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CIVILIZATION AND AGRICULTURE IN TRANSDISCIPLINARY APPROACH: AN OVERVIEW

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ABSTRACT
This literature review outlines transdisciplinary challenges to expand sociological research, including agriculture of rice landrace and human civilization. As various disciplines offer in this article, rice cultivation is a human activity that prioritizes the growth and development of rice in a specific area to obtain a more stable food supply than gathering wild plants. Sociologists use a variety of photos and videos, also texts as digital data related to agriculture. Transdisciplinary methods enable scientists and the public to collaborate in computer science, design, politics, urban geography, and other disciplines. Digital communication and information technology currently influence how conservation is carried out to achieve sustainable life on Earth. One form of conservation development in cyberspace (digital) is conservation practice using a transdisciplinary approach with computer and internet devices.

Keywords: Agriculture; Communication; Civilization; Digital sociology; Food

1. INTRODUCTION

Disciplines deal with problems that are too complex to be solved within the confines of a single field or using conventional empirical methodologies. This article describes a transdisciplinary review of agricultural civilizations that were only familiar with digital technologies after they were developed and used today.

Increasing public involvement in biodiversity conservation can be traced to content uploaded via social media, including (1) the date, location, and name of the user who uploaded the photo of the Hawaiian seal (*Neomonachus schauinslandi*) (Sullivan et al., 2019), (2) the illegal sale of Phragmipedium orchids on the eBay website (Perdue, 2021), (3) digital illustrations of birds to strengthen the narrative in the Atlas of Indonesian Birds (Wahyudi, 2020; Gadjah Mada University Wildlife Laboratory, 2020), (4) live presentation materials tweeting on the International Congress for Conservation Biodiversity (Bombaci et al., 2015). Discussions between scientists and other users in digital spaces provide feedback regarding research (Kessler et al., 2022), (5) increasing trends in public knowledge related to forests, birds, biodiversity, gardening and vegetables during the pandemic COVID-19 according to Google Trends (Rousseau and Deschacht, 2020), (6) documenting and archiving of natural landscapes and biodiversity in museums and herbariums have developed into popular digital platforms, such as digital games (eg, Pokemon) (Fletcher, 2017) to encourage ecological literacy (Callahan et al., 2019), (7) the nutritional advantages of wild food plants in YouTube (Mantasa, 2019) and soundcloud (Cifor, 2021), (8) database of texts and videos documentation related to ethnobotany, such as the use of nepenthes bags as rice pots (Keling 93, 2021) Polish myrrh (*Dysphania schraderiana* (Schult.) Mosyakin and Clemants) used in Catholic churches on the Assumption of the Blessed Virgin Mary into heaven (Łuczaj et al., 2022), as well as local rice in the culture Toraja (AGRONOMIST, 2019) via YouTube.

Digital communication and information technology currently influence how the conservation of rice landraces (local rice) is carried out to achieve a sustainable life—social

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media functions as a tool for conservation education for the public. The success of biodiversity conservation depends on public involvement (Burivalova, et al., 2018).

Digital visual sociology was developed from visual sociology to analyze memory regarding cultivating and using local rice in the past, which became the basis for current conservation. Meanwhile, digital conservation practices in this article are carried out by recording digital videos of rice rituals and spreading them through video-sharing platforms. Recording and disseminating these digital videos is part of a conservation method called conservation culturomics.

2. RESEARCH METHOD

This article is a literature review that outlines transdisciplinary opportunities that sociology can develop. Professor Dr. Basarab Nicolescu, a Romanian quantum physicist in Paris, states the epistemological axiom of transdisciplinarity, namely the complexity of these complexities. Complexity does not mean complication. The word "complexus comes from the Latin '*complexus*,' meaning "that which holds together" ("what unites") (Science & Orthodox Christianity, 2019). Transdisciplinary knowledge is both exterior and interior. Exterior refers to the study of the universe, while interior refers to the study of humans. Both of these pieces of knowledge support each other because they are interconnected. The transdisciplinary methodology must embrace complexity because transdisciplinary knowledge transcends the universe and humans' duality (Nicolescu, 2000; Nicolescu, 2005, in McGregor, 2011).

