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Food security, land use and land surveyors

P. van der Molen*

One of the measures to provide food security for the 9.5 billion people who are estimated to live on earth in 2050 is growth of agricultural production and productivity. Yield analyses reveal that all continents have potential for growth, in particular Africa. Land expansion is still possible, and land management and land administration should contribute to efficient land use and security of tenure. Much agricultural land is not well managed and unrecorded, obstructing realising the potential for growth. As land surveyors are responsible for these issues, at least in a multi-disciplinary environment, they can contribute substantially. However, further expertise on agriculturally focussed land management, knowledge of multiform land and water rights, innovative recording methods and geospatial technologies must be acquired.

Keywords: Food security, Land use, Land surveyors

Introduction

Currently, many people are faced with insecure access to food. With a growing population, food insecurity is expected to increase. Therefore, achieving food security is high on the global agenda. Achieving food security requires multifaceted policy, entailing two mainstreams. The first is the policy to change the nutrition transition as observed by Ghattas (2014) that growing population, increased urbanisation and rising incomes lead to a shift in dietary consumption patterns towards resource intensive foods, animal products, fat and sugar. The second is the policy to achieve higher agricultural production (HLEF, 2009). The latter is subject of this paper. Research papers and political documents indicate that, apart from agro-technical aspects, institutional aspects are conditional for growth. These institutional aspects comprise the way farmers have access to land, whether they perceive their possession as being secure, and how governments are facilitating socially desirable land use by creating good land governance measures. According to the definition published by FIG (1991, 2004), land management and land administration are one of the functions of a land surveyor. This paper aims primary at synthesising extant literature on the relation between food security and land use. This is the first part of the paper. It is partly quite technical in nature, because the paper also presents some relevant statistical figures, just to get the magnitude of the subject-matter right. Then the paper elucidates the changes needed for enhancing agricultural productivity. In the last part, the paper aims at identifying relations with the surveyor's professional domain.

Hunger and poverty remain persistent

Land is a scarce resource; the total land mass is estimated at 13 295 million ha, of which 1559 (12%) is cultivated

land, 4672 (36%) is grass- and woodland, 3736 (28%) is forest land, 2999 (22%) is bare land, 152 (1.1%) is settlement and infrastructure and 244 (1.9%) is inland water (FAO, 2011a).

Currently, worldwide about 868 million people are undernourished (12.5% of the world's population), of which 852 in the developing world. Sub-Saharan Africa suffers most: 26.8% of the population (numbering up to 234 million) people suffers from hunger. The correlation between poverty and hunger is high, although the overlap is not perfect. In 2004, the 'hotspots' of poverty in the world are: South Asia (446 million, 47%), South East Asia and the Pacific (169 million, 17%) and Sub-Saharan Africa (298 million, 31%). This regards people living of <1\$ a day. Of the ultra-poor (162 million people < 0.5\$ a day), 121 million (76%) live in Sub-Saharan Africa, in 2004 (IFPRI, 2007).

The global trend is a decreasing poverty in Asia (in 2004: 33 million less than in 1990), and increasing in Africa (in 2004: 50 million more than in 1990) (IFPRI, 2007). This trend continues (UN, 2012a). Despite a global trend of poverty shifting towards urban areas, the incidence of poverty is still higher in rural areas, up to 2.4–4 times more (IFPRI, 2007). Thus, the situation in Africa is most persistent: despite annual food aid of 3 billion \$ and food import of 33 billion \$ still about 265 of the 915 million undernourished people live in Africa, confirms (ECA, 2010).

Poverty remains – as said – largely a rural problem. Currently 1289 million people have an income of less than 1.25 \$/day; most of them live in Sub-Saharan Africa (47%), and South Asia (36%); looking at less 2\$/day it concerns 2471 million people, of which 69% in Sub-Saharan Africa and 70% in South Asia (UN, 2012a). Concerning the population living on less than 1.25\$/day, 70% is rural; only in the regions East Asia, Middle & North Africa, Latin America and the Caribbean this figure decreases to about 30–60% of the population, while in the rest of the world the figure is 75–80%, with South Asia having the highest figure of 82% (IFAD, 2011).

