SITE CHARACTERISTICS CHECKLIST OF AGRICULTURAL LAND FOR COMPARISON PURPOSES - EMPHASIS ON PRODUCTIVE FACTORS:PART I

by

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1.0 INTRODUCTION

In general, the most popular valuation method for smallholdings is the comparison method. This method necessitates comparison of factors contributing to land value, for which data must be collected from ground inspection. In this paper, due attention will be given on some of these factors that constitute site characteristics necessary for the purpose of comparison. The discussion will be divided into two parts. Part I deals with the physical elements of productive factors, mainly soil properties, while Part II with chemical and biological elements.

2.0 DEFINITION

Site characteristics checklist refers to a group of similar factors contributing to land value on which Information must be gathered (In view to adjudge suitable comparables) to provide for a consistent and uniform analysis of site characteristics of similar smallholdings. In the process of assessing fair open market value of the property under study.

3.0 ELEMENTS OF CHECKLIST

There are various factors Influencing the value of agricultural land, as illustrated In Figure 1, and the list Is not at all exhaustive. In most cases, the factors are interrelated in a complicated manner. There are two major subdivisions of these factors i.e. the productive and non-productive factors. The role played by the dynamics of the productive elements must not be simply ignored in an analytical valuation exercise, since as far as agricultural property is concerned, the productive capacity of a particular land is one of the important elements considered in the market, especially in pure agricultural areas.

The productive factors are in the first place influencing crop value and productive capacity. The productive capacity is In turn contributing to the productive value of the land, which is one of the value components suggested for agricultural land. On the other hand, the non-productive factors are irremissibly contributing to value as well. However, they will not be discussed here.

3.1 PHYSICAL ENVIRONMENT

Physical environment includes rainfall, temperature, photoperiod, relative humidity, air, wind, etc. Such elements are not so critical for smallholdings, except in certain rare cases, for instance, when we take comparables covering a wide geographical area, as in statistical methods. However, these elements are of some noticeable importance for big plantations, since the size of the land may give rise to marked differences in such above elements.

3.2 SOIL PROPERTIES

Soil can be described based on its physical, chemical, and biological properties. The physical properties are relatively inherent and unchangeable, while the chemical and biological properties are on the contrary, not inherent and are changeable especially by human influence.

3.2.1 PHYSICAL PROPERTIES

The description of a soil should include profile, colour, texture, structure, and drainage. Common description such as "liat", "liat kuning", and "berpasir" for example, are yet to be revised because as such, reflects inconsistent and partial explanation of soil's physical characteristics.

(a) Profile and colour

Soil profile refers to cross-sectional face where the soil layers can be seen vertically. These layers are called 'horizons'. The most important horizons for crop growth are those of rooting zone, defined as the zone up to 100 cm depth from the surface. Soil profile is important at least for understanding the nature of the soil and, identifying and classifying soil.

A good quality soil must exhibit deep profile, besides favourable texture and structure, impermeable layer, and not adversely disturbed by unfavourable elements such as acidity, alkalinity, and salinity, especially in the rooting zone.

Soil colour is another physical property to be described during field inspection. Generally, soil colour is indicative of the following phenomena, that more or less reflect soil's quality:

i) The presence of iron and organic matters.

Red - sesquioxides;
Black - organic matters, montmorilonite;
White, pale grey - caolinite;
Yellow - ferum oxides (hemathite, geothite);
Grey, olive, blue - reduced iron/fererous;
Brown, dark brown to black - increasing organic matters.

ii) The soil's history.
Blacks, dark grey, blue - poor drainage (frequent reduction process and gley/hydrogen sulphide formation);
Red, yellow - good drainage.

Suggested description (example): Deep profile, generally yellowish brown.

(b) Texture and structure

Texture refers to soil's particle size distribution. It can simply be determined on the field by finger rolling (Appendix I). However, it needs considerable knowledge and experience. For description purposes, it is quite advisable for valuers to know the conventional classification of particale size, as tabulated below:

Table 1 : Conventional classification of soil's particle size

Particle	Particle size (mm)	
	ISSS	USDA
Gravel	>2.0	>2.0
Coarse sand	2.0 - 0.2	2.0 - 0.2
Fine sand	0.2 - 0.02	0.2 - 0.05
Silt	0.02 - 0.002	0.05 - 0.002
Clay	< 0.002	< 0.002

Note : ISSS = International Society of Soil Science
USDA = United States Department of Agriculture