3. LITERATURE REVIEW

3.1. Rice Landraces in Human Civilization

Rice is a biological resource that provides more than one-fifth of the calories consumed by the world's population. Caloric needs for an adult male weighing 60 kg are 1,800–2,100 kcal daily (Blades, 2013; Sharif et al., 2014; Mahmad-Tohera et al., 2021). Conservation in the form of protection and utilization of rice is a staple food for more than half of the world's seven billion people (Veltman et al., 2019). The Food and Agriculture Organization under the United Nations states that around 90% of rice is produced by countries in Asia (Song et al., 2022), Africa, and Australia (Dogara and Jumare, 2014), as well as Latin America (Mattos et al., 2021; Hernández-Forte et al., 2022). Rice contains fiber, energy, minerals, and vitamins (Sen et al., 2020) and can be used as an ingredient for fermenting palm wine and rice wine for communal rituals (Longkumer, 2016; Lu, 2021; Marak et al., 2021), processed into gluten-free flour (Nespeca et al., 2021), scrub ingredients for skin care (Kusumawati et al., 2018), and is helpful for treatment and therapy (Cabanting and Perez, 2016; Harahap et al., 2021).

The using rice as a conservation effort is also based on the critical role of rice in the practice of religious rituals and community cultural traditions (Crystal, 1989; Kumbhar et al., 2015; Fuller and Castillo, 2016; Leipe et al., 2020; Mohapatra and Sahu, 2022). Rice symbolizes social prestige, honor (Mehta et al., 2014), prosperity, and fertility (Ramdayal et al., 2021). Paddy, or rice, is a sacred food according to Japanese manuscripts of the 7th to 8th centuries (Huggan, 1995; Bray, 2019). Rice has a soul that is respected in the form of many rituals in Sri Lanka (Wikramanayake, 2007). Several rituals in the world are carried out to honor the goddess or god of rice as a symbol of fertility and life, including the Goddess Mae Phosop in Thailand (Yoo-In, 2011; Berno et al., 2019); Inaaq Sariti in Lombok, West Nusa Tenggara (Sukenti et al., 2012); Dewi Sri and Nyi Pohaci Sanghyang Sri in Javanese culture (Jordaan, 1997); the god Inari in Shinto, Japan (Opler and Hashima, 1946); God Pu Khwan Khao in Yunnan (Sheravanichkul, 2009); and the Roman goddess of agriculture, Ceres (Toynbee, 1972; Spaeth, 1994); and rice-related rituals in Timor-Leste (Kammen, 2011; Guillaud, 2015; Browne et al., 2017).

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A community of Chinese descent in Semarang, Central Java, offers several rice-based offerings to communicate with gods and ancestors. Sajen is offered on the altar at the Chinese New Year celebration, one of which is a diamond cake made of glutinous rice, which symbolizes closeness and intimacy between relatives (Kepirianto et al., 2021). Rice is the primary ingredient for making desserts in northern Iran. The treat is served during the Persian New Year, Yalda Night, according to the Persian religion, and Ramadan (Gharibzahedi, 2018). The Alas tribe in southeastern Aceh uses glutinous rice as the basis for *dodol*, as an obligatory food in rice planting rituals, and as seeking Phuket, which is served at the Kenduri ritual to pray for spirits (Sutrisno et al., 2021).

Rice landrace is a local category for grouping cultivated rice plants based on general characteristics that are known by the community and can be identified by a vernacular name (local naming). *Landrace* is a local germplasm developed by farmers that differs from 'variety' as a breeding product (Iskandar and Ellen, 1999). Initially, rice resulted from domestication from wild plants to cultivated plants (Brush, 1991). *Domestication* is a process that leads to genetic changes made by humans (Fuller et al., 2007). Plants cultivated by humans can produce genetic changes as a response to the environment created by humans (Hayes et al., 1989). Traditional phylogenetic methods (the kinship of a species with ancestors and evolutionary relationships between organisms) that produce molecular data are more credible because Indica and Japonica varieties are the two main rice varieties in the world (Molina et al., 2011; Wang et al., 2016).