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The poorest people live in South Asia and Sub-Saharan Africa, where 80% of the people live on less than 0.75\$/day: in absolute terms about 700 million people (IFPRI, 2007). Most of them are rural (IFAD, 2011). Urban poverty in 2002 counts for 291 million (<1\$/day), 752 million (<2\$/day), resulting in a share of 24.6% resp. 26.6% of the poor population; the lower share of the urban poor will remain for the next decades, while a shift is expected in 2040 (Baker, 2008). With increasing urbanisation, the number of urban poor will thus rise.

What are the trends? By 2015, the proportion of people whose income is less than 1.25\$ per day, is halved compared with 1990 (UN, 2000). Most recent MDG progress reports reveal that worldwide the poverty rate fell from 47% in 1990 to 24% in 2010. However, because the world's population grows, the amounts are from 1818 million to 900 million. Regional differences occur: Southern Asia from 57 to 34% (in 2008), South East Asia from 45 to 17% (in 2008), China from 61 to 13% (in 2008) and Sub-Saharan Africa from 66 to 47% (in 2008) (UN, 2012b). The same MDG progress reports read that between 1990 and 2015 the proportion of people who suffer from hunger is halved (UN, 2000). Most recent progress report shows in the developing regions a decrease of the proportion from 19.8% in 1990 to 15.5% in 2008. Because of the growing population, the absolute numbers are still around 850 million people (UN, 2012b).

In sum, poverty and hunger rates fall, but remain more or less constant nominally.

Growing population requires food production

The UN estimates that by 2050, the world population will increase from 6 to 9.5 billion people, most of which live in South Asia and Sub-Saharan Africa (UN, 2011). Food security for 9.5 billion people requires a 70% increase of the global food production and up to 100% more in developing countries (FAO 2011b; HLEF, 2009). This is – annually – a billion tons of cereals and 200 million tons of meat additional to the production of 2005 (Bruinsma, 2009). This production growth can be realised for 80% from higher yields and increased cropping intensity and for 20% from land expansion. Globally it is estimated that in general 4.2 billion ha is suitable for agriculture, of which 1.6 billion ha already is cultivated (FAOGAEZ, 2009). Africa holds 60% of the area of uncultivated lands (McKinsey, 2010). Analysis shows that an increase of cultivated land is needed of 120 million ha, in Latin America (52 million ha) and Africa (64 million ha); 32 million ha should be irrigated (Bruinsma, 2009). Total yield increase is then possible of 68% (Africa), 89% (East/North Africa), 53% (Latin America), 86% (South Asia) and 81% (East Asia) (FAO, 2009).

Economic growth should provide higher per capita income which helps to reduce hunger (FAO, 2012b). In general, higher incomes through economic growth should reduce the proportion of people who suffer from hunger. One important aspect is that economic growth does not (always) reach the poor (ECA, 2012). FAO (2012b) stipulates that – amongst other aspects – this has to do with the unequal distribution of assets such as land and capital; realising that hunger and poverty are concentrated in

rural areas, agricultural growth more directly affects the poor, than other types of growth.

In sum, one way to combat growing food demand is higher agricultural production.

Farm size, fragmentation and agricultural production

Land remains a fundamental asset in the rural economy (IFPRI, 2007). Smallholders dominate the farming system (ECA, 2004; HLEF, 2009; Moyo, 2008; Nagayets, 2005). Farming on small plots is widespread, mainly for subsistence purposes (McKinsey, 2010).

Of the 525 million farms worldwide, 446 million have a size of <2 ha. These farms can be found in Asia (388 million, of which in China 193 million; India 100 million; Indonesia 17 million) and Africa (33 million which is 80% of all farms at the continent). Latin America's holds only about 4 million small farms. The average farm size here is 67 ha, understood as a sign of the unequal distribution of land, while Asia and Africa both have average farm sizes of 1.6 ha (Nagayets, 2005). In Tanzania, the average size is for example 2 ha (IAASTD, 2009); farms in Africa are normally between 0.4 and 6 ha, however in for example densely populated Rwanda <0.5 ha (ECA, 2004).

