i. Particular socio-economic circumstances and phenomena are not outcomes of household decision-making in the short run, but they are the ultimate determinants of the particular outcomes at which we look.

- ii. Households in the case study area seek to maximise total income in any year.
- iii. The resources available to households are limited and fully employed. These inputs are labour and capital.
- iv. Land is not a major constraint in production.
- v. Capital and population remain the same.

2.1.2 The Analytical Approach

In order to highlight the differences in levels of relative socio-economic development the technique of factor analysis will be applied to a large number of indices representing more or less the socio-economic structure of the surveyed locations ranked by size of population with the view to find out whether or not there is any underlying pattern of variations among the selected indices, and whether or not places tend to group on dimensions representing these patterns. We follow Berry (1962) in that, when the data reveals a fundamental character of spatial structure on a continuum of relative development, then movement along this scale will be interpreted to represent changes in these indices viewed overtime. Multivariate analyses will be used to study the interaction of interest. We start with the following identities that describe household's resource endowment and subsistence orientation in production and consumption.

2.1.3 The Identities

For each household, i aggregate labour time supplied in the course of an agricultural season is given by:

$$(\text{Totlab})_i = (\text{Labof})_i + (\text{Labmf})_i + (\text{Labnon})_i \dots (1)$$

where,

Totlab = total available labour force in days/year per household measured in adult equivalent.

Labof = household labour, in adult-equivalent allocated to own farm.

Labmf = total labour time sale to mechanised farms sector in days/year per household, measured in adult-equivalent.

Labnon = total labour time spent on unorganised household activities measured in adult equivalent.

For all households:

- (a) The agricultural subsistence orientation is measured by the ratio:

$$\text{AS} = \frac{\text{NM}}{\text{AP}} \dots (2)$$

AP

Where:

AS = the agricultural subsistence ratio.

NM = the value of non-marketed agricultural produce.

AP = the value of total agricultural produce.

(b) Subsistence orientation in consumption is measured by the ratio:

Where:

C = the subsistence share in total consumption.

Ch = the total value of goods consumed out of own production.

Ct = total value of goods consumed in the household including purchased and own production items. That is, C equals the share of the value of own produced food consumed by the household in total value of food and non-food consumption.

Identity (2) and (3) refer to two concepts for subsistence orientation relating to the effects of the technological change and commercialisation (von Braun et al. 1991). In our case the first concept captures the output effect (cases where households grow more cash crops). The second concept captures the input effect (cases where households sell more labour to the mechanised farm sector).

2.1.4 Productivity of Time and Production Function

In light of our earlier discussion and in order to model the commodity side of the transition process, it may be important both to introduce the distinction between the subsistence and market production at the level of resource use, especially with respect to labour use, and to specify the underlying causal determinants such as risk aversion, task and habits that may motivate a household to maintain a certain degree of self-sufficiency even at the cost of market income foregone. Thus a common non-monetary utility index is useful.

Following the analytical framework suggested by Becker (1965), the household is assumed to 'produce' the attributes of its utility maximisation with input of time and goods, which are obtained through income. In determining the production function, an individual's allocation of time to economic work will be viewed as a function of household's assets, his own labour productivity together with other control variables. This production function is a good proxy for a non-monetary utility. The estimation of this function will distinguish this study from previous research¹ in that it will derive a rough estimate of marginal productivity of work performed by relating time input into the production process to income generated by this work. This procedure is justified by the structural constraints prevailing in the study area. Unless it is assumed that factor markets are competitive and that the household optimises labour use by adjusting its labour endowments through labour market transaction, we expect labour productivity to depend largely on complementary resources available in the household enterprise (such as labour, know-how, assets, etc.).

For estimation purpose, a household's income (Rprod) net of transfer, is assumed to be generated by a production function where age-group specific time ($J^{1,2,3}$), human capital and know-how (Educat), net sown land (lands), value of cattle (cattle) and value of small animals (small animals) are inputs. Thus, the aggregate agricultural production function of households is assumed to be depicted by the following equation:

$$Rprod = f(J^{[a,g]}, Educat, land, cattle, small animals \sum D_i) \dots (4)$$

Where:

$\sum D_i$ = dummy for study location ($i = 1, 2, \dots, n$; so that $n = k - 1$, where k = number of study locations).

We hasten to note that income and time allocation are codetermined and hence simultaneity bias inherent in model 4 may lead to some underestimation of the time input coefficients. However, since we are interested in productivity of households which is supposed to reflect a substantial variation in earning opportunities, several versions of model 4 will be estimated. We first exclude income from wages and time spent on wage labour, rather than add wage income as part of income and wage labour, as part of time input and re-estimate the same model.

Our approach is as follows: first, we calculate the marginal productivity of labour based on the estimation results of each version of model 4 as applied to different groups of households classified by asset holding, model of land acquisition and gender composition of the household. We use these coefficients to gain information about age-group specific time allocation, and about the adequacy of the utilisation of rural labour supply. Evidence of low productivity and long hours of leisure will be interpreted as indicators of possible existence of labour surplus. Second, we assume that labour productivity is predetermined, i.e., rural labour market is competitive and wage rate measures the output forgone in the subsistence sector. Hence, the variability in the household labour supplied to off-farm (offwork) is explained by function 5 below.

$$(Offwork) = h(Wage, Rprodi, Eprod, Ecash, Yoff, Womensh, Malesh) \dots (5)$$

Where:

Wage = off-farm wage rate per day in Sudanese pounds (ILs).

Rprodi = net return in agriculture per available labour-day, an index for labour productivity.

Eprod = Expected values of current cash crops in LS, based on last year's estimates.

Ecash = Expected value of current cash crops in Ls, based on last year's estimates.

Yoff = Cash incomes from other sources in Ls.

Womensh = The share of women in the household among adult labour force, gender composition of the household.

Malesh = The share of male adult in total persons in the household.

The relation between (offwork) and wage is always positive. We note that the conversion of the subsistence household in wage labour through proletarianisation or through eviction and displacement by machine will be envisaged if the supply of labour to own-farm and to the mechanised farms is mutually exclusive and there is full employment in the subsistence sector; there is no way to shift the season by changing the crop mix. The

coefficient of R_{prodi} is expected to reflect the effect of agricultural labour productivity on the allocation of off-farm labour. We expect a negative relation. Also the coefficient of E_{prod} , E_{cash} and Y_{off} are expected to be negative. A household with high women share is expected to supply less labour to off-farm employment market; hence we expect a negative co-efficient for W_{omensh} . Conversely, a household with high adult share supplies more labour and hence the coefficient of M_{alesh} is expected to be positive.

Based on (4) and (5) above, we shall run two regressions to test the following hypotheses:

- i) Labour intensification hypothesis:

$$(Lab_{mf}/Totlab) = \beta_0 + \beta_1 (Totlab/Adult) + \epsilon \dots (6)$$

Where:

Adult = number of adults per household; the rest of the variables are defined as before and ϵ is an error term.

We test:

$$H_0: \beta_1 = 0 \text{ against}$$

$$H_1: \beta_1 > 0.$$

If H_1 is accepted, then labour intensification would be upheld. That is, the supply of labour to off-farm employment market, mainly in the mechanised farming sector, is tapped from the under-utilised peasant labour by increasing the hours worked per adult.

- ii) Inverse labour hypothesis:

$$(Lab_{mf}/Totlab) = \alpha_0 + \alpha_1 (Lab_{of}/R) + \epsilon \dots (7)$$

Where:

$R = (Lab_{of} + Lab_{non})$, ϵ is an error term and the rest of the variables are defined as before.

We test:

$$H_0: \alpha_1 = 0 \text{ against}$$

$$H_1: \alpha_1 < 0.$$

If H_1 is accepted, then supply of labour to the mechanised farms sector and to the family farms as well as to non-farm activities is competitive, i.e., the proletarianisation thesis would be upheld.

The information gained by testing the two hypotheses by itself is not sufficient to establish the labour intensification and/or the inverse labour supply. To fully evaluate the two hypotheses, we need information on the labour augmenting effect of the mechanised farming sector that works through the food crops market and eventually reduces subsistence orientation in production. This point is formalised below.

2.1.5 Subsistence Orientation in Consumption

Consumption ranks high in the household decisions about subsistence orientation in production. In specifying this relationship it is hypothesised that first, the availability of the production resources determine the production and income earning capacity of household, and hence, the degree of subsistence orientation. We propose the use of the share of adult in total number of persons in the household as an index for productive resources. Secondly, we hypothesise that household per capita stock is necessarily related to subsistence orientation. Thirdly, we expect that an increase in production and/or productivity in the mechanised farms reduce the price of the subsistence good (dura) and thus reduce subsistence orientation in household production. Farmers will gain as consumers at least in the short run and hence tend to diversify their resources out of subsistence production. In this case possible gains from policies designed to depress the price of agricultural staple in the local market eventually trickle down via the food crop market to the subsistence households. Hence, we hypothesise that expected reduction in the prices of dura reduces subsistence orientation. Fourthly, live-cycle of the household influences subsistence orientation. Finally, household's perception of risk influence subsistence-orientation, a subjective valuation of risk based on the head of the household views will be included. Using identity (3) we specify the following equation:

$$C = G (\text{Adultsh, Capital, Eprice, Childsh, Irisk Wage, Rprod}) \dots (8)$$

Where:

C is a percentage change in subsistence orientation as defined in (3);

Adultsh is the share of adult in total persons in the household;

Capital is the household per capita stock;

Eprice is the household's expectation of the prices of dura in the local market.
(Locational differences and seasonal variations of the price of dura were captured by the survey at the household level).