Rice cultivation is estimated to have been carried out 3 ka (ka: kilo annum or 1000 years ago [(Schlebusch et al., 2013)] or 3500 years ago based on the discovery of phytolith (silica absorbed into plants through roots) rice at the Minanga site Sipakko, West Sulawesi (Deng et al., 2020; Huntley et al., 2021), approximately 7 hours by car to Tana Toraja. Several other archaeological studies state rice cultivation in South Sulawesi. Charred rice remains in the form of caryopsis (seeds). The remains of rice spikelets (arrangements of rice plants or panicles) were found after the excavation of a ditch in Ulu Leang 1 cave, in Maros-Pangkep, South Sulawesi, which is estimated to be 4000 years old BP (or 2050 BC) (Bulbeck, 2008; Paz, 2005). A small rice phytolith (Oryza sp.) was found in the Karama Valley site, Mamuju, West Sulawesi. However, whether the rice is endemic wild rice or from outside the region has yet to be determined. Phyllotactic evidence is found in small quantities, while the evidence for this rice is that cultivated rice should be available in large quantities (Anggraeni et al., 2014; O'Connor, 2015). Until now, there has been no scientific research that has found archaeological evidence of the history of Toraja local rice or archaeological evidence of suspected rice migration and distribution (Bulbeck, 2008, 2021; Bulbeck et al., 2000; Bulbeck and Caldwell, 2008; Duli, 2015).

Toraja's local rice cultivation history is recorded in Nobele's report (1926). The main livelihood of the Toraja people is agriculture, especially rice. Cultivation techniques that have been carried out include planting rice in paddy fields in rows, making embankments and irrigation, weeding weeds regularly, and cutting rice during harvest. Agricultural tools used include *pekali* (a crowbar), *peteba'* (a piece of bamboo for cutting grass), *tengko* (plow) with *ayoka* (yoke), *orongan* (wood shaped in such a way as to move soil, used by launching a shovel on the surface of the paddy fields), and *raki' tallang* (bamboo rafts). Noble also noted that offerings and email are essential in Toraja rice cultivation.

Bieshaar (1926) describes the conditions of Toraja agriculture at the beginning of the arrival of the Dutch, including four barns in a row, people replacing rice with corn during mourning, planting rice in the highlands, which is done during the rainy season in December, seeds are transferred for planting after sowing for two months from the nursery to a wider paddy field, men cultivate the soil using shovels, and women help plant, weed the fields twice,

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and harvesting after five or three-six months of planting is a characteristic of local rice, widely in other areas such as Makale and Rantepao, South Sulawesi.

Rice landrace varieties are cultivated for the primary purpose of an annual ritual by the Baduy people in West Java (Murphy, 2017). The local rice variety Boadekamo (*Oryza glaberrima Steud.*) is used only in death or marriage rituals in Ghana, Africa (Teeken et al., 2012), the *ngalaksa* ritual after the rice harvest in Sundanese culture (Iskandar, 2004; Hidayat et al., 2020); rice rituals in Toraja (Sjahril et al., 2020); Bhutan (Dendup et al., 2021); India (Roy et al., 2014); and Thailand (Singanusong and Mingyai, 2019). Rice landrace varieties (local rice) are cultivars (cultivated plant varieties) that farmers develop according to local environmental conditions. *Variety* is a group of certain types of plants that can be distinguished from other groups based on a trait (Saxena and Singh, 2006). However, the number of rice landrace varieties is decreasing. For example, 94 Solok Regency, West Sumatra varieties were reduced to 24 varieties due to a decrease in the area of local rice planted in 16 years, from 42% to 20% (Anhar, 2013). The transition from cultivating local rice varieties to superior varieties causes a loss of genetic diversity in local varieties (Chaudhary et al., 2001). India had 100,000 local rice varieties until 1970, when they were reduced to 6,000. One of the causes was the impact of the Green Revolution, which prioritized monoculture farming systems and high-yield hybrid crops subsidized by the government (Gao, 2003; The Hindu, 2012; Nelson et al., 2019). The rice farming system has not been able to keep up with the rapid population growth rate (Almekinders et al., 1994), so it is necessary to accelerate food production through superior rice varieties (Ghimere et al., 2015). Adopting high-yielding rice varieties requires seed certification to increase agricultural productivity and farmers' living standards (Chandio and Yuansheng, 2018). Rice seed certification aims to control the authenticity and purity of varieties (Wahyuni et al., 2013).

