Intangible heritage for sustainable future: mathematics in the paddy field

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Abstract. Mathematics, as the only general language, can describe all phenomena on earth. Mathematics not only helps us to understand these phenomena, but it also can sustain human activities, consequently ensure that the future development is sustainable. Indonesia, with high cultural diversity, should aware to have its understanding, skills, and philosophies developed by certain societies, with long histories of interaction with their natural surroundings, which will provide a foundation for locally appropriate sustainable development. This paper discussed the condition and situation on certain area in Cigugur, Indonesia, and what skills, knowledge, and concept can be transmitted, regarding simple mathematics (arithmetic). Some examples are provided.

1. Introduction
Sustainable development (SD) becomes a major role today, as historically it is credited to Brundtland Commission: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [4]. SD is the term given to the process of developing the society to move from the existing state now to a state of sustainability. Ambali [1] stated without sustainability, development itself is ultimately counterfeit and counter productive. Undertaking SD and achieving this sustainability requires the development of knowledge, skills and attitudes. Knowledge that can be transmitted are culture-specific mathematical concepts and models; and culture-specific systems and tools for calculating, measuring and recording [4]. Skills that can be transmitted are in counting, sequencing, estimating, quantifying, matching, sorting, discerning patterns and rhythms, in process thinking, lateral thinking and problem solving [4].

This paper discussed local wisdom of indigenous people in a village in West java, namely Cigugur, particularly in determining cultivation and harvest time of rice, with simple arithmetic.

2. Main Result
Indonesia, considered as the largest archipelagic island country, with more than 13,000 islands, has an estimated population of over 258 million people, consists of hundreds of distinct native ethnic and linguistic groups. Java, as the most populous island is Java, contains more than half of the countrys population.
West Java, as part of the Pacific Ring of Fire, has mountains and volcanoes more than any other provinces in Indonesia. Because of these volcanoes mountain, West Java has rich and fertile volcanic soil, and in effect, the main way of life of the traditional Sundanese people (one of the society in West Java) is famous with the traditional rice cultivation, wet (sawah) or dry (ladang or huma). The landscape of West java is one of the volcanic mountains, steep terrain, forest, mountains, rivers, fertile agricultural land, and natural sea harbors (fisheries).

One of the provinces in Indonesia, West Java province (see picture below) has been subdivided into 21 regencies (kabupaten), and 620 districts (kecamatan), comprises of 1576 villages (kelurahan) and 4301 rural villages (desa).

![Map of Regencies at West Java Province](image)

**Figure 1.** Map of Regencies at West Java Province

### 2.1. Indigenous knowledge in Cibubur

One of the villages is Cigugur, located in Kuningan regency, has a population of 7804 inhabitants, and has mostly wet paddy field (or rice field) as the people job on it. Wet paddy field will happen in the rainy time come, so the field has a lot of water.

Indigenous people believe that their traditional-cultural calculation in managing their paddy fields, called local wisdom, is the best for cultivating and harvesting rice. This local wisdom is believed a discourse that is wise, has a life value, belong and follow by the local society. Philosophically, a local wisdom means an indigenous knowledge system, which is empiric and pragmatic. Empirically, because its land product from facts in the life of the society, pragmatically because the whole concept is build from their believe in the indigenous knowledge system, to solve daily life problem solving.

It can be understood, that local wisdom is knowledge, developed by their ancestors, to survive in life surrounds them, and becomes a part of its culture from generation to generation. This knowledge appears in legends, stories, songs, rituals, and local regularities. Every part in their society daily life will be conducted by this knowledge, and well-internalized to the people. Inevitably, this local wisdom put in effect to young people (students) in learning, as Sukadi [3] stated that traditional and cultural values are the base for people to think, learn, and interact.

### 2.2. Cultivation time

The indigenous knowledge above is owned for generations and is used in agriculture, particularly in terms of planting rice in paddy fields. These people know which of the circulatory system of stars in the sky, namely the Orion star, which is used to determine the beginning of cultivating rice in paddy fields. At roughly the beginning of November, in the dawn of time the Orion star...
is visible in the east, and it is considered by farmers as a guide to start of the cultivation of their
field. Then approximately in April, the Orion star at dusk on the western horizon seemed upside
down. It is considered by them as a sign to save the plow, and harvesting rice or harvesting
season is over [3].