Childsh is the share of non-producing members, (the dependency ratio);

Irisk is an index of risk based on the head of household perception of crop specific risk on scale of 1 to 3. (The rest of variables are defined as before.)

Equation 8 will be estimated for all households groups. In cases where **C** is significantly explained by **Eprice**, and where one or both of the alternative hypotheses is/are accepted, the situation of vulnerability among households should be explained in terms of inefficient specialisation.

2.2 Design of the Survey and Sampling Procedure

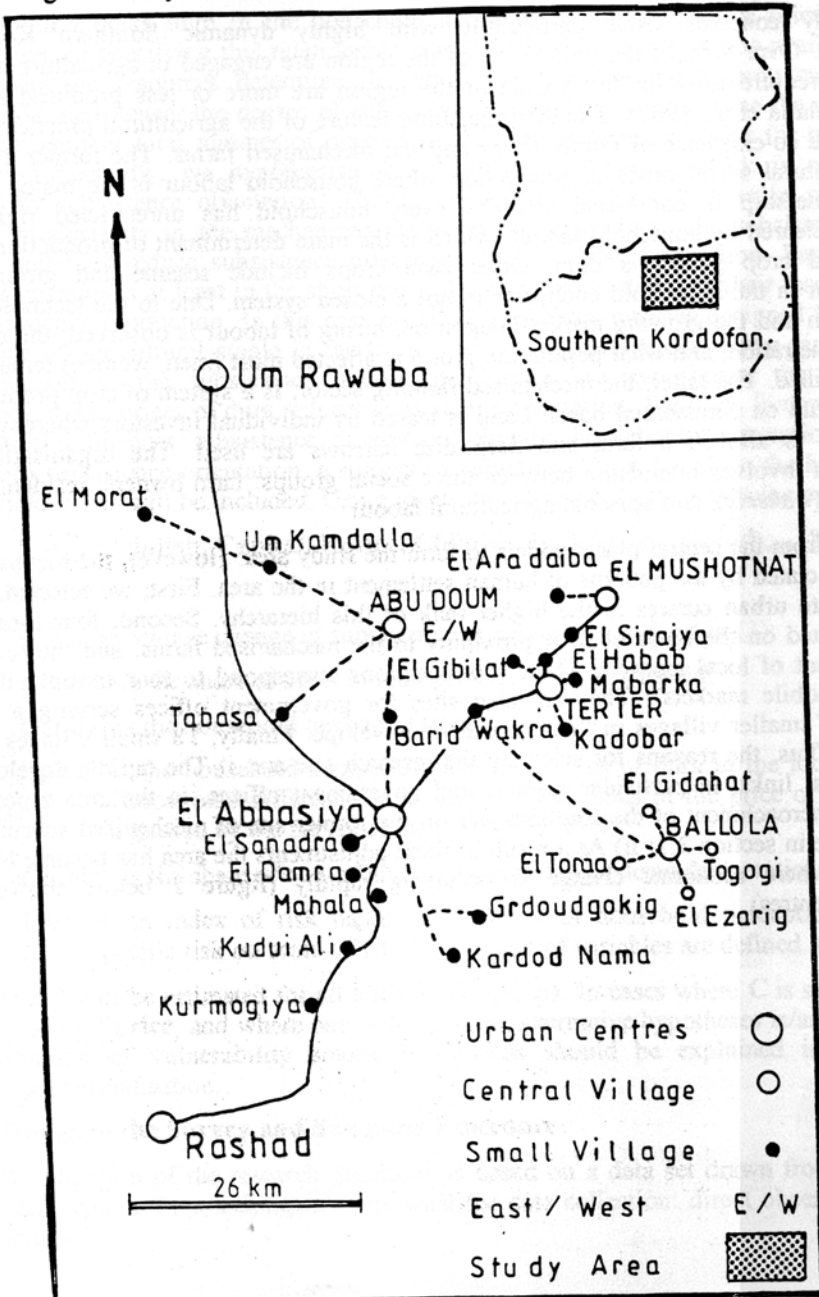
The investigation of the research questions is based on a data set drawn from southern Kordofan region. Two techniques were used for data collection: direct observation and questionnaire.

2.2.1 The Study Area

The study concerns itself particularly with highly dynamic Southern Kordofan prefecture. Over 90% of the population of the region are engaged in agriculture and all the food requirements for the people in the region are more or less produced in this sector (Falalla et al. 1982). The distinguishing feature of the agricultural practice in the area is the co-existence of family farms and the mechanised farms. The former denotes an agricultural social mode of production where household labour is the major input. Land ownership is communal whereby every household has unrestricted rights to parcel(s) cleared by household labour, which is the main determinant of production. The main food crop grown is dura. Other cash crops include sesame and groundnut. Production in the household enterprise is not a closed system. Due to the technological penetration and the growing market integration, hiring of labour is observed; the degree of this penetration, and what population group is affected most (men, women) remains to be determined. The latter, the mechanised farming sector, is a system of crop production which is run on commercial basis. Land is leased by individual investors whereby each individual is allotted a farm and deep disc harrows are used. The organisation of production involves interaction between three social groups: farm owners, resident farm managers (*wakeels*), and seasonal agricultural labour.

We drew from the central place models to form the study area. However, the hierarchical order is dictated by the patterns of human settlement in the area. First, we selected three intermediate urban centres at the higher rank of this hierarchy. Second, four locations were selected on the basis of their proximity to the mechanised farms, and the level of development of local markets. These four locations correspond to four central villages (or non-mobile markets). They are also sites for government offices serving a large number of smaller villages in their immediate envelope. Finally, 18 small villages were selected. Thus, the reasons for selecting the research site are: i) The rapidly developing institutional links, in particular markets and government offices, in the area especially after the encroachment of the southern war on the former site of mechanised schemes as we will see in section 3.1; ii) As a result of these adjustments the area has become highly dynamic where economic change is occurring rapidly (figure 2 below shows the surveyed centres).

Fig. 2. Study Area and the Surveyed Centres



We identified 13 characteristics representing the socio-economic structure of the three broad ranks of the selected study areas. Although these places vary in size, function and locational characteristics, the procedure for defining the characteristics is based on quantitative and qualitative data and is almost similar for the three orders of places. The included characteristics depict important aspects of rural change associated more or less with the rise of the mechanised farms. More than one indicator is used in defining the characteristic of a place. Then with a blend of survey data and judgment the places were classified according to these characteristics. The data matrix is obtained by ranking the 25 places on each of the 13 socio-economic characteristics using a simple linear scale. For example, the highest score (90) is assigned to a place that ranks high and 10 to a place that comes lowest in rank with respect to each characteristic. The intermediate classifications are scored at equivalent intervals between 90 and 10.

2.2.2 Limitations of the Data

We carried out one round survey to generate our data. But this method presented us with the problem of studying variation overtime. However, the problem of the timelessness of the data will be circumvented since we are using cross-section data. Unfortunately, there are no detailed records of time series data that can be used to study the dynamic path of the economic variables of interest. However, to present the reader with an idea of the dynamics of change overtime in the study area, first we determine the factor solution to the data matrix recovered from the central place schedule with a view to identifying the characteristics associated with mechanisms of change. Second, dummy variables were used to control differences of the broad spatial characteristics.

It is our contention that the diversity of a country such as Sudan cannot be captured by researching the micro-level processes of tractorisation and commercialisation for just a few locations over a short period of time. However, these observed processes are not unique to the case study area. Because of many standardised features of the Sudanese dry agriculture, the case study area has much in common with other sites of rain-fed agriculture. Hence, it could be argued that the conclusions established using the data generated from the study locations can be generalised without altering the underlying theoretical premises on which they are based.

3. PRODUCTION, CONSUMPTION AND INCOME EFFECTS OF TRACTORISATION AND COMMERCIALISATION PROCESSES

The tractorisation and the attendant commercialisation processes in southern Kordofan manifest themselves in the changing income sources of the household and in changing the patterns of household labour use. These processes occur partly on the basis of indigenous source of off-farm employment, cash crop production and collection of wild edible fruits. The increased off-farm employment generated by the mechanised farm schemes in the community has acquired increased importance. Before tracing in detail some of the issues raised earlier, background information at the regional and community levels on the rise and the role of the mechanised farms is provided below.

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3.1 The Rise and Expansion of the Mechanised Farms in the Region

The need to develop the subsistence agriculture, mainly in the southern Kordofan region, was recognised first in 1960s (Osman 1968; O'Brien 1978). Despite the conflict in views on allocating more resources to dry agriculture as a priority sector, the government strategy for developing subsistence agriculture in the region was influenced by its previous modernisation efforts, which as noted earlier were shaped by the Gezira model. A major program implemented in the region during the early 1970s consisted of the modernisation schemes run by the Nuba Mountains Agricultural Production Corporation (NMAPC). The government viewed the corporation as an exemplary institution in developing dry agriculture in the region. Its main objectives, as stated in its charter, were: i) to organise small farmers into large-scale modern schemes; ii) to promote mechanised cultivation, which was in practice limited later on to provision of tractors at low cost to the private sector, and iii) to urge all participants in the modernisation schemes to grow cotton and dura in a rotation system.