In general farm size is declining: land fragmentation occurs because of selling plots, inheritance systems, degradation of lands, conflicts and land grabbing (ECA 2004; FAO, 2011b; HLPE, 2011; Mwijage, *et al.*, 2011; World Bank, 2009). However, smallholders will need to play a key role meeting the requirements, if not for other reason than the sheer magnitude of their production in developing countries, according to (FAO, 2012b): they need to overcome considerable constraints, such as changing market-channels, food processing, knowledge intensive technologies and accessing credit. Extensive research on the future of smallholder agriculture is provided by IFAD, see for example IFAD (2009).

Landlessness is persistent, especially in Asia: studies into the characteristics of the poverty and hunger reveal that the poorest people in Asia are those who are landless (viz. of all people living of <1\$/day in South Asia 60–80% is landless, compared with Africa 4–60%). In Africa, the poorest people thus might possess land, but not enough to survive; land remains a fundamental asset in the rural economy, but the poor lack access to markets, and other key resources such as credit and agricultural inputs (IFPRI, 2007). This is in line with FAO (2011b) which argues that there is a strong link between poverty and lack of access to land and water resources.

The role of women is of paramount importance as in Africa 70% of the agricultural workers and 80% of the food producers are women (IAASTD, 2009); 31% of the households are female-headed, and yet women own less than 2% of the land (ECA, 2004). Still they are not reached by land reform programmes; forced break up of customary land holdings and titling projects mostly led to the exclusive transfer of land rights to the males; women are ignored by government services and cooperatives; new legislation aiming at correcting local inheritance rules often apply to urban areas and not to rural areas (ECA, 2004). Women's access to land remains in many cases an unresolved issue (McAuslan, 2010).

In sum, promoting higher agricultural production is access to land, in particular for women.

Africa's agricultural growth potential

Africa faces the biggest challenge, as the agricultural production growth is dramatically low compared with the rest of the world. Statistics show that for example the production of cereals globally grew from 2 tons ha⁻¹ in 1960 to 6 tons ha⁻¹ in 2007, in China from 0.5 to 5 tons ha⁻¹, in India from 0.4 to 2.2 tons ha⁻¹, but in Africa only from 0.4 to 0.5 tons ha⁻¹ (APP, 2010).

While food production in Asia grew from 100 million tons cereals to 300–500 tons in 2006, agricultural production in Africa remained about 5 million tons both in 1961 and 2006 (Langyintuo, 2011). The African Union calculates that per capita other developing countries grew from index 100 in 1961 to 170 in 2003, the world as a whole and also Asia from 100 to 130, while in Africa from 100 to 90 (African Union, 2006). Nevertheless agricultural growth increased from 2.3% in 1990 to 3.8% in 2005, however mostly based on expanding land use. Productivity hardly increased: if productivity does not boost, African food import will rise from 30 to 50 billion \$ now to 150 billion \$ in 2030 according to (Okyerere, 2012).

A study for Central and West Africa reveals that when applying better agricultural technology (high yield crop varieties, fertiliser, machinery, water) yields in any case can be improved – for example – 1.9 times for rice, 2.7 times for maize, 4.7 times for potatoes, 4.5 for bananas (IFAD, 2011). Another study estimates that the value of African agricultural production can grow from 280 billion \$ in 2010 to 880 billion \$ in 2030, generated by 225 billion \$ by cultivating new lands, 235 billion \$ by higher yields, and for 140 billion \$ by a shift towards high value crops (McKinsey, 2010). Yet another study estimates that African agriculture produces 15% of its potential, Latin America 45%, and Asia 30–50%; Europe produces 63% of its potential (van Vollenhoven, 2012).