Figure 2. Cultivating rice

Figure 3. Ready to Harvest Rice

The calculation in this paddy field management is based on palintangan (calculation), that is
etangan weton (calculation based on the birth date) of the landlord (owner) of the paddy field,
traditionally in the AKUR (Adat Karuhun Urang) society. Prior to the rice cultivation, there
are 4 philosophies to be considered, i.e. Sungut (mouth); Irung (nose); Mata (eyes), Ceuli (ear),
which means:

- **Sungut** (mouth), one cannot speak or talk too much, since the result will be unsatisfactory,
  thus people must do their job persistently.
- **Irung** (nose), sniffed by mice or several types of leafhoppers (wereng), a warning to always
  be alert for these animals.
- **Mata** (eyes), the rice that is planted will be seen by the mice and leafhoppers, so people
  must always be careful and be preventive.
- **Ceuli** (ears), means mung kapireng wungkul (only heard), so that the paddy field will be
  only heard, and these animals have no idea where the paddy field is.
The best calculation in cultivating rice is *numbuk di Ceuli*, which means at time when those animals will only heard, and it is based on calculating the days (each day has a certain value): Sunday = 5, Monday = 4, Tuesday = 3, Wednesday = 7, Thursday = 8, Friday = 6, and Saturday = 9.

Then, this value will be added with mancakalima (the cultural days in old tradition): Manis = 5, Pahing = 9, Puhun = 7, Wage = 4, and Kaliwon = 8.

For example: suppose today is Wednesday Wage, so its value is 7 + 4 = 11, means that one can cultivate rice 11 more days from today, which is believed will be the *numbuk di Ceuli* (the time where animals can only heard).

### 2.3. Harvest time

In agriculture, beside cultivation time, there is absolutely harvest time. According to the culture, there also two stages of calculation: the palintangan, that is a calculation based on *numbuk*, and etangan weton (calculation based on the birth date) of the landlord of the paddy field. Slightly different than cultivation time, in harvest time the calculation of *numbuk* is based upon:

- *Sri* (seed), that harvesting in *Sri* cannot be optimal, since it will produce more seeds instead of rice.
- *Pang* (stalk), similarly as *Sri*, harvesting will produce more stalks, rather than rice.
- *Godong* (leaf), similarly as *Sri*, harvesting will produce more leaves instead of rice.
- *Woh* (fruit), from its name, clearly this the best time to harvest.

As in cultivation time, the time *numbuk* will be combined with *naptu* (days), i.e. Sunday = 5, Monday = 4, Tuesday = 3, Wednesday = 7, Thursday = 8, Friday = 6, and Saturday = 9, and add with these number accordingly: Manis = 5, Pahing = 9, Puhun = 7, Wage = 4, and Kaliwon = 8. For example, when the owner thinks that this is the season to harvest, he/she looks at the date, if today is Monday Puhun, then its corresponding value is 4 + 7 = 11, thus 11 more days after today will be *Woh* time, the best time to harvest.

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In a certain time, before harvesting, people gather and pray to God, an elders (senior) do

\[\text{Sampurasun ka Rumuhung} \]
\[\text{Ka anu ngersakeun} \]
\[\text{Nu linggih di Buwana Nyungcung} \]
\[\text{Nu Lenggah di Buwana Mandala Hyang} \]
\[\text{Pun ... sapun sampurasun !} \]
\[\text{Ka anu lenggah di Bumi Suci Alam Padang} \]
\[\text{Pwah Aci Sanghyang Asri} \]
\[\text{Di kiwari jisim kuring, seja amit mipit} \]
\[\text{Ngajayak lenggah Nyi Pwah Aci Sanghyang Asri} \]
\[\text{Ti Weweg Sampeg mandala Pageuh} \]

a pray (by singing):

\[\text{Anu direpokkeun di bumi pertiwi} \]
\[\text{Kiwari jisim kuring, eudeuk ngajayak} \]
\[\text{Lantaran hirap turun ti anu rahayu,} \]
\[\text{Hurip ngancik na Pwah Aci} \]
\[\text{Anu kahalimpukeun di Mandala Tapa} \]
\[\text{Bari naggoan wayah} \]
\[\text{Balik ka Bumi Suci} \]
\[\text{Pulang ka Mandala Hyang} \]
\[\text{Panceg hanci di Buwana} \]
\[\text{Dina waruga manusa} \]
\[\text{Pun, mugu Rahayu !} \]

This pray tells the meaning of graciousness and asks God the Almighty, and asks that harvest
can be launched and kept away from undesirable things, so everything goes smoothly, and begged
harvest done can be launched and kept away from things that are not desirable and grateful
for harvests that can be refined into a resource for human. Rice is an important thing for the
AKUR society, because it is the main food resources, as well as an agricultural society as Indonesia.

3. Conclusion

Within indigenous society in Indonesia, such as in Cigugur village, West Java, the
understandings, skills and philosophies developed by the society with long histories of interaction
with their natural surroundings, the indigenous knowledge systems provides decision making
about fundamental aspects of day-to-day life, ritially and spiritually. This unique knowledge
provides a foundation for locally appropriate sustainable development.

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