The performance of all schemes was unsatisfactory and in many cases problematic. As a result a ministerial committee was formed in 1979 to study the problem and to recommend solutions. The committee report found that the unrewarding farm-gate cotton price was the main cause of cotton decline, i.e., the competitiveness of cotton vis-à-vis other small holders' crops (mainly dura) seriously worsened. Despite a series of farm-gate price improvements undertaken by the government, the decline in cotton production continued to the extent that the production of the crop has virtually stopped in the area.

Since the late 1970s, the (NMAPC) became active in facilitating large-scale mechanised private schemes in the area. This shift of emphasis coincided with the upsurge of the Mechanised Farming Corporation (MFC), which was developed in 1968 with a view to assist, at the national level, private investors through surveying and allocation of land for mechanised farming, provision of research, provision of credit, provision of agricultural services and also by running the state-owned farms in the venture. During the late 1970s, the (MFC) became more involved in promoting private mechanised farms in the region. The objective of both the (NMAPC) and the (MFC) became: to increase crop production per feddan, to develop and utilise available natural resources in order to maintain the best socio-economic development in the area and to guard against occasional famine due to poor production and storage facilities.

The high soil potential for rainfed mechanised dura production made the expansion of such an enterprise possible. The region comprises an area of 31,049,480 feddans; 57 percent of this area is suitable for mechanised farming and, of course, subsistence farming (see table 1). However, the growth of the latter mode of farming is compromised by the lack of drinking water. For this reason subsistence farming is practised in land adjacent to subsistence villages. This land is usually held in private usufruct, and the rest of the land is held communally. The village *Sheikhs* have final say over abandoned land (see Kevane 1992).

Table 1. Area and specification of soil potential in Southern Kordofan

Class	Specification of soil potential	Area in feddan *
A	High potential for mechanised farming	10940100
B	Moderate potential for mechanised farming	6754440
C	Low potential for mechanised farming	7047180
D	Poor soil suitable for grazing	2662760
E	Water courses, hills and rocks	3689000
Total		31049480

SOURCE: El Haj (1976).

Note: * One feddan = 0.42 hectare.

The relative abundance of arable land and the loose land tenure system had facilitated the expansion of large-scale mechanised farming. By the early 1980s, more than one million feddans were under private mechanised schemes, located mainly in the western mountainous areas of Um Labia, El Paidda, Habila, Kartala and El Mattammar, and in the eastern mountainous areas of Tetrer, El Mushotnat, Abu Doum west, Abu Doum east, El Miganis and Ballola. As a result of the outbreak of the southern war, production has virtually stopped in the production sites in the western mountains. This was the main reason for the recent expansion of the mechanised farm sector in the eastern mountains. The financial institutions have also played an active role as a number of them have moved directly to the area. The agricultural bank established one branch in El Abgbasiya, and by 1991 the commercial banks had established four other branches in the area. More than 85% of the extended credit of these branches directly or indirectly financed the agricultural operations in the mechanised farms sector. Table 2 shows the distribution of planted and cropped areas in the study area.

Table 2. Distribution^a of planned and cropped areas in the study region (in thousand feddans)

Location	Planted area	Cropped area
Tetrer	300	200
Abu Doum west	223	190
Abu Doum east	384	300
El Miganis	490	480
El Mushotnat	35	30
Ballola	29	25
Total	1461	1225

^a This area is obtained partly on the basis of temporary lease and partly in an uncontrolled form without such entitlement, which is known as the undemarcated schemes.

It is interesting to note that 80% of the cleared land is actually planted and 84% of the planted land is harvested. Such speculative farming is perhaps established by bending land rights.

It should be emphasised that the expansion of mechanised schemes, especially the non-demarcated schemes, took place mainly by cleaning and planting the formerly uncultivated land. Thus this expansion was not detrimental to small-scale farming, except for some ten thousand feddans of expropriated farmland in El Mushotnat and Terter. As we have been told by some informants, the expropriation of land did not result in direct eviction of any farmer, but had limited the room for manoeuvre for practising shifting cultivation as used to be the case. However, it could be argued that while central to current local employment and food availability, mechanised dura production in the undemarcated schemes threatens the sustainability of the production environment in the long run.

Before addressing with data the development specificity at the household level, it should be emphasised that off-farm employment is mainly in agriculture in the mechanised schemes sector, which is the main source of commercialisation that works through the labour market. Thus the conditions in the rural labour market in the study area are determined by the rise and fall of the production in the mechanised schemes.

3.2. Discussion of the Results

The people in the study area, as the case in many other rural parts of the developing countries, are primarily engaged in peasant cultivation and manual labour as organised household reproduction activities. Unorganised household activities carried out mainly during the dry season, include building and repair activities, hunting and gathering of edible wild fruits, honey, firewood, grass and building materials. Although these activities are in decline for reasons to do with the environmental degradation, yet they are important, especially among the poor households, for household reproduction because the market conditions do not offer alternative base suitable for organised household reproduction for the poor to exploit successfully. For this reason a substantial portion of economic activities, especially those performed by the poor households, take place outside the so-called formal sector. As a result a considerable amount of wealth and economic activities is difficult to measure for this household category. However, we are particularly interested in learning how holding of productive assets affects household subsistence orientation and time allocation to economic work, and how inequalities in resource ownership determine these outcomes. In the light of the conceptual framework outlined in section 2.1.2, this section attempts to quantify and discuss household subsistence orientation. Section 3.3 attempts to describe the determinants of: labour time use, production, labour productivity and off-farm work. In section 3.4, an attempt will be made to quantify and discuss the determinants of subsistence orientation in consumption.

3.2.1 *Patterns of Household Subsistence Orientation*

The two alternative concepts discussed in section 2.1.3, assessing household subsistence orientation, are presented with their quantitative results in tables 3 and 4. In table 3 households are ranked according to ownership of cattle as an index of asset holdings. In table 4 households are ranked according to gender composition and mode of land

acquisition. It is clear that agriculture in the study area is still considerably subsistence oriented.

According to concept 1, which expresses the value of subsistence production as a percentage of total agricultural production, table 3 shows that 73.3 percent of the agricultural production is for home consumption if households are grouped on asset holding basis. Table 4 indicates that 75.8 percent of the production is retained for own consumption if households are grouped according to gender composition² and mode of land acquisition. From this assessment it appears that there is a weak relationship of subsistence orientation with both assets holding and mode of land acquisition. It is only in the female-headed household group that a clear increase in the relative importance of subsistence orientation is discernible.

This conclusion is further confirmed by the 2nd and 3rd column in tables 3 and 4. Column 2 in both tables shows that the value of subsistence production as a percentage of total income, on average, amounts to 42.5 percent and 43.7 percent, respectively. Column (3) in both tables shows that the value of cash crops sales as a percentage of total agricultural sales amounts to 47.9 percent and 43.1 percent, respectively.

Column 4 of table 4 shows that more than half (51.0 %) of income is earned off-farm. The corresponding figure in table 3 is 40.7 %. The reason for this low figure is that households with cattle earn most of their income from non-agricultural wage and from sales of livestock and livestock products. Column 5 of table 3 shows that wage income per capita as a percentage of total income amounts to 51.3 % for this households group. Thus it is interesting to note that taking wage income as a source of commercialisation, it is only the female-headed households group that shows a clear negative relationship between the degree of subsistence orientation and wage income. The rest of the households groups show no such clear-cut relationship (see the 5th column in table 4). Perhaps the main reason for this is that the female-headed households earn most of their income from sales of edible wild fruits and from transfers.

Table 3. Degree of subsistence orientation and the sources of market integration between households classified by assets holding

Households group	Value of subsistence production		Percentage value of groundnut and sesame sales out of total agricultural sale ^b	Percentage of off-farm income per capita out of total income	Percentage of wage income per capita out of total income
	Percentage of total value of agricultural production	Percentage of total income ^a			
Households with cattle (22)	68.1	40.9	47.4	30.6	51.3
Households without cattle (81)	78.4	44.0	48.3	50.8	38.2
Average	73.3	42.5	47.9	40.7	44.8

SOURCE: Southern Kordofan field survey, 1993/94.

Note: The total number of observations is shown in parentheses.

^a Total income includes wage income, transfers, and proceeds from sales of cash crops and edible wild fruits.

^b Total agricultural sales income cash crops, livestock, vegetable and edible wild fruits.

^c We use the agricultural wage income as a proxy.

Table 4. Degree of subsistence orientation and the sources of market integration between households classified by gender composition and mode of land acquisition

Households group	Value of subsistence production		Percentage of value of groundnut and sesame sales total agricultural sale ^b (3)	Percentage of off-farm income per capita out of total income (4)	Percentage of wage income per capita out of total income (5)
	Percentage of total value of agricultural production (1)	Percentage of total income ^a (2)			
Female-headed households (30) ^a	83.4	49.4	18.8	35.0	21.1
Households renting land (9)	75.0	37.3	50.6	61.0	49.4
Other households (64)	69.1	44.4	60.0	59.9	46.4
Average	75.8	43.7	43.1	51.0	38.9

SOURCE: Southern Kordofan field survey, 1993/94.