In sum, from all continents, Africa has the greatest potential for higher agricultural productivity. When not realised, substantial increase if food import and food aid is due.

Access to land and security of tenure as one of the prerequisites

The expansion of land to be cultivated is often problematic. In particular in Africa ownership of land formally lies in the hands of the states, which are often unable to distribute use rights in a transparent way and which appear to be unable to enforce land claims (FAO, 2011c). Inadequate land tenure structures are a major obstacle too; long-term investments have found to be correlated to security of tenure and short term investments to insecure tenure, although land reform has not always be a solution for this. Project evaluations demonstrate that land reform projects often benefitted the elites and better-off, at the expense of the poor (IAASTD, 2009). Customary systems of land tenure and land use are often not legally recognised, which makes them vulnerable for grabbing by governments and local elites (ECA, 2004; FAO, 2011a, 2011b, 2011c; IAASTD, 2009; IFPRI, 2007; Mwijage, *et al* 2011; Deininger, 2003; World Bank,

2009, 2009), reason why it is necessary to develop systems where these local rights can be secured (Deininger, 2003; ECA, 2004; FAO, 2011b). This concurs with a McKinsey report, that the barriers of raising production in Africa include unclear land right, next to lack of advanced seeds and other inputs suitable to the continent's ecological conditions, inadequate infrastructure to bring crops to the market, perverse trade barriers and tax incentives and lack of technical assistance (McKinsey, 2010).

However, indeed, local farming systems have sometimes proven to be inefficient, prone to grabbing of common land by local elites which is fatal to farming systems where the exploitation of individually held residential and land properties is dependent of the use of common land for perennial crops, grazing, manure and mulch (Mwijage, *et al* 2011). As said, women's land rights are often neglected (IAASTD, 2009). Moyo (2008) stipulates that land tenure systems in Africa whether customary or statutory form remain unequal and discriminatory in power structure and procedures; these allocate land unequally on the basis of class, gender, ethnicity and other forms or social hierarchy. This causes the failed agrarian transition which reflects both the narrow spread of agricultural capitalism as well as the dependence on petty agricultural production.

Although land reform as a solution is contested (Bromley, 2008), Brazil and Thailand are examples where land reform has led to increased land tenure security, which together with other measures, was an important driver for higher agricultural productivity (Feder, 1987; World Bank, 2009). Such an agricultural transition worked also well in Asia: India, Thailand and Vietnam were rice importers earlier but are now the top rice exporters in the world (Bloomberg, 2012; Nielsen, 2002). An aspect is the registration of land rights, whether customary and statutory. HLPE (2011) brings to the fore that current concepts of land administration are too cumbersome to play a role. Therefore there is urgent need for innovative systems.

In the situation of increased commercial farming, two main questions are how land rights for the local population can be secured to avoid eviction and marginalisation, and how can (foreign) investors be provided with access to land already claimed and used by indigenous peoples (World Bank, 2009). The increased investments in large scale agriculture constitute a risk for neglecting those local land rights, while meanwhile about 50–80 million ha is already transferred to large investor's worldwide (HLPE, 2011).

This has also to do with the African Union's Comprehensive African Agricultural Development Programme (CAADP) of 2003, urging African States to invest 10% of government expenditure to agriculture and increasing the amount of irrigated lands, for which governments seek private investors (African Union, 2006). Since local land rights often are not documented, registered or secured, and the government still considers itself as the underlying owner of land, forest, water and mineral rights, local people using these resources can be easily displaced with little or no compensation (although: having formal state recognised rights is also not a full guarantee against dispossession) (HLPE, 2011).

According to the data recorded in Global Survey 11, a total of 4 312 161 people were, in general, affected by threatened and implemented forced evictions in 2007 and 2008. Implemented forced evictions count for 1 590 168 people, of which in Africa 270 660, Latin America 433

296 and Asia and the Pacific 872 926. Within these figures, it is unknown how many people are evicted because of large scale agricultural projects. Cotula (2013) suggests that in quite some cases local people end up in losing land and also the prospect of employment.