Some textural classes and the related soil series are listed in the following table:

Table 2 : Common textural classes in Peninsular Malaysia

Textural class	Typical soil series
Clay	Segamat, Selangor, Prang, Kuantan, Klau
Silt	-
Loam	Sogomana
Sand	Sg. Buluh, Pasir Mas
Silty clay	Durian, Batu Anam, Sitiawan
Sandy clay	Harimau, Munchong
Loamy silty clay	Senai, Kulai
Loamy clay	Jerangau
Clay loam	Bungor, Malacca
Sandy clayey loam	Renggam
Sandy loam	Serdang
Loamy sand	Holyrood, Tampoi, Ulu Tiram

Source : Extracted from Paramananthan (1987). Author's personal obserbvation

Soil's texture is importance for crop growth. A heavy sandy soil (eg. Sg. Buluh) is very permeable to water, that water could not adequately be retained for crop growth. The drainage of such a soil is said to be too excessive. A heavy clayey soil (eg. Kelau) is, on the other hand, very impermeable to water, that too much water logging occurs, and therefore not suitable for crop growth. The drainage of such soil very poor. Nearly ideal soils, comprising balanced proportions of clay, silt, and sand (eg. Telemong, Nangka, Holyrood) are said to exhibit the quality much needed for the growth of most crops. Good textural composition may facilitates air and water percolation, nutrients supply, and better rooting which are essential for crop development.

The common soil's textural compositions are shown in Table 3.

Table 3 : Common soil's textural compositions

Textural class	Particle composition*
Heavy clay	>60% clay;
Light clay	55-60% clay;
Sandy clay	35-55 %clay; <30% sand;
Silty clay	35-60% clay; >30% silt;
Sandy clay loam	18-35% clay; 20-30% sand;
Loam	18-35% clay; 10-25% silt; 10-20% sand;
Clay loam	18-35% clay; 30-40% silt;
Silty clay loam	60-70% silt; 18-35% clay;
Silty loam	70-80% silt; <30% clay;
Silt	>80% silt; <20% clay or sand;
Sandy loam	50-70% sand; 15-20% clay;
Loamy sand	70-85% sand; <15% clay;
Sand	>85% sand; <10% clay;

*Roughly observed on field, per unit area, eg: 1 m2

Source : Adapted from Paramananthan (1987)

The ideal textural class consists of about 35% clay; 35% silt; and 30% sand - sandy silty clay. It is very advisable that textural class be observed, identified and determined during field inspection by simple field methods, two of which are summerized in Appendix I. These inaccurate short-cut but sufficient methods are recommended for field visit.

Texture strictly refers to the arrangement of particle composition (clay, silt, and sand) of the soil. Soil's structure is classified according to particle shape, size, and grade. Particle shape can be blocky (angular, sub-angular); columnar; spheroid (eg. granular); prism-like (prismatic, columnar); flaky; compact; wedged; spongy; or vermicular. Particle sizes are classified into coarse, medium and fine, whilst grades are classified into strong and weak.

Soil's structure is an important physical quality needed for crop growth. A granular-structured soil (e.g. Renggam series) allows for excessive air to percolate freely, while at the same time allows for root development through pores or voids between peds. Compact or prismatic-structured soils (eg. Selangor, Sogomana, and Manik seriés) are normally inhibiting roots development, or they do not contain much pores, and rather anaerobic. Blocky-structured soils (eg. Munchong, Bungor and Durian series) are said to be more favourable for crops, especially those of deep-root system, such as oil palm and rubber. A soil of strong structure (cemented) exhibits high water stability aggregate, therefore, is not easily eroded. Cement is formed when such cations as Ca^{++}, Fe^{++}, Al_2^{+++}, OH_3^-, and Mg^{++} are present in the soil. Too much of Na^+ cation may weaken soil structure and causes disintegration of soil when it is subjected to water influence. A good structured soil necessitates a correct balance between clay, silt, sand, air, and water. An ideal soil structure is the one which comprises of 50% soil particle, 30% water and 20% air.

Suggested description (example) : Loamy sand, sub-angular, medium strong.

(c) Drainage

The drainage class of soil must be evaluated when comparing one smallholding with another to determine the relative favourability of the drainage for crop growth. A poorly drained soil, for example, has to be drained before it can be used for perennial crops. For optimal growth, different crops require different drainage classes.