Notes: The total number of observations is shown in parentheses.^a Various modes of land acquisition exist under this group. These include inherited land, rented in land and land obtained free through family links.^b Total income includes wage income, transfers, and proceeds from sales of cash crops and edible wild fruits.^c Total agricultural sales income cash crops, livestock, vegetable and edible wild fruits.^d We use the agricultural wage income as a proxy.

It is also interesting to note that the households group that earn more from sales of cash crops (group 3 in table 4) earn less from labour time sales in the rural market. This implies that commercialisation through growing of cash crops draws family labour into agriculture to produce both cash and subsistence crops. This could be considered as household's enterprise insurance strategy given the high income and employment risks at least among this household group.

We also note that the households group that rent land is not less commercialised, despite the fact that these households are usually new migrants who spend time to rent land. The explanation we give here for this seemingly paradoxical situation is that most of these households reported high quality of land under their use. Thus, it seems that they consciously maintain relatively high commercial production in addition to sales of more labour time in the rural market (see households group 2 in table 4) with a view to meeting the high production costs, including land rent.

Table 5 shows the allocation of adult labour time in person-day per households group per year. The average total labour time per working adult female member of fifteen years and above, is 202 for households with cattle, 238 for households that rent land, and 200 for female-headed households. This labour input is relatively high compared to other African countries. A study on Rwanda, which is a land-scarce and labour surplus country, found that the average total labour time per adult family member amounted to 154 person days, which is a rather low figure. One reason for this high labour input in the study region is that, due to year to uncertainty of rainfall, farmers practice *elramail*, that is, early seeding, which requires the spread of labour input. The other reason is that it seems that intensification of labour input is one of strategies followed to increase return from various household's activities in the study area. Another important result, summarised in table 5, is that, with the exception of the last households group, households with greater wealth measured by cattle as a proxy for wealth tends to allocate relatively less labour time to farming. The second row of the table shows the average working days per adult family members spent in the agricultural labour market. It indicates that both the female-headed and the cattle-owning households groups reported less work in the rural agricultural labour market.

Table 6 summarises the labour force characteristics by households groups. It indicates that almost all of the subsistence cultivators participate actively in the labour market as sellers of labour services. Columns 2 and 3 show that 70 percent of the surveyed households had some family members who participated in the rural agricultural labour market³, and 57 percent of them had members who were earning income from non-agricultural wage. The cattle-holding households group reported the highest percentage, which parallels our earlier reported observation.

The following important observations could be drawn from the above simple tabulations and stand for further scrutiny. First, although it is easy to differentiate the subsistence farmers of the Southern Kordofan region into land-owning and landless peasants, differentiation along this line is not meaningful. It seems that the growing differentiation among the subsistence peasants stems from off-farm sources. Off-farm income is emerging as a key determinant of subsistence household behavior. Hence, it is interesting to note that access to agricultural resources alone, for example land and potential pool of

labour, may not explain the dynamics of rural change. Secondly, subsistence agriculture is just one element in a complex and changing local economy. Subsistence farmers piece together a living from various sources; subsistence farming, cash cropping, wage labour and livestock. Labour intensification, in the sense of increasing labour input, represents the main strategy to increase returns from these sources.

Table 5. Allocation of labour in person average working days per working unit^a

Labour allocation	Households group		
	Households with cattle (22)	Households renting land (9)	Female-headed households (30)
Agricultural labour on own farm	91	115	102
Off-farm labour	64	68	46
Other activities ^b	47	55	52
Total	202	238	200

SOURCE: Southern Kordofan field survey, 1993/94.

Notes: The total number of observations is shown in parentheses.

^a A working unit is defined as an adult-equivalent. We weight family members in the age group 5-15 or above 55 years of age by 0.6.

^b These include, among others, unorganised household activities and social activities.

The uncertainty and poor returns of agriculture insure that no household invests all its labour in agriculture in order to survive; households must combine farming with off-farm work. It follows that the agrarian household links to the wage economy provide an interesting insight into the factors that govern the behaviour of the subsistence smallholder as well as the process of rural differentiation. In particular, by showing that the farming strategies of the smallholder are influenced by their participation in the rural labour market, and that this participation affects the dynamics of subsistence farming, this study will cast doubts on the current assumptions about proletarianisation, eviction and displacement of subsistence farmers that dominate the discussion on agrarian development in Sudan.

Table 6. Labour force characteristics by households group in Southern Kordofan

Household Group (1)*	Percentage reporting agricultural wage income (2)*	Percentage reporting wage or salary earning (3)*
Female-headed households (30)	52	21
Households that rent land (9)	88	60
Cattle owning households (22)	70	90
Average	70	57

SOURCE: Southern Kordofan field survey, 1993/94.

* The total number of observations is shown in parentheses.

Finally, the expansion of the mechanised farms is the main, but not the sole, source of commercialisation in the study area. The effect of this process of expansion unfolds itself in changing the patterns of uses of farmers' resources other than land. The household as a unit of production is strengthened through this process, which weakens its links to the community's economic system through its subordination to competition with the mechanised farms, mainly in the products market rather than in the factors market.

Understanding the full effect of the rapid growth of the mechanised farms on the socio-economic structure in the study area requires a complete model to analyse the linkages among agricultural production, income distribution and consumption orientation in production. Such a model is out of the scope of this study. However, as we noted earlier, the approach we follow uses the technique of factor analysis to highlight an aggregate pattern of characteristics associated with the mechanism of differentiation and integration in the social structure. Comparative static results will be used to describe particular aspects of this process of change. In the rest of this chapter an attempt will be made to consider these points in some detail.

3.2.2 *The Dynamics of Change and the Patterns of Variation of Non-farm Activities.*

Before presenting the results, due to data limitation, the reader is forewarned that the tone of these results will be provocative and speculative rather than conclusive.

The application of the principle component analysis to the data matrix indicates that the sorted factor pattern matrix, using varimax method, degenerates into three patterns of association of the characteristics (see table 7). However, if the factor pattern matrix is sorted, such that no loading less than .5 in absolute value is displayed, then, the data matrix collapses to form a fundamental structure. This simple structure accounts for 98% of the total variance. The characteristics that differentiate similarly among places to form this dimension and have a very high loading in factor 1 relate to local economic services, the extent of market integration, the extent of participation in non-farm activities, the educational services, and transport and communication. For all included characteristics, an increase in this factor may be broadly interpreted to represent a move along a scale that ranges from self-sufficient family units to commercially oriented and relatively specialised economic units.

Table 7. The rotated factor matrix

Indicator	Factor 1	Factor 2	Factor 3
Economic services	.67653	.13960	.12352
Subsistence orientation in production	.67531	.15516	.12012
The extent of market integration	.67222	.16346	.12376
The extent of participation in non-farm activities	.67162	.19683	.10107
Educational services	.66687	.22232	.09010
Transportation	.65871	.22163	.09689
Communication	.62657	.28686	.05577
Services provided by the Council	.60869	.26245	.14909
Political and judicial characteristics of the Council	.58820	.18119	-.08455
The character of basic social organisation	.58643	.36337	.05081
Retail establishments	.65034	.35405	.10878
Religious services	.52018	.34170	.16660
Health service	.50160	.45157	-.01494

Such an association between the levels of economic development and the degree of rationalisation and specialisation of economic roles is also established by Berry (1962). Berry researched into the association between the level of economic development and the degree of urbanisation. His results established that communities spread evenly on a *technical scale* as if along a linear continuum. He argued that such a character of spatial structure on a continuum of relative development approximates Rostow's idea of economic growth through time.

The pattern of association incorporated in factor 1 is strongly suggestive of a broad schumpeterian mechanism of destructive creation. Destruction involves the gradual demise of the undifferentiated productive units. The creation process involves the emergence of more specialised and autonomous units as well as the spatial integration of these units. The characteristics that have a high loading in factor 1 and portray the process of the demise of the undifferentiated units include, first, the economic services and the other related activities. Second, the subsistence orientation in production measures the extent to which subsistence orientation in production and consumption is declining due to technological and commercial penetration. As we saw earlier, the economic activities in the study area are, by technological necessity, extractive in character, i.e., agricultural production. However, the survey data shows that considerable variation exists in the degree of subsistence orientation and in the sources of market integration (see table 3 and 4). Third, the degree of market integration as well as the degree of participation in non-farm activities both indicate the extent to which places are served by tertiary system.

The process of the creative integration is indicated by the educational services, transportation and communication. The evolution of these characteristics tends to weld together diversified socio-economic units.

Having established a *scale* of relative development, it is possible to speculate the way in which the process of change relates to this *scale*. First, the characteristics that differentiate similarly among places to generate a unified complex of change in the life style in the study area relates to important aspects of the non-farm activities. It follows that a high percentage of inter-places variations in the levels of socio-economic development associates with differentiation in characteristics related to non-farm enterprises. Second, progression from high to low order central places along this *scale* is also a progression from the most to the least commercialised or spatially integrated places. Hence, observations about such an economic landscape could be used as indicators of structural change in the local economy.

This discussion suggests that location specific characteristics revealed by the survey data do matter. Therefore, dummy variables will be included in the relevant regression models in studying the interactions of interest. The comparative statistics to be obtained will be used to highlight important aspects of the interaction of the socio-economic variables with the levels of relative development in the economic landscape of the surveyed places.