Conserving rice landraces could be practiced through religious rituals and traditions. One of the ways to document the existence of rice in the past has been through archaeobotany, which is the study of plant remains at archaeological sites (Fuller, 2007; Castillo, 2019). The oldest archaeological evidence of rice in Indonesia was found in Ulu Leang Cave, South Sulawesi, which is estimated to be around 4,000 cal BP (or 2050 BC), in the form of grain charcoal in pottery (Bronson and Glover 1984, in Setyaningsih et al. 2019; Hutterer 1984, in Vanna 2002), as well as findings of rice at the Mleiha site, Saudi Arabia, which is thought to have caught fire in the 3rd century AD (Dabrowski et al., 2021). Cultivating a variety of rice varieties aims to meet various needs (Castagnetti et al., 2021), including offerings to ancestral spirits (van Andel, 2010) and gods (Negi and Maikhuri, 2013; Castillo et al., 2020). Rice is recorded in inscriptions from the 14th to 15th centuries found around the Khmer Empire, Cambodia (Castillo et al., 2018); manuscript al-Musannaf, written by Abu Bakar Ahmad al-Kindi in the 6th century in the Empire of Oman (Ubaydli, 1993); as well as processing and cooking rice as recorded in the Baratayudha Book in the 12th century; Kakawin Bomantaka at the end of the 12th century; and Kakawin Ramayana in the mid-9th century (Jákl, 2015).

The origin of cultivated rice can be researched through the archaeological remains of rice and knowledge of culture and ecology in the Neolithic era (Crawford and Shen, 1998). Excavations and research at archaeological sites for rice cultivation can provide better insight into rice cultivation techniques, area, yield, and environment. Archaeological and archaeological evidence can be used to estimate the progress of cultivation, morphological domestication, and the origins of rice landrace farming (Yunfei et al., 2009). '*Agriculture*' in English is rooted in the Latin '*ager*' (field) and '*colo*' (cultivate), combined into 'agriculture,' meaning field or tillage (Harris and Fuller, 2014). The word includes activities of cultivation, domestication, and horticulture, as well as forms of livestock management, e.g., mixed-livestock crop farming. Cultivation is a human activity directly involved in managing plant life and life cycles. Cultural practices include soil manipulation, water, and other components of

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the plant environment, and sowing seeds on soil cleared of other vegetation. Tillage methods and tools vary from simple hand tools (crowbar diggers, shovels, and hoes) to teamwork tools, such as the "foot plow." Cultivation also involves adding nutrients to the soil by fertilizing or using crop rotation cycles.

Archaeological data is critical to documenting the origin and distribution of rice from its centers of origin throughout much of Asia (Fuller et al., 2010). People migrating from the Malay Archipelago in the 5th and 6th centuries are thought to have introduced Indonesia's tropical japonica rice variety (Dewar and Wright, 1993; Khush, 1997). The spread of rice cultivation dates back to the Yangzi (Yangtze) Valley, China, in 8500 BP (or 6550 BC). Rice cultivation in the Southeast Asian Plains and central India began in 5000 BP (or 3050 BC), then spread to Java in 4000 BP (or 2050 BC). BP stands for Before Physics, a year marker for calculating carbon dating (carbon dating), with a benchmark of 1950 AD (The Oxford Radiocarbon Accelerator Unit, 2005). 9000 BP equals 7050 BC, while 7000 BP equals 5050 BC.