The drainage class of soil depends on the internal drainage and the presence or absence of ground watertable. Soil with heavy clay textures and coarse structures tend to have slow permeability, leading to slow percolation and results in temporary stagnation of water. Clay-textured soils which have strong fine subangular blocky structures with friable consistencies as in Oxisols have high porosity and hence a good internal drainage. Therefore, both texture and structure with their resultant porosity control the internal drainage of a soil.

The presence of a permanent groundwater table causes reduction and gleying in soil. In the zone of the fluctuating ground watertable, the amount of gleying that takes place depends on how long the watertable remains at that depth. Reduction in soil due to either slow percolation and/or the ground watertable is indicated by gleying or gley colours. These are colours which have a chroma of two or less (bluish). If the reduction in the soil horizon is only periodic, the reduction is often accompanied by iron segregation or motling.

For the purpose of description, soil's drainage can be divided into 10 classes as suggested by Paramananthan (1987), but this classification may not be practical for valuers, therefore I would suggest a somewhat simpler classification as follows:

Poor drainage : Very slow removal of water, permanent watertable, occurance of water logging, wet surface over a long period of the year, and marked gleying below 50 cm depth.

Imperfect drainage : Sufficient slow removal of water, wet surface over some period of the year, but not all the time, and obvious gleying at 50-75 cm depth.

Good drainage: Sowhat slow removal of water, no permanent water table, no significant water logging, wet surface only over a short period of the year, and no obvious gleying below 50 cm depth.

Excessive drainage: Rapid or very rapid removal of surface water, no significant existance of watertable, dry surface over a long period of the year, and no obvious gleying even at 100 cm depth.

Suggested guide for description:

- o Check soil series by using soil series map;
- o Observe flooding/water logging phenomenon;
- o Observe gleying;
- o Evaluate terrain/slope ;
- o Choose appropriate classification as above.

3.2.2 Chemical Properties

Chemical properties rather difficult to determine during field inspection and, alternatively need specific field investigations on a particular soil. However, we owe much to hundreds of past soil surveys in Peninsular Malaysia, from which compilation of the results were systematically done. 'A priori' information on almost each and every soil series become possible to obtain from those surveys, some of which are:

- o Mineralogy status;
- o Percentage of organic carbon;
- o Acidity/alkalinity;
- o Cation exchange capacity (CEC);
- o Base saturation (BS).

Gathering of all of the above information is not imperative for the purpose of valuation, but wherever possible, they ought to be taken into consideration, because together, they contribute to the quality of a particular soil - an important feature that reflects the capability of the soil to support agricultural production. An example of the comparison of chemical properties among several good quality soils is presented in Table 4.

Table 4 : Chemical properties of some important soil series, Peninsular Malaysia

Soil series Chemical Propertiy*	Segamat	Renggam	Melaka
% organic carbon	1.3-1.7	1. 1-2.2	0.09-0.33
Acidity	4.5-5.0	4.6-5.0	4.5-6.0
CEC	150 me/g	200 me/g	80 me/g
BS	high	high	low

*Taken for depth up to 100 cm.
Source : Adapted form Soong et. a. (1980); and, Anon (1983).

3.2.3 Biological properties

Soil's biological properties are not so important to be included in the checklist. However, the basic idea about these properties are useful. Soil fertility is partly contributed by organic matters resulted from decayed micro-organsims in the soil. Therefore, the amount of micro-organisms in the soil is reflective of the soil quality.

Soils left from mining activities is said to contain the least amount of living micro-organisms, followed by sandy soils. Heavy clay soils are considered containing less such organisms. It is also true for acidic soils. Soils cultivated for market gardens are on the other hand, considered containing the most living micro-organisms, followed by pasture lands.

3.2.4 Soil suitability

Up to this point, it seems significant to note that the soil properties discussed, are essential information for establishing the suitability classification of Malaysian soils for agricultural production, especially for crop cultivation. The importance of soil type must not be overlooked, since it determines the soil's quality. Soil's quality in turn, determines crop growth, productivity, crop value, and ultimately land value.

Soils are just heterogenous and they are of different qualities. This leads to the notion that soil suitability classification needs to be identified for most crops. The soil suitability classifications for oil palm and rubber are presented in Table 5 and 6 as examples. One way of evaluating the suitability of a particular soil to oil palm and rubber and to any other crops is by knowing the soil series.