3.2.3 Analysis of Productivity of Time

We use multivariate analysis based on the concepts described by model 4 in section 2.1.4. The model is estimated in two variants: The households considered in the first version includes at least one person of prime working age. Self-employment income is taken as the dependent variable. The second version includes wage income in a household's working time.

Before discussing the results, one limitation of the productivity estimates must be spelled out. In addition to what is noted earlier, we further note that time use data based on one round survey in the year may not have a high degree of precision. For this and the other noted reasons the estimated coefficients indicate only the level of magnitude.

Table 8 presents the results of the application of the ordinary least squares method to the survey data corresponding to the first version of the regression model. The regression equations show that the fit is fair and the F-statistics are highly significant at 1% of the variation in income, that for cattle-owning households explains 46%, and that for female-headed households explains 33% of variation of income.⁴ The difference in R^2 reflects the significance of the gender composition of the households in the study area. Since the model is specified in log-linear form we can obtain elasticity directly. For all households, a 10% increase in the number of adults in the household will increase income by 31%. However, for data and method limitations, such inferences are not unwarranted. From the results presented we can say that for all households, land does not seem to be a major determinant of income. Women's labour time is statistically significant in explaining variation of income in women-headed households group, while in cattle-owning households group it is not important. Children's labour time is significant only among cattle-owning and female-headed households groups. Human capital, approximated by education, seems to enhance self-employment income only in cattle-owning households group, but it is not statistically significant.

Although the coefficients of the dummy variables are not statistically significant, residence in the main urban centres in the study area seems to play a positive role in enhancing income, even among the self-employed, as compared to residence in other villages. In particular, it is interesting to note that this role declines in importance as we move down to smaller villages in the lower order of the hierarchical patterns of human settlement in the area. A possible explanation for this is that farmers in the urban centres generally use progressive techniques of farming, observe the right agricultural calendar and have access to agricultural credit. Given the differences in the quality and levels of inputs observed among farmers in the first order central places, one may assume the existence of a different production function for places in this rank. Separate production functions are estimated for these places and the rest of the places in the lower ranks; however, no major differences are observed.

Table 9 presents the estimated coefficients of the second version of the model, with wage income included in income and wage work included in working time. The coefficient of education, although statistically significant, yet it is small implying that the importance of education variable in enhancing income does not increase greatly across households groups.⁵ This result is not surprising for the obvious reason that, persons educated in the rural areas have a strong incentive to migrate to intermediate and big towns where wages for the educated are expected to go higher. The data set employed here does not cater for this migration effect. The importance of education in enhancing income is reduced in female-headed households group, as compared to other households groups. Perhaps, the rate of dropout is high among female as compared to males in this rural setting.

The estimated coefficient for age, as a proxy for experience, has significantly increased in this estimated version. The main reason for this is that, since we used the highest education attained in the household, our data set shows a positive correlation between years of schooling and the wage rate. Therefore, age and wages are also positively correlated. Hence, the inclusion of wage income in the dependent variable significantly increases the value of the estimated coefficient for age.

The coefficient of male labour time rises substantially when wages and time worked for wage are included in the data, but that of female's and children's labour time does not, except in the female-headed households group. This result parallels that reported in table 8 indicating that adult men do more labour for wage or otherwise than do females or children. Again, the contribution of land to income remains insignificant. In the female-headed households group, the estimated coefficient of time inputs of adult women has substantially increased implying that female's economic work time has a significant effect on household income, especially when wage work is included.

In general, the values of the estimated coefficients for the dummy variables significantly decrease as one moves from the main intermediate urban centres down to smaller villages. However, it is interesting to note that, for the female-headed household category, residence in high order places as compared to residence in low order places offers no advantage. This could be taken as evidence in support of rural labour market segmentation along gender line in Southern Kordofan.

Table 8. Determinants of household income, excluding wage work and wage income

Independent variables ^a	All Households			Households with cattle			Female-headed households		
	b	Beta	t	b	Beta	t	b	Beta	t
In work time:									
Men 15 yrs or over	.307	.351	1.928	.240	.217	1.061			
Women 15 yrs or over	.160	.435	2.343	.090	.080	.302	.346	.490	3.380
Children 5-14 yrs	.015	.206	.151	.030	.080	1.616	.020	.056	1.570
In lands	.126	.192	.995	.103	.131	.940	.105	.130	.880
In educate	.061	.098	.984	.132	.151	1.027	.031	.194	.412
In age of head	.650	.213	1.340	.690	.210	.197	.590	.193	1.312
In cattle	.076	.171	.406	.177	.163	1.080			
In small animals	.262	.208	1.928	.326	.382	2.090	.183	.056	3.210
Location: ^b									
Urban centres	.431	.392	.987	.159	.028	.161	.237	.039	.296
Large villages	-.068	-.122	-.860	-.090	-.082	-1.088	-.084	-.065	-1.317
Small villages	-.588	-.112	-.585	-.618	-.543	-.987	-.455	-.320	-.873
Constant	2.875		3.332	3.233		3.909	3.251		4.650
R ²	.50			.46			.45		
F	2.910			2.625			3.829		
No.	100			22			30		

Notes: The dependent variable **Rprod** = logarithm of total value of 1993/94 agricultural output in Ls. Sudanese Pounds.

^a Definition of variables:

In work = logarithm of total available labour force in the household for agriculture in days/year.

In lands = logarithm of farm size in makhamas (one hectare = 1.36 mkhamas).

In educate = logarithm of highest education in the household approximated by the numbers of years of school attendance.

In age of head = logarithm of the age of the head of household.

In cattle = logarithm of value of cattle in Ls.

In small animals = logarithm of the value of the small animals in Ls. (Goats are the most popular animal in the area.)

^b Dummy variables are used to capture the effects of the location. Villages of less than 20 households are the omitted category.

T = the t-statistic; No. = the number of observations; F = the F-statistic.

Table 9. Determinants of household income, including wage work and wage income

Independent variables ^a	All Households			Households with cattle			Female-headed households		
	b	Beta	t	b	Beta	t	b	Beta	t
In work time:									
Men 15 or over	.362	.310	2.320	.312	.298	2.744			
Women 15 or over	.192	.161	1.711	.175	.441	2.640	.414	2.340	2.302
Children 5-14	.020	.078	.261	.091	.060	1.921	.015	.230	
In lands	.130	.235	1.920	.192	.174	.952	.241	.590	3.481
In educate	.163	.229	1.475	.194	1.169	1.274	.104	.631	.541
In age of head	.782	.209	1.640	.690	.210	1.260	.801	.234	1.350
In cattle	.279	.618	1.930	.397	.300	1.105			
In small animals	.140	.152	.949	.413	.450	2.170	.290	.340	2.081
Location: ^b									
Urban Centres	3.320	.584	2.260	2.310	.928	.936	.901	.320	.267
Large villages	-1.232	-4.012	-2.980	-.901	-3.091	-2.050	-.109	-.034	-.222
Small villages	-1.232	-4.012	-2.980	-.901	-3.091	-2.050	-.109	-.034	-.222
Constant	2.155		2.297	3.018		3.481	2.47		3.104
R ²	.58			.49			.42		
F	3.800			3.574			3.273		
No.	100			22			30		

Notes: The dependent variable Rprod = Logarithm of total value of 1993/94 agricultural output in Ls. Sudanese Pounds.

a) Definition of Variables:

In work = Logarithm of total available labour force in the household for agriculture in days/year.

In lands = Logarithm of farm size in makhamas (one hectare = 1.36 mkhamas).

In educate = Logarithm of highest education in the household approximated by the numbers of years of school attendance.

In age of head = logarithm of the age of the head of household.

In cattle = logarithm of value of cattle in Ls.

In small animals = Logarithm of the value of the small animals in Ls. (Goats are the most popular animal in the area).

b) Dummy variables are used to capture the effects of the location. Villages of less than 20 households are the omitted category.

T is the t-statistic, No, is the number of observations and F is the F-statistic.

We include income from cash cropping and re-estimate the same equation based on the second version for the three groups of households. Since crop specific labour inputs are not easy to determine, we used the aggregated all-crop labour time input. The findings, not shown here, support our earlier results. However, the coefficients for the dummy variables for location indicate that no particular pattern in cash cropping appears across the central and smaller villages' categories in the case when income from cash cropping is included. This implies that location in the smaller villages offers almost the same economic opportunity in cash crop production for the three categories of the households under consideration.

3.2.4 Analysis of Aggregate Production Function

Two alternative forms of the production function based on concept (4) discussed in section 2.2.2 will be determined and estimated here. Such an exercise is justified since the results should be viewed as a kind of sensitivity analysis. In order to highlight the complementarities between factors of production, labour, capital and land, we attempt first to estimate and discuss an all-crops aggregated production function of Cobb-Douglas type.

Second, we present an explanation for the variation of labour productivity over the sample of households. We note that the determination of labour productivity on these two aspects may circumvent some of the simultaneity problems we noted earlier. Nevertheless, some caution usually should be made when interpreting the estimation results from Cobb-Douglas production function of the nature presented here.