Alphonse-Louis-Pierre Pyrame de Candolle stated that rice cultivation was first introduced to China and then to India. However, Nikola Ivanovi Vavilov stated that rice in Asia originates from India (van Driem, 2012). Migratory Indonesians are thought to have known rice before they arrived in the Malay Archipelago. Some experts reveal that the word "Java" comes from "Djawa" or "Djawa Dwipa" (rice island in Sanskrit) (van der Kroef, 1952). Paddy, which is processed into rice, is a staple food for the majority of the population in Southeast Asia. People consume rice daily in various traditional menus with an authenticity that is still maintained, and they appreciate rice as the main ingredient for making the main culinary menu (Ajwang' Ondiek et al., 2016).

Chang (1976) distinguishes two types of cultivated rice: *Oryza sativa* from Asia and *Oryza glaberrima*, an African rice grown on a limited scale in West Africa. Rice belongs to the family Gramineae or grass; wheat, maize, rye, oats, and barley Rice is part of the genus Oryza, cultivated around 130 million years ago and spreading as a weed in Gondwanaland parts of the continents of Asia, Africa, America, Australia, and Antarctica. *O. sativa* and *O. glabberima* are food plant evolutions from wild rice, commonly found in Asia, and *O. rufipogon* or *O. nivara*, which *O. sativa* cultivates. *O. glaberrima* was domesticated *by O. breviligulata* and then evolved from O. longistamineta (Khush, 1997).

Domestication of rice in northern Southeast Asia or southwest China began around 8000 years ago. Most humans had abandoned their hunting and gathering lifestyles by then. They opted for sedentary agriculture: domestication of wheat in Mesopotamia, corn in Central America, rice in Asia, and coconut and taro in Hawaii. The earliest cultivated plants became cultivated plants in Asia, including sago palms, taro, and millet. Rice is considered domesticated from wild grains collected in swamp areas. At this time, several varieties of rice can be planted in swamp areas. Rice cultivation can also be carried out in rainfed lowlands and highlands with a terracing system. Rice can adapt to low temperatures, so it takes six months to produce an annual crop. Highlanders such as the Hmong and Mien groups of mainland Southeast Asia and southwest China usually farm the dry upland lands (Greenland, 1997).

3.2. A Brief on Rice Policy in Indonesia

The accession of Indonesian rice from 1926 to 1992 was reviewed by Tjahjadi (1993) from various publications as follows: (1) The 1930s: The collection of rice germplasm was started by the Dutch colonialists, led by Van der Maulen to prepare basic books on rice cultivars (*stamboek*) in Indonesia. Total rice collections reached over 2,000 accessions of rice varieties (cited from Siwi et al., 1977); (2) In 1943, the Bengawan superior variety was introduced. This is a type of rice cross between Chinese rice varieties and Bengal Latisail varieties (cited from Siregar 1987); (3) In 1954, the Peta variety was introduced, but the Bengawan variety remains the most popular because it is planted in 15 of the total paddy fields in Java (750,000 ha)

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(quoted from Siregar 1987); (4) In the 1960–1970s, Miracle Rice, a superior variety from China, was released by the International Rice Research Institute (IRRI) in the Philippines, then sent to farmers in Indonesia, Malaysia, the Philippines, and Vietnam; (5) In 1962, IRRI began research activities in a rainfed plains area of 400 million ha worldwide (quoted from Anon 1992); (6) Early 1970s: rice varieties PB 5, PB 26, PB 36, and Pelita I-1 (all of these were old versions of high yielding rice varieties), together with several new types of superior varieties of rice that were resistant to brown planthopper pests, began to be cultivated in Indonesia (cited from Siwi and Kartowinoto 1989), (7) In 1972: old types of superior varieties of rice had reached 58% of the total superior varieties planted (cited from Siwi and Kartowinoto 1989), (8) In 1978: One of the cases at that time, it was reported that a farm worker in South Yogyakarta had to burn rice in his own paddy field when the village head found out that he was planting local varieties, and (9) In 1979: 70% of the total area of rice fields was planted with new, superior varieties of rice.