In sum, access to land and land tenure security for all is one of the conditions to boost agricultural productivity. Adjudication and recording of a pluriform variety of land rights is necessary.

Economies of scale, investment climate and political will

Despite the small average farm size, however, economies of scale matter (Okyere, 2012). Higher productivity might result over time in the increase of farm size, land consolidation and increased commercialisation (HLEF, 2009). More secure land tenure might give farmers opportunity to consolidate land holdings, through buying and selling, hereby increasing their land farm size (IAASTD, 2009). However, assembling larger parcels is still difficult because of the administrative hurdles and the lack of clear land rights (McKinsey, 2010). One aspect is that consolidation might increase rural unemployment and give way to further rural–urban migration unless growing commercialisation leads to more agribusiness providing opportunities for non-farm employment (Okyere, 2012).

Another institutional improvement should be found in the current lack of investments. Increase of agricultural production relates to the lack of a favourable investment climate (HLEF, 2009) which causes market failures because producers cannot have access to credit, to insurance and by consequence to necessary input. Also it hampers availability of equipment, which is reason that many farmers still work with hoe and cutlass (FAO, 2011c). More government investments are needed (McKinsey, 2010) and the success of the subsidy policy of many Asian countries can be followed, taking care however that subsidies are well targeted and do not only benefit the rich farmers (APP, 2010). Such a favourable investment climate calls for well-functioning financial institutions that objectively allocate, protect property rights, promote trading, reduce risks and facilitate collective action (HLEF, 2009).

Many documents urge for political will (FAO, 2011b, 2012b; McKinsey, 2010; World Bank, 2009). African leaders neglected agriculture in the past, Asian leaders did not: this explains according to Henley (2011) that agriculture in Africa is underproductive and undercapitalised. Moyo (2008) says that actually the African agricultural transition never took place. In the past, marketing boards were set up to keep domestic prices low, in order to protect the urban population, at the expense of the rural population (FAO, 2011c). However, there is now a renewed commitment based on the Comprehensive Africa Agricultural Development Program (CAADP) (APP, 2010).

What are the policy measures to boost agricultural productivity?

Policy measures are generally distinguished in two, viz. technical measures and institutional measures (FAO, 2011b). Although the paper does not deal with agro-techniques, still a few words are spent on those.

The *technical* approach assumes the use of improved crop varieties, increased use of water (irrigation: only 4% of arable land in the Sub-Saharan African region is irrigated compared to 35% in Asia and 15% in Latin America (IAASTD, 2009)), use of fertilisers (in Africa with 11 kg ha⁻¹ is about 10% of the world's average (FAO, 2011c)), better control of pests and diseases, improved mechanisation (in Africa 14 tractors/100 km² while in high income OECD countries 433/100 km²), improved road infrastructure (in Africa 9–17% of all roads paved while in OECD 90%) better electricity supply (Okyere, 2012) and improve the currently very limited technology transfer and adoption (FAO, 2011c). A major problem is land degradation, which is a major constraint to productivity growth which can only be reversed by appropriate use of chemical and manure amendments (IAASTD, 2009). IFAD estimates that around 36 billion ha worldwide has become desert, while annually 12 million ha is added (IFAD, 2011).

From an *institutional* point of view, a bottom line is FAO observing that land and water institutions have not at all kept pace with the growing intensity of river basin development and the increasing interdependency and competition over land and water resources. The lack of adequate institutions for land regulation and administration has been a major constraint to the implementation of new land policies (ECA, 2004). The needed intensification of existing land use by the cultivation of another 120 million ha and the irrigation of an extra 32 million ha, require widespread adoption of sustainable land management practices (FAO, 2011b). Well aligned with the technical changes, institutional conditions should remove constraints and barriers in the field of (1) incentive structure, (2) *land tenure and access to water resources*, (3) *collaboration between land and water institutions*, (4) efficient support services including knowledge exchange, research, and finance and (5) better and secured access to markets (FAO, 2011b). In particular, the access to and management of land and water needs to improve markedly; the lack of clear and stable land and water rights and the weak regulations and enforcement has contributed to conflict over land access and competition for water use: in particular the inclusion of customary and traditional use rights in national legislation is urgently needed; land and water institutions can be strengthened and common property systems should be protected to provide for secure land tenure (FAO, 2011b).