Table 5: Soil suitability classification for oil palm and examples of related series

Soil Class	Suitability	Examples of soil series
I	Highly suitable	Segamat, Kuantan, Rengam, Munchong, Selangor, Prang, Kg. Kolam, Tampoi, Bungor, Serdang, Jeram, Briah, Akob, Kangkong, Katong, Jempol
II	Suitable	Ulu Tiram, Yong Peng, Senai, Kulai, Batang Merbau, Telok, Pohoi, Harimau, Telemong, Chenain
III	Moderately suitable	Kulai, Yong Peng, Tavy, Durian, Kawang, Sogomana, Marang, Senai, Holyrood, Kuala Brang
IV	Marginal/	Batu Lapan, Batu Anam, Rudua
V	Unsuitable	Malacca, Kranji, Linau

Source : Adapted from Wong (1970); Ng (1964), Law and Selvadurai (1968); and Soong, et al (1980)

Table 6: Soil suitability classification for rubber and examples of related series

Soil class	Examples of related series
Ia	Munchong, Jeram.
Ib	Bungor, Jerangau, Rengam, Segamat, Kuantan.
IIa	Harimau, Senai.
IIb	Batang Merbau, Subang, Kulai.
III	Serdang, Ulu Tiram, Pohoi, Holy rood, Tampoi, Lunas, Kuala Brang.
IVa	Durian, Batu Anam, Malacca.
IVb	Pasir Puteh, Kampong Chempaka, Tok Yong, Sogomana, Sitiawan.
Va	Briah, Selangor.
Vb	Sungai Buloh.
Vc	Linau.
Vd	Gambut.

Source : Chan (1975)

Suggestion: Use small scale soil series map when conducting field inspection. The available map most accessible to valuers is the Reconnaissance Soil Map at scale of 1 : 1 900 080.

3.3 Topography

Topography is defined as the three-dimensional form of land surface raised above sea level. Some literature use the alternative terms - relief or landform. Another feature associated with topography is land shape, although it is not really an element of landform. Topography influences drainage pattern, soil quality, and thus, soil suitability for crops. A very steep slope encourages erosion, soil aggregation instability, management difficulties, and reduce planting density. On the other hand, a totally flat and facilitates water logging.

For description purpose, land's slope can be categorized into single and complex slopes, as recommended in Table 7.

Table 7 : Land's slope classes recommended for description.

Single slopes			Complex slopes		
Description	%	Degree	Description	%	Degree
Level/nearly level	0 - 2	0 - 2	Level/nearly level	0 - 4	0 - 2
Gently sloping	4 - 12	2 - 6	Undulating	4 - 12	2 - 6
Strongly sloping	12 - 23	6 - 12	Rolling	12 - 38	6 - 12
Moderately steep	23 - 38	12 - 20	Hilly	23 - 38	12 - 20
Steeply sloping	>30	>20	Steep	>38	>20

Source : Paramananthan (1987).

Conclusion

From the above discussion, it is clear that soil properties are the elements of productive factors that need to be described for smallholdings from ground inspection for comparison purpose. In depth and expert analysis are not required in gathering the data, but sharp and careful observations coupled with sufficient knowledge and experience about soil are essential in interpreting phenomena under study. Hence, sensible and improved description of the property under view could be made possible.

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SIMPLE FIELD TESTS FOR DETERMINING SOIL'S TEXTURAL CLASS.

METHOD I

- Find a cross-sectional undisturbed profile of an observed soil in the specific smallholding or surrounding area. Feel the grain between two fingers and observe the followings:

  *Clay will not disintegrate even in dry state;
  *Silt disintegrates in dry state, but adheres together and is slightly elastic when moistened.
  *Sand and gravel will neither adhere at all in dry state nor when moistened;

- Carefully observe the dominant particle;
- Repeat for the lesser dominant particle;
- Repeat for the least dominant particle;
- This observation will indicate textural composition and class.

METHOD II

Based on 'a priori' information as follows:

- Check the soil series map for Peninsular Malaysia;
- Locate the position of the smallholding under study, in the map;
- Identify the soil series of the land or surrounding area;
- Soil series gives some information about textural class (eg. Rengam -sandy clayey loam).

<u>Example 1</u> - METHOD I

Dominent - clay;
Less dominat - sand;
Least dominant - silt.

Soil's textural composition - silty sandy clay.

<u>Example 2</u> - METHOD I

Dominant - clay;
Less dominant - silt;
Least dominant - sand.

Soil textural class - sandy silty clay.