The most popular variety, PB 36, was planted for 60% of the high-yielding varieties. The number of local varieties planted is 30% and has decreased, especially irrigated lowland rice varieties targeted by the government as intensification areas (cited from Siwi and Kartowinoto 1989), (10) 1981: local rice varieties are threatened with extinction. Most varieties in Java are found only on small rain-fed lands and upland areas (cited from Siwi and Kartowinoto 1989), (11) In 1984: Rockefeller Foundation, the primary investor in the Green Revolution, implements the International Program on Rice Biotechnology, resulting in a commitment 10-15 years for the application of rice molecular biology in developing countries (quoted from RAFI 1992), (12) In 1971-1987: the government released 68 superior varieties, 47 of which were lowland rice varieties, six dry lowland rice varieties, nine rainfed rice varieties, and six swamp varieties. 45 of 68 varieties resistant to brown planthopper, 16 of 45 varieties introduced by the International Rice Research Institute (IRRI) since 1974), and 29 varieties by the national improvement program (cited from Anon 1990), (13) In 1969: Collection in Stamboek reached 3,935 accessions of rice varieties (cited from Siwi et al. 1977), (14) Before the 1970s: rice fields in Indonesia covered an area of 3.5 million ha. Indica varieties planted an area of 1.75 million ha and Indo-Japonica 1.75 million ha (cited from Siregar 1987), (15) In 1970–1987: The collection of rice germplasm in Indonesia reached 14,384 accessions, including 10,000 accessions of local rice varieties. Most of the 14,384 accessions were cere or Indica, which reached 11,309 accessions, while the remaining 3,075 were fur or Indo-Japonica accessions. Of the 14,384 varieties, 9,000 were classified as having good seed viability, 450 varieties from the original germplasm, and 1,800 accessions from other countries (Tjahjadi, 1993).

These varieties included samples of two species of rice, *Oryza officinalis* and *Oryza rufipogon*, cultivated in pots (cited from Kartowinoto 1988), (16) In 1984: The Indonesian government attempted to achieve annual rice self-sufficiency, (17) In 1989: A total of 11,690 accessions, consisting of 8,851 varieties of lowland rice, 2,134 varieties of rainfed rice, and 705 varieties of swamp rice. Most of these collections were cere or Indica, which reached 9,034 accessions. In comparison, the remaining 2,656 accessions were bulu or Indica-japonica (cited from Siwi 1989), (18) In 1988: The number of IRRI rice germplasm bank collections reached 74,550 accessions and 1,878 rice wild. India is the most significant contributor of rice seeds to IRRI, with 15,040 accessions and 183 wild rice. Indonesia contributed a total of 8,453 accessions and 37 wild rice. The United States (US) contributed 1,135 accessions through the US Department of Agriculture (USDA) and 12 wild rice. The US collection held at USDA facilities at Colorado State University with 228,000 seed samples containing trillions of genes, (19) In 1991: 5–10 years later, hybrid rice seed will be planted in 10–15 million ha of paddy fields (cited from Rhoades 1991), and (20) In 1992: The collection of Oryza germplasm in the National Program in Indonesia reached 7263 accessions (Engel, 1992, in Tjahjadi, 1993).

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The local rice policy has been supported by the Indonesian National Armed Forces (TNI) Army program "TNI-AD supports the Food Security program" since 2014 at the local level, especially by the Village Supervisory Officer (Babinsa) (Sebastian et al., 2018). Each Babinsa served in each district. Babinsa has completed courses on agricultural knowledge and how to grow rice, soybeans, and corn. Assistance for farmers to use agricultural machinery tools (*Alat Mesin Pertanian*) began in 2018, one of which was in Tana Toraja Regency. Local rice is one of the main topics discussed in the Development Planning Consultation Forum. The Paddy Field Brigade (BTS) program started in 2018, directly from the Army with the Ministry of Agriculture. Special Efforts (*Upaya Khusus*) increased agricultural yields in Tana Toraja and helped residents use the Legowo cropping system simultaneously to deal with planthopper pests.

3.3. Media Communication and Local Contents

Inclusive policies in agricultural systems in Tana Toraja and Toraja Utara, South Sulawesi, include ecological knowledge based on tradition, belief, and culture to achieve conservation goals (Xu et al., 2019). Language diversity is also essential in supporting biodiversity, especially local rice varieties. One species that is threatened with extinction in a habitat can also result in the loss of the vernacular name of that species (Gorenfloa et al., 2012; Skorek, 2021; Bromham et al., 2022; Jarić et al., 2022).