An ordinary least square method applied to the survey data gives the results of the estimation of the aggregated production function reported in table 10. From the outset it should be noted that capital and labour used here are only approximations for actual capital and labour used in the production process. For example, the quality of labour and the appropriate timing of its application are equally important. No allowance is made for such variations in quality except in the case of land.

The estimated results reveal the dominant role of labour in this land surplus rural setting. The production elasticity of labour is 0.55 indicating that an increase in labour productivity at the household level will substantially increase output. The production elasticity of land is 0.27. This rather low value of the coefficient confirms the results obtained earlier. The elasticity of capital is 0.11. This insignificant value for capital elasticity does not usually indicate the role of investment in capital for agricultural production, for the simple reason that the response of output to capital input is not always straightforward due to lags involved between the use of capital input and output. However, this point will not be elaborated here.

The production elasticities of key factors of production, labour, capital and land give a rough idea about the economies of scale, since these output elasticities are also the factor shares representing the contribution of the individual input to farm output. Adding up the estimated coefficients for the key factors of production give .93, which is below unity implying that the famous rule of the inverse relationship between farm size and productivity does apply in this rural setting. That is, the production process in large farms does not necessarily reduce factor costs. This observation contradicts Kevane's (1992) paradoxical finding that in rural Sudan there is an inverse relationship between land to labour ratio and farm wealth, i.e., poorer farmers use more land per worker. In fact, the estimated coefficients for the contribution of land to income (or production) across different households groups have a very low value.

Table 10. Estimate of aggregate production function

Independent variables ^a	All households		
	b	Beta	T
Totlab	.55	.43	2.136
Capital	.11	.14	1.174
Lands	.27	.28	1.079
Landq	.15	.14	4.074
Constant	2.34		1.987
R ²	.49		
F	20.23		
No.	103		

Notes: The dependent variable Rprod = logarithm of total value of 1993/94 agricultural production in Sudanese pounds.

^a Definition of variables:

Totlab = logarithm of total labour force available in the household in days/year measured in adult-equivalent.

Capital = logarithm of present value of all tools and implements in Ls.

Lands = logarithm of farm size in makhammas (one hectare = 1.36 makhammas).

Landq = index of land quality based on a subjective evaluation of farmer on farm specific characteristics (1 = excellent, 2 = average, and 3 = worse than average).

T = t-statistic; F = F-statistic; No. = the total number of observations considered.

Variation in agricultural labour productivity is one of the most intricate issues, especially in situations of land surplus economy where sub-optimal holding of land may often arise. An attempt will be made here to investigate landholding productivity links. Boserup 1981 argued that farm technology is influenced by population density in a positive way. It would be interesting to test this link in a land surplus economy as in the case under study. In formulating such a test, we hypothesise that labour productivity is determined by capital stock per person, quality of land, human capital approximated by the highest education attained by the head of the household and child share.

The specification of the model and the estimated coefficients are reported in table 11, which shows that the fit is fair as F-statistic is significant at 1% level. The coefficient of land quality shows a positive impact on labour productivity. Other variables at best show a statistically weak influence. As expected, farm size is not an important determinant of productivity. Thus, given the current farm technology, the induced Boserup 'effect', i.e., the endogenous technological change, is very weak. Hence. Improving labour productivity has to be supported by 'exogenous' agricultural production technology, which requires substantial investment in improving the supply of inputs, particularly effective measures to improve the quality of land.

Table 11. Determinants of labour productivity in agriculture in Southern Kordofan

Independent variables ^a	All households		
	b	Beta	t
Childish	-8.03	-.08	-.310
Educate	-1.57	-.03	-.138
Landq	.53	.13	1.631
Womanish	-6.96	-.13	-.982
Capital	.12	.01	.068
Lands	.03	.02	.158
Constant	9.51		.944
R ²	.15		
F	10.57		
No.	103		

Notes: The dependent variable is net returns per day of total household labour available for agricultural production.

^a Definition of variables:

Childish = the share of children under 5 years in total number of persons in the household.

Educate = highest education in the household approximated by the numbers of years of school attendance.

Landq = index of land quality based on subjective evaluation of farmer on farm specific characteristics (1 = excellent, 2 = average and 3 = worse than average).

Womanish = The share of women of working age in total number of persons in the household.

Capital = logarithm of present value of all tools and implements in Ls.

Lands = logarithm of farm size in makhammas (one hectare = 1.36 makhammas).

T = t-statistic; F = F-statistic; No. = the total number of observations considered.

The marginal productivity of the time worked can be calculated from the data and from the regression coefficients reported in tables 8 and 11. Assuming 6 hours working day on average, marginal productivity of male labour expressed in Sudanese pounds varies between 110 and 124 Ls., and that of female labour varies between 105 and 120 Ls. The daily average wage rate for agricultural labour at the time of the survey is 250 Ls., and the average daily per capita income, i.e., the estimated income from the collection of edible wild fruits and transfers, is 130 Ls. In all cases, the calculated marginal productivity of labour is below the ruling wage rate and the average per capita income.

3.2.5 Determinants of Off-Farm Work

An ordinary least squares method applied to the survey data gives the regression results for the determinants of off-farm work, based on concept (5) discussed in section 2.2.2. Table 12 below summarises these results, the F-statistic is significant at 10% level, and all the estimated coefficients have the expected signs, however, with varying degrees of significance. Since the model is specified in semi log-linear form we can obtain elasticities directly. Presumably, a 10% increase in agricultural labour productivity

reduces off-farm work by 6%. This implies that agricultural policy package designed to improve the supply of factors will reduce the potential seasonal pressure in the rural labour market and may even increase the wage rate. Furthermore, the results show that an increase in the number of adults at the household level significantly increases off-farm labour supply.

The estimated coefficient for wage rate is very low and statistically not significant, this implies either the existence of rigidities in the rural labour market or the existence of high risk associated with work or both.

An increase in the share of women in the household reduces the amount of labour time spent on the labour market. Also, as expected, an increase in income, an increase in the expected value of the agricultural output and an increase in the expected value of cash crops, reduce the amount of labour available for off-farm work.

Table 12. Regression results of the determinants of work time for off-farm work

Independent variables ^a	All households		
	b	Beta	t
Male	7.37	1.16	1.940
Rprodl	-.61	-.05	-1.774
Womanish	-.12	-.03	-1.969
Yoff	-.13	-.09	-2.796
Wage	.07	.15	.951
Eprod	-.02	-.05	-1.490
Ecash	-.01	-.81	-14.881
Constant	.99		2.696
R ²	.90		
F	1.79		
No.	103		

Notes: The dependent variable off work = the total number of days of off-farm work per household.

^a Definition of variables:

Male = the share of males of working age (15 – 55 years) in total number of persons of working age in the household.

Rprodl = logarithm of expected current output in Ls. (based on last year estimates).

Womanish = the share of women in total persons in the household.

Yoff = logarithm of cash income from other sources.

Wage = logarithm of average off-farm wage rate per working day in Ls.

Eprod = logarithm of net returns in agriculture per available labour day (an index for labour productivity).

Ecash = logarithm of expected value of current cash crops in Ls based on last year estimates.

T = t-statistic; F = F-statistic; No. = the total number of observations considered.

To determine household composition effect on the allocation of labour time, we include the share of adult in total number of persons in the household as a single variable approximating household's size and re-estimate model 4. The full specification of the econometric model and the results of the estimated regression coefficients for all households are reported in table 13. The findings indicate that the larger the household, the less leisure time available for its members. This applies to males and females in the age group 15-55 years. This implies that larger households tend to have more dependent members and, as we saw earlier, due to the low marginal productivity of labour, they have to work very hard to sustain their members. Hence, it could be argued that low marginal productivity does not always imply the existence of labour surplus. Furthermore, as expected the size of land does not explain the allocation of a household's labour time between work and leisure.

As regards location differences, the estimated coefficients are not statistically significant for the three ranks of the selected study places. This result lends support to the factor analysis solution that it is not easy to group places according to the degree of differentiation of nuclear family (children-parent) unit from the extended kinship complex.

Based on these results alone it is not easy to accept the view that, the emergence of off-farm work is an indicator of a rapid process of proletarianisation and/or eviction of subsistence farmers as had been emphasised in many studies on the effects of the mechanised farms on the Sudanese rural economy. To establish a robust support for this argument we run two tests, the first for labour intensification hypothesis and the other for inverse labour supply hypothesis, which are described by equations 6 and 7 in section 2.1.4. The specification of the regression models and the estimated coefficients are presented in tables 14 and 15.

The reported results show on the one hand, the labour intensification hypothesis, that is, the existence of under-utilised farmers' labour, is rejected. The result of this test parallels the above stated observation that almost all of the surveyed households have less leisure time. On the other hand, the estimated coefficient of the inverse labour supply shows the right sign; however, the t-statistic suggests that this coefficient is not statistically significant. Based on the results of these two tests it is not easy to sustain the theses of proletarianisation and inverse labour supply.