Relation of food security and land use with the land surveyor's profession

As we saw, many factors may contribute to the increase of food production and food productivity. One of those factors concern land management and secure land rights. These are typical functions of a land surveyors, as the earlier mentioned FIG definition shows. In addition, we argue that the provision of geo-information will be beneficial for good decision making.

The challenge is clear: the intensification of agricultural output on existing cultivated lands and the cultivation of an extra 120 million ha should be met, to feeding the world's estimated population of 9.5 billion by 2050. Recognising that many technical and institutional factors play a role, we believe that when this 'land question' is not

brought to a solution, problems around land and water rights will severely obstruct progress in food security.

The first relation, land management, provides opportunity to land surveyors to investigate where land expansion can take place. This requires in the first place qualifications to identify and adjudicate land rights not only form a formal statutory background but in particular non-formal types. Secondly, to master the newest geospatial technologies and working in multi-disciplinary teams. Geospatial technologies are quickly developing and deserve wide application (Doytscher, 2013). Working with other disciplines requires knowledge of other expertise and empathy. Land managers have to facilitate both small holders and commercial farms and be aware of the potential of each of them. In particular food security relies on small holder agriculture, so land surveyors should find a balance between both categories. Eviction of small holders and vulnerable people in benefit of large investors must be avoided, by providing allocation proposals that meet both interests. Land managers should in particular accommodate women's rights to land, and solve the problem of landlessness.

The second relation, land administration, is part and parcel of the profession. However, land surveyors often concentrate too much on statutory property rights and conventional land recording. One way or another many land surveyors appear to be reluctant to go outside the formal law, which leads to a situation that globally only 1–2% of land is under registered formal tenure (Alden Wily, 2012). In Central and Eastern Europe, the World Bank heaves sighs about land surveyors and their painstaking slow procedure and unreasonable high precision requirements (Adlington, *et al.* 2009). When the profession does not tackle these critiques, adjudication and registration will be done by others professions as we see already happening in Bangladesh, were – under the BRAC property rights initiative – the government certifies laymen to provide these land services (McLaren, 2014). Even more reason for innovations is the widely documented misuse of conventional land administration system by the elites (Augustinus, 2015) and the flagrant corruption in the land sector (TI, 2011). The Voluntary Guidelines (FAO, 2012a) and the Land Governance Assessment Framework (Deininger, *et al.* 2012) also explicitly urge for inclusion of all land rights, in which variety they may manifest. From the above, we learn that next to land rights, water rights are equally important, may be even more important. This is for land surveyors are rather unknown expertise, which definitely should be taken on board. Luckily, more and more technical tools today facilitate the work (Lemmen, *et al.* 2015).

The third relation, information supply, appeals to technical geospatial expertise, which is part of the profession as it is today. However, increasing demand for quick data acquisition, data integration and analysis, might challenge the expertise profession in competition with GIS experts from various backgrounds. Clear is that it requires adoption of less conventional data acquisition methods such street addressing (World Bank, 2005) and enumerations (Habitat, 2010).

Conclusions

One of the measures to provide food security for the 9.5 billion people who are estimated to live on earth in 2050

is growth of agricultural production and productivity. Yield analyses reveal that all continents have potential for growth, in particular Africa. Land expansion is still possible, and land management and land administration should contribute to efficient land use and security of tenure. Much agricultural land is not well managed and unrecorded, obstructing realising the potential for growth. As land surveyors are responsible for these issues, at least in a multi-disciplinary environment, they can contribute substantially. However, further expertise on agriculturally focussed land management, knowledge of multiform land and water rights, innovative recording methods and geospatial technologies must be acquired.

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