Suharto's New Order from 1996 to 1998 prioritized national identity and unity and tended to be Java-centric. Local television stations in Indonesia emerged after the 1998 Reform Era, supported by the Regional Autonomy Law and the new Broadcasting Law. According to Bogaerts (2017), 'local' refers to 'subnational,' 'regional,' or 'subregional.' Practically, local television stations meet the needs of viewers. For example, the local television station Jawa Pos Media Televisi (JTV) in 2001 and Bali TV in 2002. JTV uses the tagline' Satus Persen Jatim' (one hundred percent East Java), which broadcasts local content in a live and interactive format and uses Javanese with the dialect Surabaya. The target audience is mainly the lower middle class. Bali TV broadcasts several programs for target audiences from Bali, outside Bali, and outside Indonesia. Representation of Hinduism, Balinese culture, and the Balinese language plays an essential role in its programs, but it still uses national symbols through several programs in Indonesian. Various foreign-language programs and advertisements reach audiences of tourists and expatriate communities (Bogaerts, 2017).

Local cable television stations in Toraja Utara, South Sulawesi, consist of two companies under PT Toraja Media Mandiri: Toraja TV and PT Toraja Media Mandiri. Distribution of broadcasts to subscribers using fiber optic cable and coaxial cable. Optical fiber to reach the farthest point and coaxial for broadcast distribution. Local television channel subscribers pay Rp 40,000.00 per month. The initial fee for installing a broadcast receiver at a subscriber's house costs Rp. 400,000.00 to Rp. 500,000.00, depending on the distance the coaxial cable covers. The channel coverage has reached approximately 40 km. Signal distribution is delivered to distant places with fiber optic, then distributed via coax RG-11 and received by customers with coaxial cables 6 through 12. The partner will broadcast the broadcast. In 2019, local channel subscribers reached around 1200. The number of subscribers has increased since 2018 by around 5%, and the coverage area is temporarily in North Toraja. An informant stated that the TMM company had joined the Indonesian Cable Television Association. The category of coverage that was broadcast the most was the funeral ceremony in December. This channel also broadcasts coverage of pilot rice, with yields of up to 8 tons, and socialization in the Toraja Utara district.

3.4. Transdiscipline

Jean Piaget, André Lichnerowicz, and Erich Jantsch first used the word

'transdisciplinarity' in 1970 at the international workshop "Interdisciplinarity - Teaching and Research Problems in Universities." This workshop was organized by the Organization for Economic Cooperation and Development (OECD) in collaboration with the French Ministry of National Education and the University of Nice, France. Piaget is a Swiss philosopher and psychologist, Lichnerowicz is a famous mathematician in France, and Jantsch is an Austrian philosopher (Nicolescu, 2006). "Scientific methodology has limitations. People didn't realize that, especially during the 19th and 20th centuries. Something happens with the notion of the limits of science, which opens up a dialogue. Then transdisciplinarity comes in...Why is dialogue so important? Because the dialogue raises questions about psychophysics (psychophysics). The connection between the soul and physics…The key point is that in religion, there is an opening to scientific thought..." (Science & Orthodox Christianity, 2019). Levels of Reality are the main concept of the transdisciplinary approach to Nature and knowledge. Reality is not merely a social construction, collective consensus, or inter-subjective agreement. The "Real" means veiled forever (veiled forever), while "Reality" can be reached by knowledge. "Levels of Reality" are systems that do not change according to specific laws. For example, quantum entities (units of being) (parts of energy that cannot be divided any further) are subject to quantum laws, which depart radically from the laws of macrophysics (Nicolescu, 2010).