Table 13. Regression results of the determinants of the individual time use

Independent variables ^a	Number of days worked for wage					
	B	Beta	T	B	Beta	t
Cattle	.08	-.17	.406	.18	.37	1.881
Small animals	.34	.39	2.091	.26	.28	1.920
Lands	.14	1.19	.995	.10	.66	.941
Educate	.16	-.99	-.989	.13	-.75	-1.727
Age	.65	.21	1.346	5.92	7.90	1.960
Adult	.08	.07	.194	-.10	-.57	1.502
Location ^b						
Abbasiya	2.83	.13	.343	-2.31	-.15	-.364
Large villages	.95	.15	2.341	3.41	.58	2.261
Small villages	.20	-.13	.222	.39	.30	1.105
R ²	.46			.34		
No.	100			100		
F-value	11.0			10.9		

Notes: The dependent variable = logarithm of total labour force measured in adult – equivalent in days /year spent on organised production, unorganised production and leisure per household.

^a Definition of variables:

In cattle = logarithm of value of cattle in Ls.

In small animals = logarithm of the value of the small animals in Ls. (Goats are the most popular animal in the area).

In lands = logarithm of farm size in Makhamas (one hectare = 1.36 Makhamas).

In educate = highest education in the household approximated by the numbers of years of school attendance.

In age of head = logarithm of the age of the household.

Adult = the share of adults of working age (15 – 55 years) in total number of persons in the household.

^b Dummy variables are used to capture the effects of the location. Villages of less than 20 households are the omitted category.

T = t-statistic; F = F-statistic; No. = the total number of observations considered.

Table 14. Regression results of the test for predicted sign for labour intensification

Independent variables ^a	All households			
	b	Beta	t	f
Totlab/adult	-.09	-.02	-2.518	6.4
Constant	14.25		.958	
R ²	.47			
No.	103			

Notes: The dependent variable = the ratio of days of off-farm work to total available labour force in days/year per household.

^a Definition of variables:

Totlab/adult = logarithm of the ratio of total available labour force in days/year to total available adult labour force in days/year per household.

Table 15. Regression results of the test for predicted sign for inverse labour supply

Independent variables ^a	All households			
	b	Beta	t	f
Labof/R	-.03	-.01	-.641	.411
Constant	6.95		.521	
R ²	.39			
No.	103			

Notes: The dependent variable = the ratio of days of off-farm work to total available labour force in days/year per household.

^a Definition of variables:

Labof/R = logarithm of the ratio of total labour time spent on the mechanised farms sector in days/year to total available labour force in days/year per household, plus labour time spent on off-farm work.

3.2.6 Determinants of Subsistence Orientation in Consumption

In this section an attempt will be made to test the significance of labour augmenting effect of the mechanised farms sector that works through the food crop market. Multivariate analysis is used in formulating the test. The regression model is based on the concept of subsistence orientation in consumption (ratio [ii] in section 2.1.3.) and on equation (9) in section 2.1.4. The specification of the model and the results of the estimated parameters are reported in table 16 below.

Table 16. Regression results of the determinants of subsistence orientation in consumption

Independent variables ^a	All households		
	b	Beta	t
Irisk	15.49	-.04	-1.537
Adult	1.23	.49	2.131
Childish	27.23	.09	.583
Wage	.17	.12	1.628
Capital	.03	.03	.253
Rprodl	-5.27	-.16	-1.34
Eprice	.07	.05	.340
Constant	84.51		1.496
R ²	.15		
F	14.13		
No.	103		

Notes: The dependent variable = the ratio of the value of own-produced food consumed by the household to total value of food and non-food consumption in Ls.

^a Definition of variables:

Irisk = index of risk based on the head of household's perception of crop specific risk on scale of 1 to 3.

Adult = the share of adults in total number of persons in the household.

Childish = share of children under 5 years in total number of persons in the household.

Wage = average off-farm wage rate per working day in Ls.

Capital = household per capita stock in Ls.

Rprodl = logarithm of net returns in agriculture per available labour day (an index for labour productivity).

Eprice = household expectation of the prices of dura in the local market based on last year's prices.

F = F-statistic, t = t-statistic; No. = total number of observations considered.

For the determinants of subsistence orientation in consumption, approximated by the percentage change in subsistence share of total expenditures, the regression equation shows that the fit is fair and F-statistic is highly significant at 1% level, implying that the model is correctly specified. As expected, the signs for the estimated parameters for the availability of productive resources, household per capita stock, expected price of dura, the dependency ratio and household's perception of risk are in the right direction, although with varying degree of significance.

The regression results suggest a strong effect of an increase in adult share in persons in the household in reducing subsistence orientation. They also indicate a significant effect of household's capital stock per capita in reducing subsistence orientation. The results also lend support to the hypothesis that access to off-farm wage employment reduces subsistence orientation. Also both household's perception of the crop specific risk and the household cycle have very strong effects on subsistence orientation. The coefficient

of the expectation of change in the price of dura in the local market has the right sign as expected, but it is not statistically significant. This result implies that even households with sufficient off-farm resources are not willing to completely depend on the market for their staple food consumption, and hence are unwilling to cultivate other crops in dura plots in response to dura price changes. In fact, almost all of the surveyed households are not self-sufficient in dura production, even though it is their primary subsistence crop. Hence, they are keen to cultivate dura to keep food expenditure low. Fluctuation in dura prices and inflation makes this even an urgent strategy. Nevertheless, the result also suggests that there is a great potential for policies designed to stabilise dura prices in the local market to induce farmers to diversify their resources out of subsistence production. Such policies should be viewed as an integral part of a comprehensive food-insurance mechanism, including rural credit programme; otherwise the costs of efficient specialisation will be very high, especially for the poorer households.

4. SUMMARY OF FINDINGS AND IMPLICATIONS FOR POLICY ACTION

The prime objective of this study is to identify and quantify the links of the subsistence farmers in Southern Kordofan to the wage economy and to subsistence production. An attempt was made to portray the impact of these two micro-economic aspects of household behaviour upon subsistence orientation in production and consumption.

In particular, we looked at the determinants of the productivity of labour, and at the factors that limit the growth of a household's income from self-employment. Furthermore, we looked at the determinants of off-farm work and tested for the existence of labour intensification and inverse labour supply.

Before turning to the general issues, we singled out the main empirical and analytical problems encountered that may be of use in future research on the dynamics of change among subsistence cultivators. Some of these problems have already been pointed out at the relevant places.

4.1 Analytical Approach and Data

Specific models identified in chapter two and quantified in chapter three are based on the standard micro-economic theory. From this perspective, the concept of 'Household' as used in the standard micro-theory does not fit well in the subsistence setting such as the area of the case study. Various traditional support systems exist in this high-risk production environment. Households make use, to a varying degree, of these systems as farm-based food insurance. Although this approach is feasible from the household point of view, it presents some problems of data collection and quantification. To circumvent such problems one needs more information on the history of the household, availability of relatives, etc., as a proxy for the extent of use of the traditional support systems.

The second problem is that the production environment in the case study is very heterogeneous. It includes organised and unorganised household production, which is carried out throughout the year. Some of these activities have no market price. This adds further complication to the use of the classical micro-theory, which assumes the existence of markets and prices.

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The third problem relates to the static nature of the classical theory, which yields comparative statistics concerning the manipulation of choice variables to maximise household welfare under *ceteris paribus* assumption. This premise overlooks the issue of dynamics and hence limits insight into the development process, largely based on capital accumulation and population change. This conceptual problem is further exacerbated in our case where the data used is generated through a one-shot survey.

4.2 Summary of the Main Findings

The data set on which the main findings are based is generated from one round survey of production, consumption and income for 103 households. Given the limitations of studying the dynamics of change in the region with one-shot data set, we apply the principle of components analysis to the data matrix recovered from the spatial schedule with a view to gaining some semi-quantitative insights into the interaction of various types of socio-economic variables with the levels of relative development in the economic landscape of the region. The following observations are reported: First, the variables that differentiate similarly among places to generate a unified complex of change in the life style in the study area relate to important aspects of the non-farm activities. It follows that a high percentage of interlaces variations in the levels of socio-economic development associate with differentiation in the variables related to non-farm enterprises. Second, progression from high to low order central places along this scale is also a progression from the most to the least commercialised or spatially integrated places. Hence, observations about such an economic landscape could be used as indicators of structural change in the local economy. The results also indicate that intensive and extensive synchronic study could be successfully carried out to map the location and time patterns of markets along with their size and function indices in the region.

Simple tabular analysis and various multiple regression models were used to study the main interactions of interest. From the analysis, the following conclusions and comparative static results about the process of change are reported.

First, the value of subsistence production in terms of percentage of total value of agricultural production or total income does not vary across households classified by asset holding, gender composition or by mode of land acquisition, implying that agriculture in the region is subsistence oriented. The results of the multiple regression analysis of the subsistence orientation in production show that, other things being equal, the percentage change in subsistence share in total expenditure is significantly reduced as the adult share in persons in the household increases. That is, the commercialisation of items of household consumption positively correlates with availability of adult labour at the household level. Although the effect of dura production in the mechanised farms, approximated by its price effect in the local market has the expected sign, statistically it is not significant.

It could be argued that the expansion of mechanised dura production tends to reduce subsistence orientation in production, yet farmers are unwilling to cultivate other crops on dura plots in response to this expansion and the attendant reduction in dura prices. Own production of dura allows the subsistent household to intensify the use of its

potential labour force. In particular, production of *dura* utilises the labour of old adults and children. The adult female, in addition to her indirect support of subsistence production through domestic unpaid work, makes a substantial contribution to subsistence production across all types of households considered.