Nicolescu describes transdiscipline in the following interview: "...transdisciplinarity goes beyond the definition of a discipline, meaning it is not a single [discipline]... The term transdisciplinary was first used in 1970 by... Jean Piaget...During my research, I found that the word 'transdiscipline' was in the workshop's title, but the organizers were wary of the word and the connotation of "trans", which means to go beyond. The organizers of the workshop used the term interdisciplinary rather than transdisciplinary because of the presence of heads of state and ministers at the time… Transdisciplinary offers a rigorous way of dialogue… but my starting point is not religion, metaphysics, or philosophy. Paradoxically, my starting point is science. I first started with quantum physics, through the works of great founders like Niels Bohr, Werner Heisenberg, Wolfgang Pauli. They confront the problem of such contradictions at different levels, between macro and micro scales... There has to be a new logic to approach several disciplines at once. What might be true in one discipline, might not be true in another... One of my early challenges was to tackle the problem of logic as a starting point "How do I reconcile quantum physics and the theory of relativity?" That's when transdisciplinary comes into play (Science & Orthodox Christianity, 2019)".

3.5. Conservation: Classic and Contemporary

Conservation aims to maintain livestock germplasm (Soini et al., 2012) and plants (Wang et al., 2016), protected areas on land and sea (Álvarez-Romero et al., 2018), and protect conservationists and their knowledge (Oguamanam, 2004). Changes in the paradigm of conservation have occurred from 1960 to 2010. Conservation that prioritizes nature itself is the cornerstone of human effort—the main ideas based on environmental change and conservation from 1960 to 1970. Species, wild nature, and protected areas must be maintained. This framework is based on species and habitat science and wildlife ecology. Conservation during the 1980s to 1990s prioritized nature over humans. This second conservation period includes humans as the cause of extinction, a threat to the species. The basis of conservation science is population biology and natural resource management—conservation from 2000 to 2005 prioritized 'nature for people' (nature for humans). Humans use natural resources using an ecosystem approach, environmental services, and economic values—a foundation of knowledge on ecosystem functions and environmental economics. Conservation for the 2010 period balances the natural position of humans, natural adaptation, and the socio-ecological

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system. The scientific approach involves social and environmental sciences and is interdisciplinary.

The conservation method used to analyze conservation efforts from 1960 to 2010 based on the development of the paradigm described by Mace (2014) was carried out technically in the field. Technical conservation methods include protecting life support systems, preserving biodiversity, and sustainably utilizing resources. Contemporary conservation studies have used a transdisciplinary approach, one of which is digital conservation (Barve, 2014; Correia et al., 2021; Fink et al., 2021; Fletcher, 2017; Kays et al., 2020; Ladle et al., 2016; Pavelle and Wilkinson, 2020; Ranteallo et al., 2021; Sandbrook et al., 2015; Schaal et al., 2015; van der Wal and Arts, 2015; Vaz et al., 2020) and conservation culturomics (Correia et al., 2021a; Fink, 2021b; Jarić et al., 2021; Ladle et al., 2016; Michel et al., 2011; Millard et al., 2021), to analyze the use of the internet and social media that contribute to conservation biodiversity.

Conservation culturomics is a quantitative analysis based on the measurement and number of word frequencies, which serves to analyze changes in culture and language over time and space of text corpora, as well as semantic text data and images (Ladle et al., 2016; Fink, 2021; Correia et al., 2021b). The development of rice landrace conservation referred to in this study includes changes in conservation, from cultivation practices to utilization, to conservation practices in the form of utilizing local rice, which is digitally recorded and then disseminated via YouTube. Digital conservation consists of collecting and using data in images or text from social media platforms, identification of camera traps, and trends in human and natural interactions.

4. CONCLUSIONS

Social sciences in biodiversity conservation seek to increase public understanding of why, how, and when the impact on nature, the loss of this diversity, and human motives for carrying out activities that harm or promote biodiversity conservation (Sandbrook et al., 2013). Sociology, as one of the social sciences, could contribute to transdisciplinary research and management of biodiversity through better understanding and management of habitat change, improving research methodology and decision-making, developing theoretical synthesis, and analysis of conservation social organization and conservation biology.

Biodiversity conservation is a matter of social construction due to human preferences determined by perceptions and culture (Machlis, 1992). Sociologists need to be involved in collaborative algorithm design (collaborative algorithm design) through the computer field that supports the collaboration of various disciplines (Edwards et al., 2013). This collaboration is in the form of 'open science,' which is critically dependent on open societies in the context of data use and monitoring.

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