The analysis also shows that variation in household farming strategies is particularly evident in cash crop production and off-farm work, where households with higher share of adults in total persons in the household or own cattle, cultivate more cash crops and/or send more people to off-farm work including non-agricultural wage work. The poorer households, including female-headed households, spend more time on unorganised household production, mainly on collection of edible wild fruits for the market.

The growing household's links to the local economy increasingly alter the basic conditions of peasant production, especially the patterns of labour time use. Although it is possible to differentiate farmers in terms of landholding, differentiation along this line is not meaningful. Off-farm income is emerging as a key determinant of the behaviour of the subsistent household, which is increasingly losing its control over the most important agricultural input, namely, labour. The role of the household is not so much the organisation of disposable labour according to household needs as much as the co-ordination of the participation of its members in relation of production outside the household and the management of income from off-farm work. Therefore, the role of pure demographic factor and household's dependency cycle in determining the family's use of the agricultural labour come in a lower order of importance. In this case it appears that neither the access to agricultural resources, basically the size of farm and the potential pool of labour force, nor the asset holding are sufficient to explain the dynamics of rural change. Off-farm work is becoming increasingly an important determinant of household farming strategies and of the process of rural differentiation.

Second, from the various multivariate analysis of the productivity of time and production function, the following results are reported:

- (i) The analysis of households' income, excluding wage work and wage income, shows that residence in the first order central places seems to play a positive role in enhancing income even among the self-employed as compared to residence in lower rank in the hierarchical patterns of human settlement in the area. When wage income is included in income and wage work is included in working time, the reverse pattern emerges for the female-headed household. This implies that gender composition of household is an important determinant of the allocation of time to agricultural production. It could also be taken as evidence in support of rural labour market segmentation along gender lines in the region.
- (ii) Human assets and to some extent non-human assets are key determinants of productivity levels in the study area. Women and children across all households tend to undertake agricultural work up to the point where the marginal return to their labour is close to zero, rather than diversify their income sources through employment. This preference for food production from own enterprise could be viewed as a farm-based insurance mechanism to cope with the high risks related to production, markets and employment. Hence, market integration of

agriculture will be reduced if the market environment does not become less risky and/or off-farm employment opportunities do not improve.

- (iii) The estimated production elasticity of capital suggests that rural financial institutions may have a great potential role in inducing the productivity augmenting technological change. Furthermore, the estimated production elasticity of adult labour time shows that the presence of more adults could raise crop time; the presence of more adults could raise crop output, however, it could do so only with greater use of other supporting inputs. Without off-farm employment most of the households will not be able to maintain the current level of production. Thus in a risky production environment, the need for rural credit system is very urgent especially if the poorer segments of population are to gain access to improved inputs and to gain from efficient specialisation.

Finally, it could be argued that the expansion of the mechanised farms has not directly evicted farmers and transformed them en masse into wage labourers. From the reported evidences we cannot say that the capitalist agricultural development depletes peasant production and creates a landless proletariat. The farmers in the case study area share the world-wide experience of declining agriculture and incomplete proletarianisation. Furthermore, the expansion of the mechanised farms tends to reduce farmers' resource base through increased competition on products markets. The mechanised farms sector generally produces dura and sesame. On the one hand, the production of the latter crop competes with the products of small farmers in the market, and thus tends to undermine petty commodity production. However, some of the farmers make use of the difference in the agricultural calendar between the start of production in the subsistence farms and the mechanised farms sectors⁶ and accordingly responded through renting tractors during the sub-optimal production period in the mechanised farms sector (mainly between May and July). Other farmers adjust either by changing their previous crop mix, cultivating more groundnuts for example, or by supplementing their subsistence production with income from more off-farm work, including collection of wild edible fruits. Nevertheless, when no better alternative exists some farmers are willing to expend considerable labour time on tasks of low productivity. Thus, what people lack are better knowledge, information, productive opportunities and attractive price structure.

4.3 Implications for Policy Action

To maximise the potential gains of commercialisation and to minimise expected losses, policy-makers must give due attention to needs and constraints facing, in particular, the poor subsistence farmers. A policy package designed to increase labour productivity in agriculture will at least safeguard against the potential damage of tractorisation and the attendant commercialisation among subsistence farmers. The estimated production elasticity of capital suggests that rural financial institutions may have a great potential in inducing the productivity augmenting technological change. Furthermore, the estimated production elasticity of adult labour time shows that the presence of more adults could raise crop output; however, it could do so only with greater use of other supporting inputs. Without off-farm employment most households will not be able to maintain production. Thus, in a risky production environment, the need for rural credit system is

very urgent, especially, if the poorer segments of population are to gain access to improved inputs and to gain from efficient specialisation.

The high year to year uncertainty of rainfall makes most of the households unable to observe the right agricultural calendar that minimises labour input. Hence, there is a need for some insurance mechanism along with agricultural extension services in order to improve the absorptive capacity of the subsistence farms sector, to economise in the agricultural labour input and to minimise the production risks.

NOTES

- ¹ Cf. Khalid (1983).
- ² About 29% of households in the surgery area are, either permanently or for lengthy periods, female-headed.
- ³ Where employment is mainly but not solely in the mechanised schemes.
- ⁴ The few number of observations on landless households does not generate enough variation; thus this equation is not defined for this households group; we include them in all households group only.
- ⁵ For education we use the highest education attained in the household approximated by the number of years of school attendance. Thus no allowance is made of the fact that younger persons have more schooling. This is the main reason for the improvement of the estimated coefficient (b) as compared to the earlier estimated version of the model.
- ⁶ Production in the subsistence farms sectors starts as early as May and the production in the mechanised farms sector starts in late July.

REFERENCES

- Adams, M. E., and J. Howel. 1979. Developing the traditional sector in the Sudan. *Journal of Development and Cultural Change* 27, no. 3: 505 – 518.
- Adelman, I., and J. E. Taylor. 1991. Multisectoral models and structural adjustment: New evidence from Mexico. *Journal of Development Studies* 19: 154 – 63.
- Ali, T., and J. O'Brien. 1984. Labour community and protest in Sudanese agriculture. In *The politics of agriculture in tropical Africa*, edited by T. Barker. Beverly Hills, California: Sage.
- Bautista, B. M. 1994. Dynamics of rural development: Analytical and policy issues. IFPRI Research Report, no. 317.
- Becker, G. 1965. A theory of the allocation of time. *Economic Journal* 75 (September).
- Bernal, V. 1991. *Cultivating workers: Peasants and capitalism in a Sudanese village*. New York: Colombia University Press.
- Berry, B. J. L. 1962. Some relations of urbanisation and basic economic development. In *Urban system and economic development*. Proceedings of a conference on urban systems research in

- underdeveloped and advanced economies, edited by F. R. Pitts. Eugene, Oregon: The School of Business Administration, University of Oregon.
- Binswanger, H., and J. Von Brawn. 1991. Technological change and commercialisation. *The World Bank Research Observer* 6, no. 1 (January).
- Von Braun, J., et al. 1991. Commercialisation of agriculture under population pressure: Effects on production, consumption and nutrition in Rwanda. IFPRI Research Report, no. 85.
- O'Brien, J. 1978. How traditional is traditional agriculture? *Sudan Journal of Economic and Social Studies* 2, no. 2.
- _____. 1983. The formation of the agricultural labour force in Sudan. *Review of African Political Economy* 26.
- _____. 1986. Sowing the seeds of famine. The political economy of food deficit in Sudan. In *World recession and food crises in Africa*, edited by P. Lawrence. James Currey.
- Chayanov, A. V. 1956. *The theory of peasant economy*, edited by Thomer et al. Homewood: Irvin Press.
- Chernichovsky, D., et al., eds. 1985. The household economy of rural Botswana: An African case. World Bank staff working paper no. 715.
- Dorosh, P., and S. Haggblade. 1993. Agricultural-led growth: Food grains versus export crops in Madagascar. *Agricultural Economics* 9: 165-80.
- Duffiel, M. 1978. Peripheral capitalism and social relations of agricultural production in village of Maiurno near Sinnar. Economic and Research Council, National Centre for Research. Bulletin no. 66.
- _____. 1981. *Miaurno: Capitalism and rural live in Sudan*. London: Ethaca Press.
- El-Haj, M. S. 1976. Basic facts of traditional agriculture in Southern Kordofan. (Unpublished Report, Khadugli).
- El-Hassan, A. M. 1988. The Encroachment of large-scale mechanised agriculture: Element of differentiation among the peasantry. In *Sudan states, capital and transformation*, edited by T. Barnett and A. Abdel Karim. New York: Croom Helm.
- Fisk, E. K. 1975. The response of non-monetary production units to contact with the exchange economy. In *Agriculture in development theory*, edited by R. Lloyd. Yale.
- ILO. 1974. *Sharing in development in the Philippines*. Geneva: International Labour Office.
- ILO/UNDP. 1976. Growth, employment and equity: A comprehensive strategy for the Sudan. Geneva.
- Kevane, M. 1992. Agrarian structure and agricultural practice in Western Sudan. Department of Economics, the University of California, Berkeley, USA.
- Khalid, A. 1983. An analytical framework for the relationship between migration to mechanized farming and aggregate peasant labour supply in Sudan. Development Studies and Research Centre (DSRC), University of Khartoum.